

The STEM Society Archive

James Emery

8/29/2012

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0.1 Introduction

This is an archive compilation of the notes for the STEM Society from about 2006 to the present. The society started in the fall of 2006. The notes contain links to many other documents.

0.2 About the STEM Society and the STEM Society Website

STEM is an abbreviation for Science, Technology, Engineering and Mathematics. There are about 60 people on the mailing list, although usually a much smaller group attends any one meeting. We meet on the second Tuesday of each month at the Trailside Center at 99th and Holmes in Kansas City Missouri. The meetings are open to all. We make presentations, have discussions, and sometimes have scientific demonstrations. The topics range from General Relativity to scientific experiments for kids.

The set of meeting notes may be viewed by going down the list of notes appearing on the front page of the site. These notes contains links to documents, which may be viewed or downloaded by clicking the link. Other documents can be reached by clicking the heading "Documents and Downloads" that appears on the left side of the front page. Then click on "documents." The meeting notes may also be viewed in an archive file in the list of documents. Most of the documents are PDF files. They may be viewed or downloaded to the computer by clicking, provided Adobe Reader is present, or another program capable of reading PDF files. There are often more documents available at the site than are listed under "Documents" because they may not have been added to the documents.htm file yet. The web site is at

<http://stem2.org/>

To go directly to the "Documents" list:

<http://stem2.org/je/documents.htm>

1 MEETING NOTES, 8/14/12

The August meeting of the STEM Society will take place on the second Tuesday of the month, August 14, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible Topics are:

- (1) An Introduction to Projective Geometry. Projective geometry has application to various parts of applied mathematics, for example areas such as computational geometry and the solution of partial differential equations using the finite element method.
- (2) Electronics and microcontroller projects.
- (3) Some Available Biological Laboratory Equipment.
- (4) Surprise Contributions by Members: Talks, Demonstrations, Apparatus, et cetera.

(5) Book Reports.

(6) Scientific Computer Programs.

1.1 Projective Geometry and Barycentric Coordinates

A reference for this discussion is **Projective Space and Screen Mapping** by James Emery.

<http://www.stem2.org/je/projectivespace.pdf>

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1.2 Other Documents Related to Projective Space by James Emery

[1] Emery James D, **Computer Graphics and Geometry.**

<http://www.stem2.org/je/graphics.pdf>

[2] Emery James D **Conics, Quadrics and Projective Space.**

<http://www.stem2.org/je/quadric.pdf>

[3] Emery James D, **A Finite Element Current Flow Program.**

[4] Emery James D, **Projective Space.**

<http://www.stem2.org/je/projsp.pdf>

[5] Emery James D, **Projective space, Quadric surfaces, Conics And Rational Curves.**

<http://www.stem2.org/je/rational.pdf>

[6] Emery James D, **The Simplex and Barycentric Coordinates.**

<http://www.stem2.org/je/barycentric.pdf>

[7] Emery James D, **Tolerancing and Geometric Design.**

<http://www.stem2.org/je/tgd.pdf>

[8] Emery James D, **Conics.**

<http://www.stem2.org/je/conics.pdf>

1.3 Rich Kaufman: KCP&L Smart Grid Project

A smart grid contains advanced technology that enables enhanced, two-way communication between a utility and its customers. The resulting information provides customers with:

Tools to help manage their energy Improved energy efficiency Improved reliability (fewer outages) The opportunity to sell back to the grid power generated through renewable generation sources

KCP&L believes this project will serve as a blueprint for future smart grid implementation and will accelerate a realization that the "utility of the future" safely delivers reliable electricity with greater efficiency and improved environmental performance.

Why KCP&L SmartGrid?

Through the SmartGrid Project, KCP&L will gain knowledge about customer needs and usage patterns. In addition, the company will be able to gather information about smart grids storage capabilities, supply and delivery.

The SmartGrid demonstration improvements will enhance service for the entire Midtown area through improved service reliability, reduced energy delivery costs, more efficient energy consumption, an improved carbon footprint and better information flow.

A SmartGrid Demonstration Project is located at 47th and Troost. There is a semitrailer truck there, which is essentially a giant Lithium Hydride Battery. We should find the details about solar panels and about feeding power back into the grid, giving needed hardware and so on.

<http://www.kcplsmartgrid.com/>

1.4 Book Reports

Knocking on Heavens Door, Lisa Randall.

This book is an up-to-date book on Particle Physics written for the lay audience, but with some insider technical details and a very good introduction to what science is and is not. The book is available at Linda Hall Library.

The Mathematics of Life, Ian Stewart.

This book by a mathematician is a popular science work, but gives information that other such books do not. There is some insight on how DNA is sequenced, how the the molecule is broken up into pieces, each piece sequenced, and stored, then using matching of overlapping sequences, each piece joined to its correct adjacent piece using the computer, to finally assemble the entire molecule in sequence. There is material on DNA, on Fibonacci numbers and phyllotaxis, on knots and folds, and on genetics and such. The book is available at Linda Hall Library.

Physics Demonstrations Julien Clinton Sprout.

Sprout is a Physics professor at the University of Wisconsin and has done these demonstrations for years in connection with his popular lecture series. There are two DVD videos that come with the book. The book has a section for each demonstration with references. Another version of his demonstrations is available in a YouTube video. The book is available at Linda Hall Library.

1.5 Maurice Smith: Ruskin High School Academy of Engineering

<http://ruskinmathachievers.wetpaint.com/>

2 MEETING NOTES, 7/10/12

The July meeting of the STEM Society will take place on the second Tuesday of the month, July 10, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible Topics are:

(1) The Higgs Mechanism in the Standard Model of Particle Physics, and the Possible Discovery of the Higgs Boson.” Because I just thought of this topic, I may not find time to make the kind of presentation I would like to make. But still we can have a discussion on it, and I encourage others to prepare something.

(2) Using MikTeX to Produce Scientific and Mathematical Documents.

(3) Book Reports by Members on Scientific, Mathematical, Technical, and Philosophical Works.

(4) An Update on Microcontroller projects.

(5) An Overview of the Maker Faire Held June 23 - 24 at Union Station.

(6) The Usual Invitation for Surprise Contributions by Members: Talks, Demonstrations, Apparatus, and so on.

2.1 Installing and Using MikTeX

<http://www.stem2.org/je/miktex.pdf>

2.2 Chris Sanderson: The Discovery of the Higgs Boson

Cris described the CERN LHC (Large Hadron Collider) and summarized the recent successful search for the Higgs boson.

2.3 Jim Emery: An Outline for the Study of Particle Physics

<http://www.stem2.org/je/particle.pdf>

<http://www.stem2.org/je/higgs.pdf>

2.4 Book Reports

Knocking on Heavens Door by Lisa Randall.

This book is an up-to-date book on Particle Physics written for the lay audience, but with some insider technical details and a very good introduction to what science is and is not. The book is available at Linda Hall Library.

2.5 2012 Maker Faire Projects

<http://www.stem2.org/je/makerfaire2012.pdf>

3 MEETING NOTES, 6/12/12

The June meeting of the STEM Society will take place on the second Tuesday of the month, June 12, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible topics are:

- (1) A talk about "Solar radiation and heat transfer on hill sides," by Cécil Lagandré

- (2) Henry Stoeber and Ann Suellentrop, will talk about alternate uses of nuclear weapons plants, the convoluted involvement of Kansas City, Missouri in the new facility at Missouri Highway 150 in Grandview Missouri, and related topics.

- (3) Book Reports by Bob Kessler.

- (4) Using MikTeX and various computer aids to science.

- (5) A continuing discussion of microcontroller projects.

- (6) A Little Astronomy Related to the Recent Transit of Venus.

- (7) Information About the Coming Maker Faire June 23 - 24 at Union Station.

- (8) The usual member projects and Surprise Topics.

3.1 Solar Radiation and Heat Transfer on Hill Sides: Cécil Lagandré

Let λ be the latitude, v the hill grade, α the hill aspect, σ the declination, and ω the hour angle, where

$$\sigma = (23.45\pi/180) \sin(2\pi(284 + n)/365)$$

$$\omega = \pi(12 - T_{solar})/12.$$

Then the projection factor giving the solar radiation energy is

$$P(\lambda, v, \alpha, \sigma, \omega) = \cos(\sigma) \cos(\alpha) \cos(v) \cos(\omega) - \sin(\sigma) \cos(\lambda) \sin(v) \cos(v) \\ + \cos(\sigma) \sin(\lambda) \cos(v) \cos(\omega) + \cos(\sigma) \sin(v) \sin(\alpha) \sin(\omega)$$

Note. The projection factor given here according to Cécil contains some typos, as does the equation given in one of the slides. She has given me corrections, and I will fix this. Also we should have a reference for this projection function.

Cécil took some of the pictures from her Lear Jet while buzzing her estate in southwest Missouri (Yes, this is a joke, I think they were created with Google Earth). //
Cécil's beautiful slides:

<http://www.stem2.org/je/SunHills.pdf>

3.2 The Evil of Nuclear Weapons, and Alternate Uses of Nuclear Weapons Plants: Henry Stoeber and Ann Suellentrop

Henry is a lawyer in the Kansas City area. He and his wife Jane have been involved in protesting the manufacture of nuclear weapons for many years. Ann Suellentrop is a nurse at the Shawnee Mission Medical Center and is a member of Physicians for Social Responsibility.

The 1985 Nobel Peace Prize was awarded to the International Physicians for the Prevention of Nuclear War (IPPNW). This organization includes medical doctors from the competing power blocs working harmoniously together, bound only by the Hippocratic oath and by the shared goal of eliminating

the global nuclear threat. Ann said that the famous Helen Caldicot attended a local meeting of their organization a while back.

Henry Stoever, a lawyer from Overland Park and the chair of the Board of PeaceWorks, Kansas City, will share ideas about the illegalities of nuclear weapons of mass destruction and the convoluted involvement of Kansas City, Mo., in the new facility at Mo. Hwy. 150.

Ann Suellentrop, a master's-prepared maternal-child nurse from Kansas City, Kan., directs activities related to the Kansas City Plant for the local chapter of Physicians for Social Responsibility and serves on the PeaceWorks Board. She will discuss the threat of nuclear darkness and the international effort to reach a nuclear-free world.

Addresses:

Jane Stoever 913-206-4088, janepstoever@yahoo.com

Henry Stoever 913-375-0044, henrystoever@sbcglobal.net

Ann Suellentrop 913-271-7925, annsuellen@gmail.com

Note. Henry gave me a hard copy of a two page summary of his talk titled "Nuclear Engineers Talk, June 12, 2012." I will place that here if I can get him to send me a computer version. My recollection of the talk may not be terribly accurate, because my journalistic skills are somewhat lacking.

Henry started his talk by asking "What important event occurred in 1986." None guessed the answer that Henry was looking for, which was the 1986 meeting of Reagan and Gorbachev in Reykjavk where they almost agreed on a complete ban of nuclear weapons. Then he described the terrible consequence of nuclear war, and why we should be devoted to the elimination of such weapons so as to preserve the earth.

The Reykjavk Summit was a summit meeting between U.S. President Ronald Reagan and General Secretary of the Communist Party of the Soviet Union Mikhail Gorbachev, held in a famous house in Reykjavk, the capital city of Iceland, on October 1112, 1986. The talks collapsed at the last minute, but the progress that had been achieved eventually resulted in the 1987 Intermediate-Range Nuclear Forces Treaty between the United States and the Soviet Union.

Much of the talk was about converting nuclear weapons plants to positive uses, which in my opinion has no real practicality. Secondly, it was about the convoluted involvement of Kansas City, Missouri in the construction of the new facility at Missouri Highway 150 in Grandview Missouri. This latter topic is scandalous and probably corrupt, and even bribery would not be surprising. The net result seems to be that the citizens of Kansas City Missouri have bought a new Nuclear Defense plant through the issue of municipal bonds. And in all likelihood will be liable for it, and will be stuck with it when it is ultimately abandoned in a few years. These bonds are supposed to be payed off through rent. Nobody really understands this deal at all, except perhaps the crooks that cooked it up. The whole thing is disgusting. There is really nothing wrong with the old plant. It is claimed that it is massively polluted, but that is probably quite exaggerated. The old plant is no more polluted than any large manufacturing plant in the US.

Another argument given for the construction of this new plant is that heating and cooling of the old plant was very inefficient. But since the new plant costs the best part of a billion dollars, it would probably take a hundred years to make this new construction pay off in reduced heating and cooling.

Another topic was the subject of contamination of the plant by such as Beryllium and PCBs. The seriousness of this pollution is probably quite exaggerated, but one never knows absolutely. Ann I believe has made a study of Beryllium poisoning, but did not really talk about this much.

Now Henry, Jane, and Ann are really primarily devoted to the abolishment of nuclear weapons and of nuclear war, and not really to the economic issues, of saving money and preserving jobs. In the next two sections are links to related documents that we prepared for the May meeting.

One should also note that the National Laboratories and the Production Plants have always done useful work and research not related to nuclear weapons at all. So actually they were always partially converted to other purposes.

3.3 Beryllium

<http://www.stem2.org/je/beryllium.pdf>

3.4 A Discussion on the Atomic Scientists

<http://www.stem2.org/je/atomicscientists.pdf>

3.5 Book Reviews: Bob Kessler and Greg Swartz

Bob Kessler reviewed the book:

The Universe in a Single Atom: The Convergence of Science and Spirituality by The Dalai Lama, (Sep 12, 2006).

I wonder if it says "Dalai Lama" on his drivers licence?

No one seemed to have an answer to the question "What is spirituality?" A hundred years ago it was a big craze, and everyone flocked to séances to hear table knocking from the dead, and to watch Ouija boards move about.

I think Bob liked and recommends the book highly, and even does this when he is not high. He has a curious interest in Buddhism, and all things Chinese. Bob may have said "It has a good beat, and you can dance to it," but perhaps I am putting words into his mouth. As you might surmise I am not tuned into this wavelength, perhaps I have a faulty capacitor.

For comment and enlightenment about books like this, one might read the introductory chapters of the new book by particle physicist Lisa Randall, **Knocking on Heaven's Door**. Also see Carl Sagan's **The Demon Haunted World**, and Martin Gardner's classic **Fads and Fallacies In The Name of Science**.

Bob also gave a review of the book:

Consciousness: Confessions of a Romantic Reductionist by Christof Koch.

Koch is from Kansas City, but nobody is perfect. Christof Koch is an American neuroscientist working on the neural basis of consciousness. He is the Lois and Victor Troendle Professor of Cognitive and Behavioral Biology at California Institute of Technology, where he has been since 1986.

He is the son of German parents; his father was and his older brother Michael is a diplomat. He was raised as a Roman Catholic and attended a Jesuit high school in Morocco. He received a PhD in nonlinear information processing from the Max Planck Institute in Tbingen, Germany in 1982. He then worked for four years at the Artificial Intelligence Laboratory at MIT. In 1986, he joined the newly started Computation and Neural Systems PhD program at Caltech.

He has been active since the early 1990s in the promotion of consciousness as a scientifically tractable problem, and has been particularly influential in arguing that consciousness can now be approached using the modern tools of neurobiology. His primary collaborator in the endeavour of locating the neural correlates of consciousness was the late Francis Crick.

Together with James Bower, he founded in 1988 the Methods in Computational Neuroscience summer course at the Marine Biological Laboratory in Woods Hole, which remains ongoing. In 1993, he founded, together with Rodney Douglas and Terrence Sejnowski, the Neuromorphic Engineering Summer School in Telluride, Colorado, which remains ongoing. Koch was the executive officer of the Computation and Neural Systems program at Caltech from 2000 to 2005.

In early 2011, Christof Koch became the Chief Scientific Officer of the Allen Institute for Brain Science, leading their high through-put, large scale ten year, cortical coding project.

Recall that Greg Hodes does philosophical research on consciousness, and gave a talk on this at one of our illustrious meetings a couple of years back.

Greg Swartz reviewed a book countering the Dalai Lama book:

God and the Folly of Faith: The Incompatibility of Science and Religion. by Victor J. Stenger, 2012. Greg co-hosts a radio program on this topic on community radio station KKFI on Sunday mornings.

Other related books by physicist Victor J. Stenger:

1988. *Not by Design: The Origin of the Universe.*
ISBN 0-87975-451-6

1990. *Physics and Psychics: The Search for a World Beyond the Senses.*
ISBN 0-87975-575-X.

1995. *The Unconscious Quantum: Metaphysics in Modern Physics and Cosmology.*
ISBN 1-57392-022-3.

- 2000. Timeless Reality: Symmetry, Simplicity, and Multiple Universes.
ISBN 1-57392-859-3.
- 2003. Has Science Found God? The Latest Results in the Search for Purpose in the Universe.
ISBN 1-59102-018-2.
- 2006. The Comprehensible Cosmos: Where Do The Laws Of Physics Come From?.
ISBN 1-59102-424-2.
- 2007. God: The Failed Hypothesis: How Science Shows that God Does Not Exist.
ISBN 1-59102-481-1. New York Times bestseller.
- 2009. Quantum Gods: Creation, Chaos and the Search for Cosmic Consciousness.
ISBN 1-59102-713-6.
- 2009. The New Atheism: Taking a Stand for Science and Reason.
ISBN 1-59102-751-9.
- 2011. The Fallacy of Fine-Tuning.
ISBN 978-1-61614-443-2.
- 2012. God and the Folly of Faith: The Incompatibility of Science and Religion.

Peer-reviewed articles by

- 1964 (with W. E. Slater et al.), "K-N Interactions in the I=0 State at Low Energies,"
Phys. Rev. 134, B1111. Publication of Stenger's Ph.D. thesis results.
- 1984, "The Production of Very High Energy Photons and Neutrinos
from Cosmic Proton Sources," Astrophys. J. 284, 810.
- 1985, "Photinos from Cosmic Sources," Nature 317, 411.
- 1986, "The Extraterrestrial Flux Sensitivity of Underground
and Undersea Muon Detectors," Il Nuovo Cimento 9C, 479.
- 1990, "The Universe: the ultimate free lunch,"
European Journal of Physics 11: 236-43.
- 1999, "The Physics of 'Alternative Medicine': Bioenergetic Fields,"
The Scientific Review of Alternative Medicine, Vol. 3(1).
- 2000, "Natural Explanations for the Anthropic Coincidences,"
Philo 3: 50-67.

3.6 Canadian Tar Sands: Rich Kaufman

Rich discussed the tar sands in Canada and what it takes to turn that into useable petroleum product, and related mining technology....e.g. froth flotation.

A background for this discussion is the Wikipedia article on **Athabasca Tar Sands**. From Wikipedia:

"The Athabasca oil sands or Athabasca tar sands are large deposits of bitumen or extremely heavy crude oil, located in northeastern Alberta, Canada - roughly centered on the boomtown of Fort McMurray. These oil sands, hosted in the McMurray Formation, consist of a mixture of crude bitumen (a semi-solid form of crude oil), silica sand, clay minerals, and water. The Athabasca deposit is the largest known reservoir of crude bitumen in the

world and the largest of three major oil sands deposits in Alberta, along with the nearby Peace River and Cold Lake deposits.

Together, these oil sand deposits lie under 141,000 square kilometers (54,000 sq mi) of sparsely populated boreal forest and muskeg (peat bogs) and contain about 1.7 trillion barrels ($270 \times 10^9 m^3$) of bitumen in-place, comparable in magnitude to the world's total proven reserves of conventional petroleum. Although the former CEO of Shell Canada, Clive Mather, estimated Canada's reserves to be 2 trillion barrels ($320 km^3$) or more, the International Energy Agency (IEA) lists Canada's reserves as being 178 billion barrels ($2.83 \times 10^{10} m^3$).

With modern unconventional oil production technology, at least 10 percent of these deposits, or about 170 billion barrels ($27 \times 10^9 m^3$) were considered to be economically recoverable at 2006 prices, making Canada's total proven reserves the second largest in the world, after Saudi Arabia's. The Athabasca deposit is the only large oil sands reservoir in the world which is suitable for large-scale surface mining, although most of it can only be produced using more recently developed in-situ technology."

3.7 Optical Instruments, Steve Cummins

Steve brought some optical instruments to the meeting. In particular he brought his polarized light device, which consists of polarizers that produce fringes showing elastic stresses in transparent substances such as glass and plastic. We will have to give a talk on this subject at some point.

Dave VanDyne is especially interested because he once wrote a paper on this subject.

4 MEETING NOTES, 5/8/12

The May meeting of the STEM Society will take place on the second Tuesday of the month, May 8, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible Topics are:

(1) Steve Cummins will bring various scientific devices that he will demonstrate in a show and tell.

(2) A discussion of Beryllium, and PCBs. A history of the Nuclear Weapons Complex and a discussion of accidents and toxic exposures that have occurred throughout this history. Biographical material on the scientists who worked in the Manhattan Project. We ask for any information that people have on these matters.

(3) A possible discussion of CCDs by Bob Williams.

(4) A discussion and demonstration of microcontrollers.

4.1 Bob Williams: The CCD (Charge Coupled Device)

Here is Bob's Power Point slides converted to pdf:

<http://stem2.org/je/ccd.pdf>

For more information see the Wikipedia article on the CCD. Boyle and Smith invented the CCD at Bell Labs in 1970. They received the 2009 Nobel Prize in Physics for this work. Here is their original paper, which is available on the internet:

[1] Willard Boyle, George E. Smith **Charge coupled semiconductor devices**. Bell System Technical Journal, 49(4): 587-93, April 1970.

At Fairchild, a team led by ex-Bell researcher Gil Amelio, developed the first commercial devices, and by 1974 had a linear 500-element device and a 2-D 100 x 100 pixel device.

Steven Sasson, an electrical engineer working for Kodak, invented the first digital still camera using a Fairchild CCD in 1975. Steven J. Sasson (born July 4, 1950 in Brooklyn, New York), is an American electrical engineer and the inventor of the digital camera. Sasson is a 1972 (BS) and 1973 (MS) graduate of Rensselaer Polytechnic Institute in electrical engineering.

Sasson's invention began in 1975 with a broad assignment from his supervisor at Eastman Kodak Company, Gareth A. Lloyd: to attempt to build an electronic camera using a charge coupled device (CCD). The resulting camera invention was awarded U.S. Patent 4,131,919. Leica Camera AG honored Steve Sasson by giving him the 4th million Leica camera, a limited edition 18 megapixel Leica M9 Titanium at Photokina 2009.

On November 17, 2009, US President Barack Obama awarded Sasson the National Medal of Technology and Innovation at a ceremony in the East Room of the White House. This is the highest honor awarded by the US government to scientists, engineers, and inventors.

Sasson recently gave a talk at Linda Hall library in the fall of 2011. I talked to him a bit there. Being quite familiar with Kodak, I asked him if he worked at the old giant brick building in Rochester. He told me no that even back then, he worked at a research facility in a different location. I may have been there also. Kodak was a giant place back then. Someone told me that they had recently filed for bankruptcy. Sasson said that he still works there though.

4.2 Cris Sanderson: Internet demo, *Scale of the Universe 2*, Book Review *The Road to Reality*, by Roger Penrose.

Cary and Michael Huang: The scale of the universe 2. This very interesting and beautiful internet application gives smooth zooming views of the universe, from the smallest objects to the largest.

<http://htwins.net/scale2/>

[1] Penrose, Roger **The Road to reality : A Complete Guide to the Laws of the Universe**, QC20 .P46 2005, 2005 .

4.3 Steve Cummins: A Demonstration of Various Scientific Instruments

This book is out of copywrite, and is available at Google Books as a pdf.

[1] Ervin Sidney Ferry, Oscar William, **A Handbook of Physics Measurements**, 1917.

http://books.google.com/books?id=HXhCAAAIAAJ&pg=PA18&dq=cathetometer&as_brr=1#v=onepage&q=cathetometer&f=false

*"I ran across the reference **A Handbook of Physics Measurements** while researching how to properly set up and use a measurement tool that I*

have. I thought it was some kind of "transit level" measurement tool. When I finally took the time to figure out the instruments maximum resolution capabilities, I was astounded to realize the vertical vernier display is individuated with 0.1 mm increments spread over a span of 0 to 1 mm full scale. I believe this calibration provides for a total instrument resolution of 100 microns per fine-scale division!

I called Gaertner Scientific Instruments today to obtain whatever information they have available for this piece of equipment they produced in 1967. The guy in Customer Service was not willing to "look up" my particular instrument in their archive of instrument manuals. I was finally able to "drag enough information out of him" so as to be able to properly identify the true name of this device. I have attached the above link to show to you (and any others you may wish to share this reference with) what it is that I have (it is called a vertical cathetometer, or "optical ruler" in layman's terms).

I think many others in our group might be interested in the overall scope and content of the many types of physical measurements instrumentation also described in "A Handbook of Physics Measurements".

I hope to be able to come to the next STEM Society meeting. I plan on bringing several "smaller and very much less heavy to carry" mechanical and electro-mechanical devices for show and tell.

1) An example of "Maxwell's Demon", also called a "Vortex Cooler" manufactured by the Exair Corporation.

2) A small hand-held "Tesla Coil", that can be used to look for very small and even "virtual leaks" often present in dielectric components assembled into the construction of a high vacuum pumping system. I have forgotten exactly where I stashed this device, but hopefully I can find it once again!

I have many other interesting scientific curiosity pieces that I would also like to share with the group members sometime. I have a "McCloud Gage" (without the mercury inside) that I am particularly fond of, as it is constructed out of all hand-blown glass components. I have only "used" this device perhaps once or twice. These devices were already "extinct" or at least a "rare and endangered" laboratory measurement "species" by the time I entered the field of high vacuum laboratory technology.

Steve Cummins.

4.4 Jim Emery and Kent Smith: Microcontrollers

I showed a couple of physical circuits relating to the Arduino. Then rapidly went over a document on the Arduino, which can be found on the Stem Society web site:

<http://www.stem2.org/je/arduino.pdf>

Kent Smith talked briefly about his project using the ATTINY (made by Atmel) microcontroller.

4.5 Jim Emery: A Discussion on Beryllium

<http://www.stem2.org/je/beryllium.pdf>

4.6 Jim Emery: A Discussion on the Atomic Scientists

<http://www.stem2.org/je/atomicscientists.pdf>

5 MEETING NOTES, 4/10/12

The April meeting of the STEM Society will take place on the second Tuesday of the month, April 10, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Topics are:

- (1) Charley Mentasana: Driving and controlling piezoelectric devices and motors, with a discussion of controlling them with the Arduino microcontroller.
- (2) Kent Smith and Chris Sanderson: Building a spectroscope for viewing biological changes.
- (3) Bob Kessler: Buddhism and Scientific Research in China.
- (4) Jim Emery: Optics and Tribar Redux.

5.1 Charley Montesana: Driving Piezoelectric Devices and Motors

Charley demonstrated a device that rotates a wheel by flexing a thin plate, which has piezoelectric material glued to the bottom. An alternating voltage applied to the piezoelectric material makes it flex like a bimetallic strip. On top of the strip are a couple of tabs whose motion drives a wheel above the tabs. The voltage is supplied by an audio voltage from a PC, generated by the GoldWave software. Goldwave is a poor man's function generator. The generated wave shapes may be controlled by equations. Normally a travelling wave piezo motor operates by setting up travelling waves on a disk. Upon the disk are mounted fingers which move in little elliptical like paths and cause a revolving rotor to rotate by friction. Usually these motors operate at about 30k Hz, which is well above the hearing range. Charley's demonstration operates at an audio frequency so produces quite a bit of noise. Charley also demonstrated a small Japanese car operating on the same principle. The vibrating plate must be driven at a resonant frequency. Charley calculated the resonant frequency and then tweaked and fine tuned it by experiment.

The Arduino Microcontroller might be able to drive this device at a higher frequency. Because this controller can deliver only about 40 mA maximum, it would need to be connected to a device that could supply more current such as an FET (Field Effect Transistor).

5.2 Kent Smith and Chris Sanderson: Building a Spectroscope for Viewing Biological Changes.

Kent and Cris are working on a spectroscope for viewing a spectral line that is generated when hemoglobin is oxygenated. They are using a transmission diffraction grating. So a light source illuminates a test tube or beaker containing the solution. The light produces an absorption spectrum which passes through a slit made of a pair of razor blades. The light is diffracted in all directions from the slit. A collimating lens with its focus at the slit changes this light as it passes through the lens into a parallel beam. Then the diffraction grating causes the rays at a given wave length to be reinforced at an angle determined by the wave length and the spacing between diffraction rulings. So these rays appear to be coming from infinity. That is these rays of a given "color" (wavelength) when viewed through a telescope focused

at infinity are focused in the same way that colored stars at huge distances would have images that are separated by small distances with distinct colors corresponding to the wave lengths. Since these images are images of a slit, the images are lines. The first step in verifying there spectroscope would be to look an a source such as a fluorescent tube, to verify that it produces lines for the specified light for the gas in the tube. This would require a clear glass tube without a normal white coating. The coating in a normal florescent light excites the white fluorescent material and produces white light, and not the gas spectrum. It is not at all clear that this crude spectroscope can properly separate the lines that are sought for.

These lines can also be viewed with the naked eye with the eye focused at infinity. However then there is no magnification of the image and the lines would not be properly separated in the image. They are also working with a digital cameral to examine the image. The camera must be able to magnify the image to separate the lines. Perhaps this could be done with a telephoto lens. Then commenced a discussion on the properties of CCD cameras.

5.3 Bob Kessler: A Discussion on Buddhism and Science

Bob may be writing a book on this subject, but we have not yet received the first draft.

5.4 Jim Emery: A Demonstration of the Arduino Microcontroller

Jim presented a demonstration of running an arduino program and downloading it to the microcontroller, where it actually runs. The download is by a USB cable connected from the laptop (a Macintosh in this case) to the Arduino board.

6 MEETING NOTES, 3/13/12

The March meeting of the STEM Society will take place on the second Tuesday of the month, March 13, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Topics might be selected from the following list: Driving piezoelectric motors with microcontrollers such as the Arduino, Astronomy calculations, Using the Latex typesetting language, The four laws of Thermodynamics, Various Electronics projects and Biology projects, Drawing a Penrose Tribar. A little Algebraic Geometry, a review of some Calculus in connection with using Latex, a discussion of Regression Analysis, and a little electromagnetic theory. And of course any topic members want to introduce.

There are a few additions to the previous announcement. (1) I received an email from Dave Theilen about an interesting geometric modeler called T-FLEX. There is a free student version. It would be nice if he could give us some information about his experience with this.

(2) If you bring a laptop or a flash drive, we can distribute some software.

(3) Kessler will discuss the book: Turing's Cathedral.

6.1 The T-FLEX Parametric Modeler

Email from Dave Theilen to Jim Emery:

Do you have any interest in parametric CAD software.
I ran across a product called T-FLEX.
It uses parasolids as the core. Seems to come from Moscow.

I downloaded the free student version yesterday and am trying to build a simple model. It seems even the student version does some FEM and dynamics analysis. I haven't found the price of the full package.

I am considering applying for an academic license using STEM as an excuse, with the group's permission of course. I think students could get some good experience with something like this. Maybe model their robot and show dynamics.

Do you have a good free parametric CAD software package that you like?

6.2 Video and Pictures of Charlie Montesana's Piezo Moter Experiments

I showed Charlie's video and pictures. He was not at the meeting, but will probably make a presentation next month.

6.3 Scientific and Mathematical Writing: L^AT_EX

If people would learn how to create mathematical and scientific documents with L^AT_EX, we might have an expanded group of authors presenting material at our STEM Society meetings.

Installing Miktex and a L^AT_EX Tutorial:

<http://www.stem2.org/je/miktex.pdf>

<http://www.stem2.org/je/GSWLaTeX.pdf>

6.4 Bob Kessler: Book Review *Turing's Cathedral: The Origins of the Digital Universe* by George Dyson

I don't have a record of Bob's presentation and the ensuing discussion, but here is another published review.

Review by Evgeny Morozov The Guardian The Observer, Saturday 24 March 2012

"The foundation myth of the internet invariably involves an iconoclastic and romantic technology entrepreneur, who, free from government restraint, enlists free-floating venture capitalists in building the Next Great Thing. It's a myth that borders on delusion, for some of the key technologies that led to the internet were underwritten by government subsidies and arose in the context of larger-than-life geopolitical battles.

Thus, cryptography, which powers much of today's electronic commerce, advanced in the background of the second world war, while packet switching a cold war-era technology that made the internet possible was to guarantee resilient communications in the event of a nuclear attack. More recently, 9/11 and the wars it unleashed have magically transported biometric technologies

such as automated facial recognition from the battlefields of Afghanistan and Iraq into our offices and living rooms.

In Turing's Cathedral, George Dyson shows that the history of the modern computer belies the foundation myth as well. Dyson, who has previously written on the history of the Aleut kayak and a failed American attempt to send a mission to Mars, traces one particular effort to build and operate a computer—the unassumingly named Electronic Computer Project (EPC) based at the Institute for Advanced Study (IAS) at Princeton.

EPC was underwritten by various parts of the American government shortly after the second world war. The idea was to use computers to forecast the consequences of a thermonuclear explosion; eventually, the IAS computer was also put to more peaceful uses in biology and meteorology.

The project's godfather—the Hungarian migr John von Neumann—was a polymath whose interest in computing had roots in both politics and academia. A superb mathematician who also made landmark contributions to economics and game theory, Von Neumann believed that computers might push mathematicians—who constituted the most powerful group at the institute—to appreciate the theoretical challenges posed by applied work. At the same time, his aversion to totalitarianism made him eager to help bolster the military might of his adopted homeland.

It took a genius of Von Neumann's scale to overcome the immense opposition to the project at the institute, which was a fascinating microcosm of intellectual life at the time (Dyson's book is worth reading for its treatment of the institute's early history alone). Building and operating a computer on the institute's premises meant opening its doors to engineers—a development that professional mathematicians, averse as they were to any work that didn't require chalk, blackboard, paper and pencils, didn't like at all. The institute's humanists hated mathematicians and engineers alike and, now that the war was over, didn't shy away from expressing their discontent.

It didn't help that Einstein, who was then at the institute, opposed the idea of "secret war work" and feared that "the emphasis on such projects will further ideas of 'preventive' wars." However, "preventive wars" were exactly what the hawkish Von Neumann wanted: in the immediate aftermath of the second world war, he briefly advocated the idea of a quick preventive war with the USSR to be followed by a Pax Americana. He also had no qualms about working with the government, eventually leaving the institute in 1953 to join the United States Atomic Commission—a government agency

that would soon humiliate his friend and colleague Robert Oppenheimer by stripping him of his security clearance.

Strictly speaking, Von Neumann's was not the first computer. However, it played an extremely important role in getting the nascent computer industry off the ground. First of all, its origins in academia made it easier to get working scientists to pay close attention to what computing had to offer. Second, Von Neumann wanted to ensure that any work that the institute did on the EPC was put in the public domain and widely disseminated rather than patented by engineers (this noble effort was marred by Von Neumann's consulting gig with IBM not well-publicised at the time which required him to grant all of his own subsequent inventions to the company). Third and most important Von Neumann chose not to optimise his computer to do only pressing or lucrative tasks; he knew that its most useful applications had not been anticipated yet. By arguing that "the projected device is so radically new that many of its uses will become clear only after it has been put into operation", Von Neumann helped to usher in the era of general-purpose computing which, alas, may now be finally coming to a close, as consumers embrace single-purpose apps and tightly controlled computing devices.

While Dyson doesn't shy away from discussing obscure technical and theoretical aspects of Von Neumann's computer, he also provides ample social and cultural context. Gottfried Leibniz, Francis Bacon, and Bishop Berkeley appear next to more contemporary luminaries such as Norbert Wiener (the originator of cybernetics), Vladimir Zworykin (a pioneer of television) as well as numerous members of the Huxley family (Aldous, Julian and Thomas). Dyson, who grew up at the institute, where his father Freeman Dyson was a fellow, also brings a charming personal touch to the narrative.

Alas, the book is not perfect. Dyson, who spent a decade writing and researching it, bombards the reader with a mind-boggling stream of distracting information that adds little to his tale. We get to learn of the discrepancy between the British and Canadian war records of Jens Fredrick Larson, the architect of the institute's main hall; the price of oysters served at lunch meetings of its building committee; the price of nappies in Los Alamos hospitals in the 1950s.

Dyson's efforts to connect Von Neumann's cold war computing to today's Silicon Valley result in a slew of untenable generalizations. Is it really true that "Facebook defines who we are, Amazon defines what we want, and Google defines what we think"? Occasionally, Dyson makes mystical claims

that no serious historian would endorse. What to make of his statement that "only the collective intelligence of computers could save us from the destructive powers of the weapons they had allowed us to invent"? This is a very odd way to tell the story of numerous disarmament campaigns, of fervent antiwar activism of the 1960s, of the emergence of groups like Computer Professionals for Social Responsibility that sought to draw clear ethical boundaries between academia and the defence industry. Surely, all of that mattered more than the "collective intelligence of computers"?

Despite these shortcomings, Turing's Cathedral is an engrossing and well-researched book that recounts an important chapter in the convoluted history of 20th-century computing. An equally rich history of Google and Amazon is long overdue."

6.5 Book Review: The Four Laws That Drive the Universe, by Peter Adkins

<http://www.stem2.org/je/fourlaws.pdf>

6.6 A Calculus Problem

Prove that the derivative of

$$f(x) = \frac{1}{x}$$

is

$$-\frac{1}{x^2}$$

from the definition of the derivative.

We have

$$\begin{aligned} \frac{df}{dx} &= \lim_{h \rightarrow 0} \left(\frac{1}{x+h} - \frac{1}{x} \right) / h \\ &= \lim_{h \rightarrow 0} \left(\frac{x - (x+h)}{(x+h)x} \right) / h \\ &= \lim_{h \rightarrow 0} \frac{-1}{(x+h)x} \\ &= -\frac{1}{x^2} \end{aligned}$$

The L^AT_EXcode for this little section is:

Prove that the derivative of
 $f(x) = \frac{1}{x}$
is
 $-\frac{1}{x^2}$
from the definition of the derivative.

We have

$$\frac{df}{dx} = \lim_{h \rightarrow 0} \left(\frac{1}{x+h} - \frac{1}{x} \right) / h$$
$$= \lim_{h \rightarrow 0} \left(\frac{x - (x+h)}{(x+h)x} \right) / h$$
$$= \lim_{h \rightarrow 0} \frac{-1}{(x+h)x}$$
$$= -\frac{1}{x^2}$$

6.7 How to Draw a Tribar

We may draw a Tribar by constructing an equilateral triangle in the center of a page. Add a 60 degree parallelogram on the bottom edge of the triangle, Do the same for the other two edges. Fill in the three corners. Add partial parallel edges inside the original equilateral triangle so that each corner looks like a 3d corner made from two adjacent blocks. Extend these lines to complete the Tribar. Click here for a pdf file showing these drawing steps.

<http://www.stem2.org/je/drawtribar.pdf>

6.8 Statistics: Regression Analysis

Suppose we have two random variables x and y . Consider the joint distribution of these two variables with joint PDF (Probability Density Function) $f(x, y)$. If x and y have some relationship they are said to be correlated, and there may exist some function say $y = g(x)$ so that the probability density tends to be concentrated near this curve. The probability density is said to "regress" towards this curve. Then given a sample of $\{(x_1, y_1), \dots, (x_n, y_n)\}$, we can attempt to find an equation for this curve. This is usually done by

finding a least squares fit. The most common case is when there is a first degree linear relationship of the form

$$y = f(x) = a + bx.$$

We attempt to find the most probable value for the constants a and b . For more information click below.

<http://www.stem2.org/je/regression.pdf>

6.9 David Frazee: Proposed Methods for Liquifying Gases

David presented many slides, which I shall post here when I get them.

6.10 What is Algebraic Topology?

Topological theorems can be proved by applying algebraic theories. Some of the concepts in Algebraic Topology are: The Simplicial Complex, Homology, Cohomology, Homotopy and the Fundamental Group.

6.11 What is Algebraic Geometry?

Sets of polynomial equations in several variables define certain geometrical figures, called manifolds, and varieties. Thus there is a correspondence between abstract algebra and geometry.

6.12 What is a Differential Manifold?

A differential manifold is an n -dimensional space of geometric points, such as a 2-d surface such as the surface of the earth. Such spaces or figures can be defined as a collection of local Euclidian maps known as an atlas. So we can cover the Earth with a set of maps, but not the whole earth with a single flat map. Surfaces called Riemann Surfaces are manifolds that arise naturally in Complex Analysis.

6.13 What is M-Theory?

M-Theory is an extension of string theory. String theory is an attempt to simplify and solve general problems in physics by introducing higher dimensional spaces, and considering "points" as tiny 1-dimensional closed manifolds, which are called strings. The strings vibrate. The very complex theory employs Algebraic Geometry, Topology, Manifold Theory, and Differential Geometry.

7 MEETING NOTES, 2/14/12

The February meeting of the STEM Society will take place on the second Tuesday of the month, February 14, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

We will have a talk on "The Lawn as a Carbon Sink" by Cecil. We can talk about the topic of electrical grounding, a topic which a member introduced a couple of meetings ago. Other topics could be Astronomy calculations, The Latex typesetting language, vocational education verses academic education, Booker Washington verses Dubois. Is the Fab Lab and Maker movement a version of traditional vocational education? The four laws of Thermodynamics, ongoing Electronics projects and Biology projects, How to draw a Penrose Tribar. A little geometry, a review of of some Calculus, a discussion of Regression Analysis, Maybe some electromagnetic Theory, and of course any topic members want to introduce. So the schedule is loose like the morals of the Stem Society Members.

7.1 Electrical Grounding

<http://www.stem2.org/je/electricalgrounding.pdf>

<http://www.stem2.org/je/staticelectricity.pdf>

7.2 Cecil Lagandre: The Lawn as a Carbon Pool

Cecil gave a talk about the structure of plants, and specifically grass. And how natural grass and natural management without excessive cutting, can create a carbon pool in the ground. Here are her slides:

<http://www.stem2.org/je/grasscarbonpool.pdf>

7.3 Scientific and Mathematical Writing: \LaTeX

If people would learn how to create mathematical and scientific documents with \LaTeX , we might have an expanded group of authors presenting material at our STEM Society meetings.

Installing Miktex and a \LaTeX Tutorial:

<http://www.stem2.org/je/miktex.pdf>
<http://www.stem2.org/je/GSWLaTeX.pdf>

7.4 Bob Kessler: MRIGlobal research management

As you know, I have a strong interest in the DOE/NNSA repurposing of the Bannister Federal Complex and the potential improvement in STEM education in the Kansas City area.

Because the DOE manages non-nuclear weapons R and D sites, as well as NNSA dominated nuclear weapons sites, I reviewed some information on the local organization, MRIGlobal.

Midwest Research Institute last year changed their name to MRIGlobal. For many years MRI (a non-profit organization) has had a contract with the DOE to manage the NREL, National Renewable Energy Laboratory, in Golden, CO.

In 2008 this changed ...the managing contract was awarded to the Alliance for Sustainable Energy, LLC, a company equally owned by MRI and Battelle Memorial Research. In addition to managing NREL, the Alliance created the Joint Institute for Strategic Energy Analysis, with six founding institutions, NREL, MIT, Stanford, University of Colorado, Colorado School of Mines, and Colorado State.

In reviewing STEM education activities that Battelle has been involved in indicates they have a significant STEM education program across the laboratories they are involved with. In addition, they, along with Ohio Business Roundtable, created the Ohio State STEM Learning Network.

To help me better visualize what I was finding I scratched out the attached conceptual picture...and added four people's names that have some connection with MRIGlobal...Dale Basham, Leo Morton, Lou Smith, and Michael Helmstetter ...and may have an interest in enhancing STEM education in the area.

<http://www.stem2.org/je/MRIGlobal.jpg>

7.5 Are Maker Spaces and FabLabs Just Traditional Vocational Education?

<http://www.stem2.org/je/fablab.pdf>

7.6 Booker Washington vs W. E. B. Duboise

Reference:

The American Reader, Diane Ravitch Editor, 1990. Harper-Collins. p 185, Booker Washington "The Atlanta Exposition Address", delivered September 18, 1895.

7.7 Vince Thompson Reply

Question: Is the Fab Lab and Maker movement a version of traditional vocational education?

NO!

If you read the book FAB by Neil Gershenfeld you get a sense of the Fab Lab being a way of correcting errors of the past in education since the Industrial Revolution. I'm promoting the Fab Lab not as a shop class for the lesser students anymore. This is a place where our future scientists and engineers are being forged. At the same time who are the lesser students that our schools seem to cull out? Someone like Jeri Ellsworth who dropped out of high school then with the help of a few mentors learned how to design computer chips and build race cars? A high school drop who gave a lecture at Stanford for electronics engineering students.

http://en.wikipedia.org/wiki/Jeri_Ellsworth

Similarly, the Maker Movement is not about vocational training. The movement is about people who are intrigued by the emerging technologies and are willing to take upon themselves a way of learning how to embrace and enhance these techniques on their own or with collaborative groups often in a casual setting.

Hope this helps. I wish I could make it to more of your meetings.

I am working on getting a group of people for a brainstorming session about Makers and Education on Monday Feb 13 at the BTC Fab Lab if you're interested. I have the room reserved starting at 6:00 p.m.

Vince Thompson

MakeKC.org

Making: The Art of STEM

7.8 Book Review: The Four Laws That Drive the Universe, by Peter Atkins

<http://www.stem2.org/je/fourlaws.pdf>

7.9 A Calculus Problem

Prove that the derivative of

$$f(x) = \frac{1}{x}$$

is

$$-\frac{1}{x^2}$$

from the definition of the derivative.

We have

$$\begin{aligned}\frac{df}{dx} &= \lim_{h \rightarrow 0} \left(\frac{1}{x+h} - \frac{1}{x} \right) / h \\ &= \lim_{h \rightarrow 0} \left(\frac{x - (x+h)}{(x+h)x} \right) / h \\ &= \lim_{h \rightarrow 0} \frac{-1}{(x+h)x} \\ &= -\frac{1}{x^2}\end{aligned}$$

The L^AT_EXcode for this little section is:

Prove that the derivative of
 $f(x) = \frac{1}{x}$
is
 $-\frac{1}{x^2}$
from the definition of the derivative.

We have

$$\frac{df}{dx} = \lim_{h \rightarrow 0} \left(\frac{1}{x+h} - \frac{1}{x} \right) / h$$
$$= \lim_{h \rightarrow 0} \left(\frac{x - (x+h)}{(x+h)x} \right) / h$$
$$= \lim_{h \rightarrow 0} \frac{-1}{(x+h)x}$$
$$= -\frac{1}{x^2}$$

7.10 Statistics: Regression Analysis

Suppose we have two random variables x and y . Consider the joint distribution of these two variables with joint PDF (Probability Density Function) $f(x, y)$. If x and y have some relationship they are said to be correlated, and there may exist some function say $y = g(x)$ so that the probability density tends to be concentrated near this curve. The probability density is said to "regress" towards this curve. Then given a sample of $\{(x_1, y_1), \dots, (x_n, y_n)\}$, we can attempt to find an equation for this curve. This is usually done by finding a least squares fit. The most common case is when there is a first degree linear relationship of the form

$$y = f(x) = a + bx.$$

We attempt to find the most probable value for the constants a and b . For more information click below.

<http://www.stem2.org/je/regression.pdf>

8 MEETING NOTES, 1/10/12

Our meetings are held on the second Tuesday of the month, normally at the Trailside Center at 99th and Holmes. However, this month is a rare exception and we are meeting at the Southwest High School planetarium. The meeting will start as usual at 6PM. Southwest High School is at 6512 Wornall Road in Kansas City, Missouri. Parking is to the west of the building. To get to the parking lot turn west from Wornall road onto 66th Terrace. The planetarium is a modern addition at the southeast corner of the building. To enter walk from the parking lot along the south side of the building to doors located on the south side and toward the front.

We will see the remodelled planetarium and have discussion on long distance learning of science on the internet, and a planetarium show. The meeting will be hosted by Craig Nulan, Tom Brenneman, and Dave Anstaett of the Kansas City Missouri School system. Tom Brenneman was formally with the Blue Valley CAPS project as I understand. So we will also discuss the possibility of a CAPS East project in Missouri.

Associate Professor John Hoopes, an Archaeologist in the department of Anthropology at the University of Kansas has been invited and may speak also. His research areas are: Archaeology, Human Ecology, Ceramic Analysis, Digital and Internet Applications; and the regions of Southern Central America, Mesoamerica, and South America.

hoopes@ku.edu, Fraser Hall, number 629, (785) 864-2638

Because we will be in a planetarium, time permitting, I will deliver a little talk on Kepler's laws of planetary motion, and the mathematical method Kepler used to compute the elliptical planetary orbits.

We will also present a brief overview of the kinds of topics we present at our stem society meetings. Recall that last month we had a talk on Parkinson's disease and an overview of the nervous system. There were other topics that were introduced briefly, and which we did not deal with very well, and so deserve more devotion. As I recall some of these were wind power, and the character of our electrical power system, specifically concerning the role that grounding plays. Unfortunately, I have not yet put up on stem2.org the notes for the last meeting, but I shall do that, probably later today.

8.1 Dave Anstaett and the Long Distance Learning Labs

Dave Anstaett is a long time teacher of English and Literature. He has taught in high schools, community colleges and and universities. He was at UMKC for a long time and taught televised courses on the local learning channel managed by UMKC on Time-Warner Cablevision. For the last two years he has been with the Kansas City Public schools managing the Long Distance Learning activity. Currently they have six Long Distance Learning Labs with the latest technology, with two-way interaction with students. A teacher has the ability to focus a camera on individual students. Dave claims that this type of teaching is very effective. He told us that "just yesterday he we made a connection between students at Border Star School on Wornall Road and Brookside, and students at a school in Australia." They do this sort of thing routinely.

8.2 Tom Brenneman

Tom is the manager for networking at the school district. He had this sort of job at UMKC, and created the networking for the Blue Valley CAPS project.

Tom gave us an introduction to the planetarium and its history, and the struggle to restore it, and future plans for it. It seats 46 people and it is intended that all students in the school district will eventually have an opportunity to see a presentation at the planetarium. Also it is planned that it will also be made available to students in other school districts, lastly the public will have access also. The details of this have not been worked out. They are looking for a person with an astronomy background to run the planetarium. There will be a grand opening the 29th of January, 2012. Tom ran the projector for the demonstration.

8.3 Introduction to the New Planetarium by Craig Nulan

"It would honestly be an understatement to call it a planetarium anymore though it leverages the domed ceiling to produce a truly unique set of sensory effects. It is the second of its kind installation in the U.S., and will become a showpiece and destination point for many school districts across the city

when it comes fully online next year. While there, we would also like to show you one of our distance learning labs and briefly explain the why and how of these facilities use both to leverage scarce exceptional teaching resources, and, as a lynchpin content source for our one-to-one endpoint initiative.

This field trip would afford you an opportunity to get better acquainted with my boss Tom Brenneman (who is with no exaggeration on my part, the most qualified, astute, and visionary superior I've had in 27 years of IT service work) and our Instructional Technology Manager Dave Anstaett who is the driving force behind expert instruction in the distance learning environment. Dave has been a teacher for 43 years and is one of the most highly regarded creative writing and English teachers in the U.S. I have been truly blessed to be associated with these two gentlemen. Our collaboration is yielding tremendous results, that are to a great extent overshadowed by the political follies swirling around the District at this time.

I believe that making introductions given many of our shared objectives might be one of the most effective means available to us of catalyzing additional highly focused effort to accomplish the aims of the CAPS-East initiative. Tom Brenneman built the entire IT infrastructure on which CAPS depends before coming to undertake the profound challenges of IT in the Kansas City Public Schools earlier this year. I see would love to see Tom playing a role in this proposed development at the Bannister Federal Complex below, as well - and I think it only makes sense that the CAPS-East team leverage his detailed knowledge and experience of costs, lessons-learned, etc - from the original CAPS installation in Blue Valley. I see all of this coming together in helping to foster and promote a Smart Community.

In any event, I promise you a most enjoyable experience in the planetarium at SWECC, and I hope that you will be amenable to this offer. When I hear back from you, I'll get the ball rolling on my side to make arrangements to make it so. What I envision for the evening's program will be a Distance Learning Lab demo and talk by Dave Anstaett on his experiences with Distance Learning and one-to-one computing - over the course of his career which is nearly as long as I've been alive - Dave has worked with all strata of students, but for the last several years with the most challenging students of all - and I think his insights are little known, eye-opening, and quite profound. We'll wind up the evening with a show or two in the planetarium and some casual discussion."

8.4 The Southwest High School Planetarium

The planetarium has a new digital projector, which produces very detailed and spectacular images on the domed ceiling of the planetarium. The planetarium had been decommissioned a few years ago and had been used as a store room and received quite a bit of hard treatment and damage during that time. It has been remodelled with a new projector, the old one is now in a school in Colorado. This new projector is made by the Spitz company, a company created by Armand Spitz (July 7, 1904 – April 14, 1971) of Philadelphia. He was a famous planetarium designer.

www.spitzinc.com

The new projector is a Spitz SCI Dome XD. A special lens had to be fabricated to project to the existing domed ceiling. Spitz personnel came to Kansas City and measured the planetarium and the dome. The projection is very bright and spectacular. The astronomy software is the package called Starry Night.

Spitz supplies special videos called "Trips" which are projected onto the spherical dome. These can be videos on any subject. They are very spectacular, and give a feeling of being in the middle of the action. There were Trips into outer space viewing astronauts, under the ocean seeing fish and sea creatures, a video on telescopes, the African Serengeti Plains and so on. Apparently there is software for making these Trips from flat videos. If the technology is accessible, one could maybe create interesting demos of mathematics, physics, map projections and so on.

Special movies called **Video Trips**.

Planetarium software called Starry Night.

8.5 Armand Spitz and His Planetariums

From Wikipedia:

"Armand Neustadter Spitz (July 7, 1904 – April 14, 1971) was a planetarium designer.

Armand Spitz, the son of Louis Spitz and Rose (Neustadter), was born in Philadelphia, Pennsylvania and was educated at the University of Pennsylvania and the University of Cincinnati, without receiving a degree from either. In 1926 he began working as a journalist, and within two years purchased

a newspaper in Haverford, Pennsylvania. This went bankrupt in 1934, and Spitz traveled to France, discovering an interest in astronomy on the voyage to Europe. On his return to the United States, he became a lecturer on astronomical topics at Haverford College. As a side effort he made a 1-foot-diameter (0.30 m) papier-mache model of the Moon, which is on display to this day at the Academy of Natural Sciences in Philadelphia.

Spitz became a volunteer at the new Fels Planetarium in Philadelphia, doing publicity, but soon was allowed to do planetarium lectures. He also created a series of radio programs in which he covered scientific topics, with an emphasis on astronomy. His first book, *The Pinpoint Planetarium*, appeared in 1940. The first half of the book described the sky and legends attached to it. The last half of the book contained star charts to be punched out and held in front of lamps, projecting stars in their proper relationships onto a wall or other smooth clear surface. Spitz dodecahedron planetarium projector.

Concerned that the only planetariums then available were so expensive that few institutions could have them and few people would live near enough to visit, in 1947 Spitz completed design work on a very inexpensive planetarium model. The main problem, he discovered, was that creating a globe for stellar projection was very complex and expensive. Following a suggestion by Albert Einstein, Spitz used a dodecahedron as the "globe" equivalent for his star projector.

Following a demonstration at an astronomical conference at the Harvard-Smithsonian Center for Astrophysics, Spitz received considerable publicity, and began marketing his Model A planetarium for 500 dollars. These were sold to the various American military academies, small museums, schools, and even to King Farouk of Egypt.

Within a few years, Spitz introduced the model A-1, which incorporated the Sun, Moon, and five naked eye planets, still using the dodecahedron shape for the star projector. Later a model A-2 came out, projecting more stars (the model A only gave stars brighter than magnitude 4.3). Just at the time that Sputnik caused the United States government to provide considerably enhanced funding for science education, Spitz produced his model A3P. This had a spherical star projector, and mechanized motions for the Sun, Moon and planets, and lunar phases. Well over a thousand of this model were ultimately sold, and in fact, when the Spitz company stopped making this model for a few years, had to bring it back due to continuing demand. Spitz

had his company developing the Space Transit Planetarium, a model with additional motion capabilities and more stars, when he suffered the first of a series of strokes in 1967. He went into semi-retirement after this. Spitz died in Fairfax, Virginia.”

8.6 The Technology of the Spitz Planetarium Projector

I did a brief search of the Spitz Company website www.spitzinc.com, looking for technical details of the Spitz SCI Dome XD. I did not find much, but one of their claims is that the borders of the projection segments are mapped seamlessly so that the boundaries of the individual image segments projected to the spherical dome are not visible. So apparently this modern digital very bright projector does use a projecting technique that bears some relationship to the original Spitz projection method. **Spitz dodecahedron planetarium projector.**

8.7 Map Projections: The Mapping of the Spherical Earth to A Plane Map, and the Inverse

<http://www.stem2.org/je/mapproj.pdf>

8.8 Long Distance Learning

Kansas City Public schools uses **Cisco ITbase**. They have communicated with Australia with students from Border Star School elementary school. Dave Anstaett, a veteran English literature teacher, has taught at the High School, Community College, and University levels, and is well known for his UMKC programs taught on the Time-Warner public access channel, channel 19, and so on.

8.9 John Hoops

Archeologist John Hoops of the KU Anthropology department attended, and informally volunteered to create a program on the Mayan Calender and the end of the world and so on.

John W. Hoopes
Associate Professor
Archaeology
Director Global Indigenous Nations Studies
Ph.D., Harvard 1987

Research Areas: Archaeology, human ecology,
ceramic analysis, digital and Internet applications;
Southern Central America, Mesoamerica, South America

hoopes@ku.edu
Fraser Hall, number 629
(785) 864-2638

8.10 The Kansas City Star

Reporter Joe Robertson,

jrobertson@kcstar.com>

of the Kansas City Star attended the meeting and may write a piece on
the planetarium.

Reporter

8.11 Kepler's Laws of Planetary Motion and Kepler's Orbit Calculation

See the sections on **Conics**, and the sections on **Kepler's Laws** in the
document called Astronomy.

<http://www.stem2.org/je/astronomy.pdf>

9 MEETING NOTES, 12/13/11

We did not have a November meeting because of a city election on the second
Tuesday of November, and the use of the Trailside Center as a polling place.

The December meeting of the STEM Society will take place on the second Tuesday of the month, December 13, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Meg Duggan, a former director of the midwestern Parkinson's Foundation, which serves Kansas, Missouri, Oklahoma, and Arkansas, will give a talk on Parkinson's disease, and on an online website she has constructed to aid Parkinson's patients by monitoring their status, collecting data, and making it available to doctors. This is an opportunity also to learn about and discuss brain structure and behavior, diseases of the brain, neurons and their functioning, neural transmitters, ion transport, electric potentials in the brain, action potentials and so on. Bring any knowledge you have in these areas to the meeting to enhance the discussion. There is a relation here to electrochemistry and physical chemistry, and I believe we have some physical chemists in the group. As I recall the squid has very large neurons, which are relatively easy to study. In the unlikely event that you have a squid, bring it to the meeting. Also I recall seeing an electronic device that is cheap and able to demonstrate the firing of neurons in cockroach legs. As I recall Michael Stoffel ordered one of these devices. I would like to see another demonstration of this device sometime. We could also discuss any possible connection to neural net programming.

If we have time for other topics, here are possible suggestions. Some of us have been working on some interesting electronics projects, which we could demonstrate and talk about.

In the past three years or so we have presented many topics, and we have many documents on our website about them. We could review these topics and determine if we should revisit them.

I do want to continue with our coverage of Quantum Mechanics, so maybe we could discuss this and review what we have done.

9.1 Meg Duggan: Parkinson's Disease

Meg Duggan
Data Driven Health Care Solutions
meg@datadrivenhealth.org
www.datadrivenhealth.org
816-797-7412

Meg Duggan, the former director of the Midwest Parkinson Foundation, gave a talk on the disease and on her current business, a website to record data from Parkinson's patients and deliver this information to their doctors.

See Wikipedia for a summary of the disease: "Parkinson's disease is a degenerative disorder of the central nervous system. The motor symptoms of Parkinson's disease result from the death of dopamine-generating cells in the substantia nigra, a region of the midbrain; the cause of this cell death is unknown. Early in the course of the disease, the most obvious symptoms are movement-related; these include shaking, rigidity, slowness of movement and difficulty with walking and gait. Later, cognitive and behavioral problems may arise, with dementia commonly occurring in the advanced stages of the disease. Other symptoms include sensory, sleep and emotional problems. PD is more common in the elderly, with most cases occurring after the age of 50."

"The disease is named after the English doctor James Parkinson, who published the first detailed description in *An Essay on the Shaking Palsy* in 1817."

Here are some of the topics that Meg introduced:

- (1) Citizen Science.
- (2) Levodopa Therapy. L-DOPA crosses the protective blood-brain barrier, whereas dopamine itself cannot. Thus, L-DOPA is used to increase dopamine concentrations in the treatment of Parkinson's disease and dopamine-responsive dystonia. This treatment was originally developed by George Cotzias and his coworkers. Once L-DOPA has entered the central nervous system, it is converted into dopamine by the enzyme aromatic L-amino acid decarboxylase, also known as DOPA decarboxylase (DDC). Pyridoxal phosphate (vitamin B6) is a required cofactor in this reaction, and may occasionally be administered along with L-DOPA, usually in the form of pyridoxine.
- (3) Motor and non-motor symptoms.
- (4) Patients can be on and off. They may show symptoms or not show symptoms. This can cause doctors to misdiagnose.
- (6) Meg's Parkinson's disease online log.

- (7) HIPAA. Health Insurance Portability and Accountability Act of 1996.
- (8) Agonist. An agonist is a chemical that binds to a receptor of a cell and triggers a response by that cell. Agonists often mimic the action of a naturally occurring substance. Whereas an agonist causes an action, an antagonist blocks the action of the agonist and an inverse agonist causes an action opposite to that of the agonist.
- (9) Mindfulness.
- (10) Brady Kinesia, "Bradykinesia means slowness of movement and is one of the cardinal manifestations of Parkinson's disease. Weakness, tremor and rigidity may contribute to but do not fully explain bradykinesia. We argue that bradykinesia results from a failure of basal ganglia output to reinforce the cortical mechanisms that prepare and execute the commands to move", From the journal **Brain**, Volume 124, Issue 11, Pp. 2131-2146).
- (11) Nebraska Parkinson's Disease Registry.
- (12) Dopamine. Dopamine is a neurotransmitter present in a wide variety of animals, including both vertebrates and invertebrates. In the brain, this substituted phenethylamine functions as a neurotransmitter, activating the five known types of dopamine receptors D1, D2, D3, D4, and D5 as well as their variants. Dopamine is produced in several areas of the brain, including the substantia nigra and the ventral tegmental area. Dopamine is also a neurohormone released by the hypothalamus. Its main function as a hormone is to inhibit the release of prolactin from the anterior lobe of the pituitary.
- (13) 23andMe. 23andMe is a privately held personal genomics and biotechnology company based in Mountain View, California that is developing new methods and technologies that will enable consumers to understand their own genetic information. The company is named for the 23 pairs of chromosomes in a normal human cell.
- (14) Freezing and Cuing. This is a feeling that Parkinson's Disease patients have, which feels like their feet are stuck in cement.

(15) MPTP. 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine is a neurotoxin precursor to MPP+, which causes permanent symptoms of Parkinson's disease by destroying dopaminergic neurons in the substantia nigra of the brain. It has been used in disease models in various animal studies. It is used to induce artificial parkinson's disease in animals so that Parkinson's disease may be studied. The MTPD drug was discovered by seeing Parkinson's disease symptoms in drug addicts.

9.2 Kent Smith: Worms, Ants, Silk

Kent is performing an experiment of growing silk worms to harvest silk, which is chemically altered to produce a material that may have biological uses. This activity was generated by seeing a TED Talk. Kent Smith described his ant farm, and his hatching silk worms, and the future processing of silk to make compound for biological treatment. These compounds have been shown to be compatible with human tissue.

9.3 James Emery: A Description of the Nervous System and the Functioning of Neurons

This is an outline of the character of nerve cells as presented in chapter 48 of the book **Biology** by Neil A. Cambell and Jane B. Reece, 6th edition, 2002.

9.4 James Emery: A Digital Electronics Test Circuit Board

This is demonstration of a digital test circuit board that we are building, which was designed by Chris Wilkenson. For more information:

<http://stem2.org/je/logic.pdf>

9.5 Bob Williams: Magnetic Monopoles

Bob Williams gave an informal talk about his adventures searching for magnetic monopoles by studying cosmic rays, while a PhD graduate student at

LSU and Georgia. He described his digital electronic circuit that he designed for recording cosmic rays and measuring properties that would identify magnetic monopoles. Researchers are still searching in vain for them. If they are ever found, all the Maxwell Equations tee shirts will have to be changed. He followed his professor from LSU to Georgia, but when the professor left Georgia for Wyoming, that was too much, so Bob returned to LSU to finish his PhD in a new subject.

9.6 Steve Cummins: Making a Wind Electricity Generator With a Spinning Roof Fan, The Use of Ground in Home Electrical Power Systems

We shall discuss these topics more in later meetings.

10 MEETING NOTES, 11/8/11

There was no meeting in November because the Trailside Center was being used for an election on the second Tuesday of the month.

11 MEETING NOTES, 10/11/11

The October meeting of the STEM Society will take place on the second Tuesday of the month, October 11, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

We will go over the proof that the efficiency of a wind turbine can not exceed about 59 per cent. Other possible subjects for presentations that come to mind, include: the overview of a program we have constructed for generating circuit diagrams in Postscript, electronics topics, measuring oxidation potential, the generation of hydrogen by electrolysis, the Google high speed one Gigabit network for Kansas City, and "Are Americans really interested in education, or is it all just sham and scam?"

11.1 The Circuit Diagram Program

The first document below gives some views of the screens and windows that are opened when running the program. The second document gives more detailed information about the program. The idea of the presentation was to show how one might go about constructing such a program rather than describing how one might use it. It would be a little difficult to use in its present form by a stranger who did not construct the program. The second document will be updated.

<http://www.stem2.org/je/cdiagramppt.pdf>

<http://www.stem2.org/je/cdiagram.pdf>

11.2 Proof of Betz's Law

Betz's law relates to the maximum possible efficiency of about 59 per cent for an idealized model of a wind turbine.

<http://www.stem2.org/je/windturbines.pdf>

11.3 Cecil Lagandre: Missouri Geology

Cecil talked about a computer tool concerning the availability of water in regions of Missouri, especially in Benton County Missouri.

11.4 Maurice Smith's Recap of the Great Nuclear Weapons Debate

There was a recap of the debate held Sunday October 9, 2011 between opponents of nuclear weapons and limited advocates of continued production. Some are interested in a replay of the debate at one of our meetings. The debate was held at UMKC and organized by "The Community of Reason" organization.

11.5 Discussion of the Kansas City Google One Gbit Network

Google is introducing its high speed network in Kansas City and is soliciting ideas on its uses.

11.6 Kent Smith's Discussion of the Use of Silk in Biology and the TED Talk on Silk

We did not get to this discussion due to an oversight on my part. We will probably reintroduce it and view the TED talk later.

11.7 Discussion of Oil and Peak Oil

One of our members worked in the oil industry (Rich Kaufman) and is interested in the subject of peak oil. See the reference.

11.8 Bob Kessler's Discussion of the RFP for Uses of the Old Nuclear Weapons Plant on Bannister Road

An RFP has been issued for uses of the Bannister facility. Various comments and suggestions were thrown about.

11.9 References

The theory of rocket motors, jet engines, and propellers is relevant to the discussion of wind turbines.

Deffeyes Kenneth S
Beyond Oil: the View from Hubert's Peak
(logistic curve, sigmund curve)
linda hall library discussion June 9, 2008

Bonney, Zucrow, and Besserer (edited by Merrill)

Principles of Guided Missile Design (Aerodynamics, Propulsion, Structures and Design Practice)

(The book used by Homer Hickham, as described in the book "Rocket Boys," and the movie "October Skys.")

D. Van Nostrand Co, Inc. 1956 At Linda Hall Library.

12 MEETING NOTES, 9/13/11

The September meeting of the STEM Society will take place on the second Tuesday of the month, September 13, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Topics:

- (1) Paul Morasch will give a talk on Underwater Acoustics.
- (2) Impromptu topics, projects, or news from attendees.
- (3) If a void needs filling, I am sure I can stick in a subject or two.

12.1 Underwater Acoustics

Paul Morasch has great practical experience in underwater acoustics gained while serving in the Navy and serving as an intelligence officer as a private contractor after retiring from the Navy. He talked about the properties of acoustic waves in the oceans of the world. He also mentioned the use of Fourier Analysis and Digital Signal Processing. The behavior of underwater acoustic waves depends on density, salinity, pressure and depth.

He talked about many things including the class of Russian submarines called Alfa, which had titanium hulls, could travel at 40 knots or more and at tremendous depths. Paul had prepared a Power Point presentation, but did not present it because of some technical problems that had occurred on his computer. We shall post his presentation here later.

12.2 Green Technology

Rich Kaufman gave a short talk on his interest in green technology, and specifically about the content of the book **Powering the Dream: The History and Promise of Green Technology** by Alexis Madrigal. We also talked about this book a couple of months or so ago. Several copies

of the book are available at the Johnson County library. Specifically we talked about two topics from the book, namely Wind Turbines, and using mirrors to heat large boilers to generate steam and energy. I might mention that Sandia Laboratories had a pilot project in this area many years ago in Albuquerque, which some of us may have done a little work on. Mike Wolf, a former colleague, worked on this while at Black and Veach. Diane Query may also have worked on this at Black and Veach. Mike and Diane later worked at Allied-Signal.

Concerning wind turbines, I had prepared a proof of Betz's Law, which places a limit on the efficiency of a wind turbine. I mentioned it, but we did not have time to present the proof.

12.3 Betz's Law

I will probably go over this law and my document called **Wind Turbines** at our October meeting. See

<http://www.stem2.org/je/windturbines.pdf>

13 MEETING NOTES, 8/9/11

The August meeting of the STEM Society will take place on the second Tuesday of the month, August 9, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible topics:

- (1) David Frazee: The Economics of Fuel: The design of cars with replaceable modules.
- (2) Differential Geometry and envelope curves, a program to draw caustic curves, an elementary geometry refresher, a little quantum mechanics,
- (3) A Discussion of Conrad Wolfram's new interactive Mathematica system.
- (4) Surprise topics from attendees.
- (5) An Africa Quiz.
- (6) The Riverfest Mini-Maker Faire this month in Parkville.

13.1 David Frazee, The Economics of Fuel: The Design of Cars With Replaceable Modules.

I've been working on a presentation about The Economics of Fuel. It's an idea I had a little while back about how to solve the fuel crisis that's going to be an issue within a short while. It's essentially creating cars with a cab, motor and connector which connects to a black box power plant, which is a combination of the fuel storage and generator and can be made by anyone. So any inventor or engineer can design a power source as long as it fits in the box. So the car can be taken in to the shop and refitted with a new compressed air powerplant if there is a new breakthrough in that field. It will at least be interesting. Lexus sort of did it with their new multi-fuel vehicles.

13.2 A Discussion of Fredric Heeren's Publication in Nature on the Rise of The Dinosaurs

Frederic Heeren is a Kansas City science writer. He gave a talk at the Midwest Skeptics Group on his publication in Nature. The article appeared in the 13 July 2011 issue. The article is Fredric Heeren **Dinosaurs: Rise of the Titans** Nature 475, pp 159-161 . I discussed this presentation a bit.

Talk was on Saturday, August 6, 2011, 7:00 PM at Perkins 11200 W. 87th ST, Overland Park, KS

Just once on this planet, a group of land animals, the long-necked sauropod dinosaurs, reached lengths of 130 feet and approached weights of 100 tons. No animals today reach much more than a tenth this mass, and if they did, they'd be crushed under their own weight. And they'd never be able to eat enough to sustain that weight. So how'd the sauropods do it? Hint 1: It has nothing to do with a different climate back then, or being supported by water. Hint 2: It has everything to do with the unique pathway these animals took in their earlier evolution. Fred will talk about the answers that smashed earlier hypotheses, coming out of recent discoveries in Argentina, South Africa, Morocco, Germany, and Antarctica and what the fossil hunters went through to find them. Fred Heeren is a science journalist and author who has written for The Boston Globe, The New York Times, The Wall Street Journal, The Washington Post, and a number of science outlets, including Nature, New Scientist, Scientific American, ScienceNow, and The

Smithsonian. His work also appears in the college textbooks Understanding Human Origins and McGraw-Hills Physical Anthropology. His specialities include cosmology and paleontology.

13.3 Differential Geometry, Envelope Curves, and a Program to Draw Caustic Curves.

Some solar reflecting collectors take advantage of caustic reflections. Caustic curves are envelope curves produced by the reflection or refraction of light. Straight rays are a collection of tangents and they form a curve and an optical image. See the following linked document for a discussion of the caustic curves of an involute and figures showing these caustics.

www.stem2.org/je/diffgeom.pdf

Here is the program invol.ftn that was used to create and draw the caustic curves in the Differential Geometry Document:

```

c invol.ftn < involute.ftn version of general parametric curve
plot, for parametric equations of an involute 7/12/11 c
paracplt.ftn modified 8/15/2009 c plot a parametric curve c
writes an eg file c Define the number of points, and the
function f, which is at the end of c this program. Then
recompile the Fortran. c c To compile with microsoft power
station Fortran: c c fpsvars, script to set parameters for
finding the microsoft power station fortran c fl32 pplt.ftn c
implicit real*8(a-h,o-z)
dimension x(500),y(500)
dimension r(3),ut(3),un(3)
dimension v(3),rv(3)
dimension sc(3)

c
c ***** set number of points (do not exceed the dimensioned array length)*****
n=200
c *****set domain*****
tmin=0.
pi=3.14159265358979
tmax=1.*pi
nfile2=2
open(nfile2,file='q.eg',status='unknown')
a=1.
do i=1,n
t = (i-1)*(tmax-tmin)/(n-1)+tmin
call point(t,a,r)
x(i) = r(1)
y(i) = r(2)
if(i .eq. 1)then

```

```

        xmin=x(i)
        xmax=x(i)
        ymin=y(i)
        ymax=y(i)
    else
        if(x(i) .lt. xmin)xmin=x(i)
        if(x(i) .gt. xmax)xmax=x(i)
        if(y(i) .lt. ymin)ymin=y(i)
        if(y(i) .gt. ymax)ymax=y(i)
    endif
enddo
c *****Manual change of automatic plot range*****
xmax=3.
xmin=-3.
ymax=2.5
ymin=-3.
if(ymax .gt. ymin)then
    call egplt(x,y,n,nfile2,xmin,xmax,ymin,ymax)
end if
c
c draw circle
write(nfile2,'(a)')'a 0. 0. 1. 0. 6.28 100'
t1=.5
t2=2.5
n=10
dir=-20.
c    call drwcaustic(nfile2,t1,t2,dir,a,n)
dir=0.
call drwcaustic(nfile2,t1,t2,dir,a,n)
dir=20.
c    call drwcaustic(nfile2,t1,t2,dir,a,n)

write(*,*)' Wrote eg plot to file q.eg '
write(*,*)' To make a pdf plot, follow these steps: '
write(*,*)' (1)Run pltmerge (if combining plots) '
write(*,*)' (2)Run pltax to add axis and labels. '
write(*,*)' (3)Run eg2ps to convert eg file to postscript. '
write(*,*)' (4)Convert postscript to pdf using Distiller. '
write(*,*)' (5)View and print pdf with Acrobat Reader. '
write(*,*)' (6)Option: Modify postscript, aided by Ghostview . '

end

c+ egplt eg plot of a 2d curve
subroutine egplt(x,y,n,nfile,xmin,xmax,ymin,ymax)
implicit real*8(a-h,o-z)
c Input:
c
c    x,y    arrays containing x and y values.
c    n      number of elements in arrays x and y
c    nfile  output is written on file number nfile.
c    xmin,xmax limits for x values

```

```

c      ymin,ymax  limits for y values
c
c      use pltax to add labels and axis
c      display with wineg
c      use eg2ps to convert eg file to postscript
c      display with ghostview
c      use acrobat distiller to convert postscript to pdf

dimension x(*),y(*)
write(nfile,'(a)')'v -1. 1. -1. 1'
write(nfile,'(a,4(1x,g15.8))')'w ',xmin,xmax,ymin,ymax

do i=1,n
  if(i .eq. 1)then
    write(nfile,'(a,2(1x,g15.8))')'m',x(i),y(i)
  else
    write(nfile,'(a,2(1x,g15.8))')'d',x(i),y(i)
  endif
enddo

return
end
c+ nfac factorial.
function nfac(n)
c      n factorial.
  if(n .lt. 2)then
    nfac=1
    return
  endif
  i=1
  do k=2,n
    i=i*k
  enddo
  nfac=i
  return
end

c+ point curve point
subroutine point(t,a,r)
  implicit real*8(a-h,o-z)
  dimension r(3)
  r(1)=a*(cos(t) + t*sin(t))
  r(2)=a*(sin(t) - t*cos(t))
  r(3)=0.
  return
end

c+ utan unit tangent vector
subroutine utan(t,a,ut)
  implicit real*8(a-h,o-z)
  dimension ut(3)
  ut(1)=cos(t)
  ut(2)=sin(t)
  ut(3)=0.

```

```

        return
    end

c+ unorm  unit normal vector
    subroutine unorm(t,a,un)
        implicit real*8(a-h,o-z)
        dimension un(3)
        un(1)=-sin(t)
        un(2)=cos(t)
        un(3)=0.
        return
    end

c+ refv  reflected vector
    subroutine refv(un,v,rv)
c  un unit normal vector at reflecting plane
c  v incident vector
c  rv reflected vector
        implicit real*8(a-h,o-z)
        dimension un(*),v(*),rv(*)
        dimension w(3),p(3)
        dp=dotpr(un,v)
        write(*,'(a, 2(1x,g15.8))') dp= ',dp
        sgn=1.
        zero=0.
        if(dp .lt. zero)sgn=-1.
        write(*,'(a, 2(1x,g15.8))') sgn= ',sgn
        do i=1,3
            w(i)=dp*un(i)
        end do
        do i=1,3
            p(i)=v(i)-w(i)
            rv(i)=-w(i)+p(i)
        end do
        write(*,'(a, 2(1x,g15.8))') v= ',v(1),v(2)
        write(*,'(a, 2(1x,g15.8))') w= ',w(1),w(2)
        write(*,'(a, 2(1x,g15.8))') p= ',p(1),p(2)
        write(*,'(a, 2(1x,g15.8))') rv= ',rv(1),rv(2)
        return
    end

c+ dotpr scalar product of 3-space vectors
    function dotpr(a,b)
        implicit real*8(a-h,o-z)
c  2/5/97
        dimension a(*),b(*)
        s=0.
        do i=1,3
            s=s+a(i)*b(i)
        enddo
        dotpr=s
        return
    end
c

```



```

c+  drwcaustic  draw caustic envelope
      subroutine drwcaustic(nf,t1,t2,dir,a,n)
      implicit real*8(a-h,o-z)
      dimension r(3),ut(3),un(3)
      dimension v(3),rv(3)
      dimension sc(3)
c  define direction of light source
      pi=3.14159265358979d0
      theta=dir*pi/180.
      sc(1)=cos(theta)
      sc(2)=sin(theta)
      sc(3)=0.
      do i=1,n
      t=(i-1)*(t2-t1)/(n-1) + t1
      call point(t,a,r)
c  compute and draw unit tangent
      call utan(t,a,ut)
      sf=.5
      v(1)=r(1)+sf*ut(1)
      v(2)=r(2)+sf*ut(2)
c      write(nf,'(a,2(1x,g15.8))')'m',r(1),r(2)
c      write(nf,'(a,2(1x,g15.8))')'d',v(1),v(2)
c  compute and draw unit normal
      call unorm(t,a,un)
      v(1)=r(1)+sf*un(1)
      v(2)=r(2)+sf*un(2)
c      write(nf,'(a,2(1x,g15.8))')'m',r(1),r(2)
c      write(nf,'(a,2(1x,g15.8))')'d',v(1),v(2)

c  compute and draw reflected ray
      call refv(un,sc,rv)
      v(1)=r(1)+3.*rv(1)
      v(2)=r(2)+3.*rv(2)
      write(nf,'(a,2(1x,g15.8))')'m',r(1),r(2)
      write(nf,'(a,2(1x,g15.8))')'d',v(1),v(2)
      end do
      return
      end

```

13.4 Making the Plots

Running the program invol.ftn produces some information on making plots from the output file:

Wrote eg plot to file q.eg

To make a pdf plot, follow these steps:

- (1)Run pltmerge (if combining plots)
- (2)Run pltax to add axis and labels.
- (3)Run eg2ps to convert eg file to postscript.
- (4)Convert postscript to pdf using Distiller.
- (5)View and print pdf with Acrobat Reader.
- (6)Option: Modify the postscript, aided by Ghostview.

13.5 A Little High School Geometry, a Theorem About Included Angles in Circles

I gave the traditional proof that the angle of an included angle in a circle is one half of the angle generated from the center. I presented a sketch produced with the Smartboard notes software. From this it follows that a circle can be drawn with a carpenter's square by pivoting against a couple of pegs defining a diameter.

13.6 We Rapidly Reviewed Our Previous Work On the Quantum Mechanics of the Hydrogen Atom

www.stem2.org\je\hydrogenatom.pdf

13.7 A Little Grade School Geography

I presented a map of Africa and said that it is important to know about the bewildering number of African countries because it is where we all come from according to the current scientific notion of the origin of human beings. Then I presented the same map, but with the names of the countries erased and asked the audience to supply the names. This gave us some amusement.

13.8 Bob Kessler: A Review of Conrad Wolfram's New Mathematica Simulation Program

Conrad is Steve Wolfram's brother. For more information search the internet.

14 MEETING NOTES, 7/12/11

The July meeting of the STEM Society will take place on the second Tuesday of the month, July 12, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Rich Kaufman has suggested the topic of wind and solar energy:

"I have just almost finished a book called " Powering the Dream ", a history and current status of the wind and solar power industries. It dwells quite a bit on reliability issues for wind generation which has been partially solved, on storage of wind energy as compressed air pumped underground, and on mirror arrays focused on an elevated absorber....actually in use and being adopted in various sunny desert locations.

Look up Brightsource Energy re: solar arrays. There is a major danish company which is the largest manufacturer of Wind Power machines."

Bob Kessler will talk on his "Marian Innovative Campus" idea for promoting research on energy and science education in the Kansas City area. See the attachment.

Thursday I heard a very interesting talk on programming with the Lambda Calculus delivered by Bill Burdick as a Turbo Talk in the CCCKC Cave, (Pardon me Rick, I know it is not really a cave, but a former limestone mine). So if anyone has knowledge or interest in talking about such things as: Lambda Calculus. Scheme, Lisp, Haskill, Lazy Evaluation, Currying, Alonzo Church, Turing, Kurt Gödel, or Hilbert's famous unsolved problems of Mathematics, then a presentation, or the leading of an engaging dialogue would be quite welcomed. Wikipedia has a good article on Lambda Calculus.

14.1 Book: Powering the Dream

Alexis Madrigal, **Powering the Dream: The History and Promise of Green Technology**

This is a history of inventions of "green" energy devices, together with a summary of the status of current green technologies. Johnson County Library has several copies of this work. You would probably enjoy it and also learn a little history.

The history of using windmills both to pump water and to generate electricity goes way back. At the turn of the century electric cars were considered the future and became quite popular. Efforts to capture the energy of ocean waves was once very fashionable and at the time attracted many hopeful investors. Unfortunately they lost their money as the ocean tore apart these clever machines, or exposed their inefficiencies. The collapse of these technologies is described extensively in the book. Now some of these old energy extraction methods, after the dimming of memory, are considered newly created technologies.

The last part of the book describes some of the current efforts in green energy. Much of this effort is densely entangled with the twists and turns of politics. Not all of this new technology, much of which is not so new, has yet to be shown viable. The point of view of the author is optimistic because of modern developments in electronics, computers, engineering, and physics. The final parts of this "Dream" were a bit draggy. As with most books of this type, there was far too little technical detail.

14.2 Lambda Calculus

We had a rather brief discussion of the fascinating subject of computability, Lisp, Turing machines, Alonzo Church, and Hilbert's famous problems.

Bill Burdick:

<http://tinyconcepts.com/fs.pl/lambda.fsl/doc/tip/slides.html>

14.3 The Marian Innovative Campus, and Discussions of Problems of Education

Bob Kessler presented his "Marian Innovative Campus" idea for promoting research on energy and science education in the Kansas City area. The idea is to take over one of the buildings at the soon to be abandoned Bannister federal complex.

At one point the meeting spontaneously broke into various groups, arguing their favorite points of view of science, mathematics, and technology education. I noticed no exchanges of insults and no fisticuffs.

15 MEETING NOTES, 6/14/11

The June meeting of the STEM Society will take place on the second Tuesday of the month, June 14, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

I will talk about my Makerfaire projects (Kansas City Makerfaire, June 25-26, 2011, Union Station) . These include a new ellipse machine, inversive geometry and the inversive linkage, the Penrose Tribar, a stroboscopic effect,

demonstration of ways of producing electricity, including a thermocouple amplifier demonstrating the Seebeck effect, perhaps piezzo electricity, a water powered turbine or water wheel with a Chinese wench simulating evaporation, static electricity with a dead cat, extracting electricity from the air via electromagnetic waves with a simple peak meter, and the three dimensional pantograph for making sculpture. Also a couple of paintings. Way too much! Too ambitious, but we shall see.

Maybe a review of our presentation on the hydrogen atom and quantum mechanics, so that we can continue with it in the future. As well as exciting surprises by yourselves. We shall have to talk fast! Words shall fly, maybe even pigs! And refreshments may appear, probably of some modesty.

Does anyone have a distributor from an old car around? I am curious to see if I could make a stroboscope with a timing light. Also any suggestions for a piezo demonstration would be very welcomed.

15.1 Kansas City Maker Faire STEM Society Projects

The Kansas City Maker Faire will be held at Union Station on the 25th and 26th of June, 2011.

15.2 The Ellipse Machine

An ellipse machine draws an ellipse using a rod that is connected to sliding blocks that are constrained to move in two perpendicular slots that are located along the two axes of the ellipse. The end of the rod contains a pen or pencil that draws the ellipse. The distance b to the closest block is the minor axis of the ellipse. The distance a to the second block is the major axis of the ellipse. See

www.stem2.org/je/ellipseengine.pdf

15.3 Inversive Geometry and the World Famous Straight Line Peaucellier-Lipkin Linkage.

This version of the linkage is made from steel bars and pivot pins and is mounted on a board. See

www.stem2.org/je/inversivegeometry.pdf

15.4 The Penrose Tribar, Impossible Figures, Symmetry Groups, and Physics

This figure has a three-fold rotational symmetry. A sketch and a painting show the tribar.

A full image of the Tribar will appear when one third of the figure is mounted on a rotating disk and the disk illuminated with a stroboscope. A rotating plastic bottle with strips of black plastic tape was meant to demonstrate the first primitive attempt to demonstrate a mechanical stroboscope before the age of electricity. This was a bit of a failure, so back to the drawing board.

Bob Williams suggested a simple commutator switch mounted on the rotating shaft driving LEDs This should work. Another idea is to use an old ignition coil, a distributor, and a timing light. We shall try this because it also demonstrates an interesting electrical circuit.

Eventually, we will create an adjustable stroboscope, perhaps using a 555 timer, and an FET connected to bright LEDs.

The tribar figure consists of three trapazoids, and two sets of three parallelograms. A puzzle problem consists of the task of assembling these nine wooden figures to build the tribar.

See

www.stem2.org/je/tribar.pdf

15.5 An Op Amp Circuit Increasing the the Small Thermocouple voltage From a Copper-Iron Thermocouple, Ways of Generating Electricity

I showed the +15 volt, -15 volt, and +5 volt power supply I am using for this, as well as a proposed circuit diagram. This is part of a proposed display of ways of generating electricity.

15.6 Creating Sculpture Using a Three-Dimensional Pantograph

See

www.stem2.org/je/pantograph.pdf

15.7 Fibonacci Numbers, The Golden Rectangle, Drawing a Pentagon Using the Golden ration, Phylotaxis

See

www.stem2.org/je/fibonacci.pdf

15.8 Maurice Smith: The Kansas City Google Networking Project

Talk and Handout:

www.google.com/fiber/kansascity/faq.html

15.9 Maurice Smith: An Introduction to Chemical Oxidation Potential and a Device For Measuring This Potential

Oxydation-Reduction Potential ORP Instrument:

Safedip

ORP or PPM

Handout:

www.safedip.com

www.eutechinst.com/

PPM or Orp: Which Should Be Used?, Jacques M. Steininger, Swimming Pool Age and Spa Merchandiser, November, 1985.

Maurice will expand on the topic of oxidation potential, and Oxydation-Reduction Reactions at a later meeting.

16 MEETING NOTES, 5/10/11

The May meeting of the STEM Society will take place on the second Tuesday of the month, May 10, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Topics might include some, but certainly not all of the following: experiments and demonstrations, electronics projects, a program for creating electrical diagrams, a program to design printed circuit boards, theorems from vector analysis, group theory and its relation to physics, using Python, using Latex, and finally contributions and descriptions of work and projects of attendees. The latter will take priority, since it is the main purpose of our group. So attendees, clear the material from your desks and laboratory workbenches. Stuff it in a satchel and bring it and your brain to the meeting. **Our web site is:**

<http://www.stem2.org/>

16.1 Vector Analysis

We looked at a proof of Green's Theorem in the plane, and the use of it in proving Stokes' Theorem. We examined Faraday's law of induction and how we may use Stokes' Theorem to arrive at the version appearing as one of Maxwell's equations. Most of this appears as sections 8 through 13 in the document

<http://www.stem2.org/je/vecana.pdf>

16.2 Experimental Demonstrations

- (1) Demonstration of Faraday's Law of Induction Using a magnet and a coil.
- (2) The Seebeck effect using a Thermocouple made from an iron and a copper wire twisted together. Using an op amp to amplify the voltage.

16.3 Drawing Circuit Diagrams

I mentioned my program `cdiagram.ftn` for drawing circuit diagrams and some of our projects in the analog electronics class held at the cave space, ccckc:

<http://blog.cowtowncomputercongress.org/>

<http://groups.google.com/group/ccckc/>

<http://stem2.org/je/electronics.htm>

17 MEETING NOTES, 4/12/2011

The April meeting of the STEM Society will take place on the second Tuesday of the month, April 12, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Bob Kessler wants to create a CAPS East in the newer building at the Bannister Fedral Complex. He will talk strategy and lead a discussion on the subject. CAPS stands for Center for Advanced Professional Studies and is a program run by the Blue Valley School District in Kansas.

I think we have not treated experiments and demonstrations much lately, so I was planning to do some of this. A few things that occur to me are the creation of a 3d pantograph for aiding in the copying of objects and for doing sculpture. A demonstration of the thermocouple effects using amazingly cheap multimeters. Amplification with op amps. Some current projects in electronics, and ideas of inversive geometry that lead to interesting linkages.

It has been suggested that we look into the ideas behind Green's functions, examine the ideas of String Theory, and the concept of the Event Horizon that occurs in General Relativity, in the theory of Black Holes.

Green's functions and the modern idea of the fundamental solution occur in modern theories of partial differential equations, where solutions are generalized functions, also called distributions. This theory of partial differential equations involves concepts of Topological Vector Spaces.

String Theory involves quite advanced mathematics, and requires a background in differential geometry, algebraic geometry, modern particle physics, relativity and quantum mechanics, so is not easily approached. I prefer treating such subjects mathematically, rather than with hand-waving and analogy. One nice approach is to look at the history of such subjects. So if a loop of string travels in space-time it generates a surface, a manifold, and leads to high dimensional spaces and so on. So one of Brian Green's favorite illustrations demonstrates curled up dimensions by showing an ant crawling around a telephone wire. This never fails to generate a question from the audience such as "What if it is not an ant?." Perhaps we can discuss some of these topics.

We have not completed our discussion of quantum mechanics, but we shall relieve ourselves from this for a while.

I have recently updated the meeting archive file combining our meeting notes. Find it under documents on the WEBSITE.

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17.1 CAPS East, Bob Kessler

Here is a document from Bob concerning this topic:

<http://www.stem2.org/je/capseast4.pdf>

17.2 Pantograph

Motivated by a sculpture demonstration at the April first friday KC art walk, we have decided to create a three dimensional pantograph for carving

a reproduction using an electric rotary tool. I created a prototype out of wood for the meeting. See the following document for a brief mathematical presentation on the operation of the pantograph:

<http://www.stem2.org/je/pantograph.pdf>

17.3 Measuring Small Thermocouple Voltages With Very Cheap Multimeters

A traditional moving coil multimeter can not measure the small millivolt potentials generated by thermocouples (Peltier and Seebeck effects). However, very cheap digital multimeters, which can sometimes be purchased from places like Harbor Freight for about three dollars, can do this. I demonstrated this by simply twisting a steel wire and a copper wire together and heating the junction. Copper and steel do not make the best thermocouple, but yet, a value of a few millivolts was measured.

17.4 A Brief Description of Some Electronics Projects

I talked a bit about the switching power supply we are designing, and some about Operational Amplifiers.

17.5 George Green and Green's Functions

I gave a presentation on Green's functions:

<http://www.stem2.org/je/greens.pdf>

17.6 Nature Photos, Cecile Lagrande

Cecile presented some pictures made at her estate in southern missouri.

18 MEETING NOTES, 3/8/2011

The March meeting of the STEM Society will take place on the second Tuesday of the month, March 8, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Possible subjects for the meeting include, (1) A continuing talk on Quantum Mechanics and the Hydrogen Atom, (2) Mathematical History: The French "L" boys, Monge and Descriptive Geometry. (3) Kansas City Spaces: Hacker, Maker, FabLab Science Cafe, and the Maker Faire. (4) Book Report: "The Abacus and the Cross.", and (5) Member Projects and Topics.

WEB Site:

www.stem2.org

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18.1 Geology of Missouri, Cecile Lagandre

Cecile concluded her discussion on geology presenting many beautiful pictures. Her presentation finished on the geology of Missouri. See the meeting notes for January for her previous document.

18.2 Kansas City Spaces: Hacker Spaces, Maker Spaces, FabLabs, The Science Cafe, and the Coming Kansas City Maker Faire.

We discussed these topics, and in addition, schools, and the topic: vocational education vs professional education. Professionals do it for money, amateurs for love. We neglected to discuss academic education for those of us who love knowledge for its own sake. Below is a preliminary document, which will probably be added to.

<http://stem2.org/je/fablab.pdf>

18.3 French Enlightenment Mathematicians and Scientists Whose Names Start With "L"

This was a somewhat facetious and humorous discussion. Cecile gave us a proper pronunciation of the French names. Here is a preliminary document, to which material may be added. Check back for added enlightenment.

<http://stem2.org/je/frenchlguys.pdf>

18.4 Quantum Mechanics and The Hydrogen Atom, Jim Emery

We ran out of time so that I was not able to continue the treatment of this topic much further. I did make some summary remarks on the subjects to come later. Here is the current document:

<http://www.stem2.org/je/hydrogenatom.pdf>

19 MEETING NOTES, 2/8/2011

The February meeting of the STEM Society will take place on the second Tuesday of the month, February 8, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

Topics for the meeting include, a beginning talk on Quantum Mechanics, computer computations involving this subject, running software on the Trailside Center computer, a finish to Cecile's talk on Geology, and any other topics that anyone cares to bring up.

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19.1 More on Stacking Cannon Balls

Last month Bob Williams talked about stacking Cannon Balls.

<http://www.stem2.org/je/StackingCannonballs.pdf>

The following document is a drawing generated by a computer program showing how cannon balls, or molecules can be stacked layer upon layer, with two choices, at each stacking step. The small circles and the dots in between the big circles represent two alternate locations for a second layer of cannon balls. They are small so that these positions will not hide the first layer. So at each stacking step there are two possible ways to stack. We are assuming here that the number of balls in each layer is very large or infinite.

<http://www.stem2.org/je/hexcircles.pdf>

Recall from a previous talk about the structure of Iron and Steel, that this is relevant to the BCC (Body Centered Cubic) and FCC (Face Centered Cubic) crystal structures, which have different properties. This previous talk concerned the observed change when a heated wire is heated by an electric current and then cooled, showing a phase change.

19.2 Quantum Mechanics and The Hydrogen Atom, Jim Emery

We went over some preliminary material, some history, Bohr's 1913 quantum theory, De Broglie's wave theory, and introduced the Schrödinger equation. Our unfinished document is:

<http://www.stem2.org/je/hydrogenatom.pdf>

20 MEETING NOTES, 1/11/2011

The January meeting of the STEM Society will take place on the second Tuesday of the month, January 11, 2011, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time as usual is 6PM.

Tentative Topics are:

- (1) Jeff Burns of the the University of Kansas Medical Center Department of Neurology will talk about his groups research on brain science.
- (2) Craig Nulan will give a talk about Google Apps for Education as the ultimate Content Management System, and as a close out to the SMART Community thread that he attempted to start in October.
- (3) Cecile Lagrande will talk on "The Ozarks Through Geologic Time."
- (4) If there is time, or if a presenter passes out during a presentation, or more likely at a future meeting, I will start my talks on Quantum mechanics and the structure of the Hydrogen atom, or I can present a Python computer program concerning sphere packing and stacking relating to Bob Williams talk last month. In future meetings we can talk about electronics and various scientific experiments. Also we might have a very short book report on a recent book, "The Abacus and the Cross," which is about Pope Sylvester II (Gerbert of Aurillac), circa the year 1000, who brought Arabic learning in science and mathematics, to Europe.

20.1 Jeff Burns, Kansas University Medical Center: Brain Science

Neurologist Jeff Burns did research at Washington University in St Louis and heads the Kansas University Alzheimer and Memory Program. The question to be answered by his research is " What affect does exercise have on Alzheimer's Disease?

Aloysius "Alois" Alzheimer (14 June 1864 19 December 1915), was a German psychiatrist and neuropathologist and a colleague of Emil Kraepelin. Alzheimer is credited with identifying the first published case of "presenile dementia", which Kraepelin would later identify as Alzheimer's disease. Together with two Italian physicians, he would use the staining techniques to identify amyloid plaques and neurofibrillary tangles. Dark areas in the brain. Progressive brain disease.

In 1901, Alzheimer observed a patient at the Frankfurt Asylum named Auguste Deter. The 51-year-old patient had strange behavioral symptoms, including a loss of short-term memory. PET scan half life hours. Louis bodies. Loss of brain cells. 5.3 million suffer from dementia in the US. Dementia: any brain behavior problem. Short term memory problems, but long time memory preserved. Alzheimer patients suffer pure amnesic problems, but with much of problem solving abilities preserved. Anti-amyloid. Single protein. Mitochondrial research with Russell Swerdlow, M.D. Hypocampus is hit hard with Alzheimer disease. Burns seeking volunteer subjects for his exercise research at KU.

Tools for studying the brains of Alzheimer patients: MRI, CT scans, PET scans.

Amyloids are insoluble fibrous protein aggregates sharing specific structural traits. Abnormal accumulation of amyloid in organs may lead to amyloidosis, and may play a role in various neurodegenerative diseases.

The name amyloid comes from the early mistaken identification of the substance as starch (amylum in Latin), based on crude iodine-staining techniques. For a period, the scientific community debated whether or not amyloid deposits were fatty deposits or carbohydrate deposits until it was finally found that they were, in fact, deposits of proteinaceous material.

* The classical, histopathological definition of amyloid is an extracellular, proteinaceous deposit exhibiting beta sheet structure. Common to most cross-beta type structures they are generally identified by apple-green birefringence when stained with congo red and seen under polarized light. These deposits often recruit various sugars and other components such as Serum Amyloid P component, resulting in complex, and sometimes inhomogeneous structures.[2] Recently this definition has come into question as some classic, amyloid species have been observed in distinctly intracellular locations.[3]

* A more recent, biophysical definition is broader, including any polypeptide which polymerizes to form a cross-beta structure, in vivo, or in vitro. Some of these, although demonstrably cross-beta sheet, do not show some classic histopathological characteristics such as the Congo red birefringence. Microbiologists and biophysicists have largely adopted this definition,[4][5] leading to some conflict in the biological community over an issue of language.

Amyloid is characterized by a cross-beta sheet quaternary structure.

Other polypeptides and proteins such as amylin and the Alzheimer's beta

protein do not have a simple consensus sequence and are thought to operate by hydrophobic association. [

Amyloid beta is a peptide of 3643 amino acids that appears to be the main constituent of amyloid plaques in the brains of Alzheimer's disease patients.

20.2 Google Science Fair

http://www.readwriteweb.com/archives/for_many_of_us_science.php

20.3 Craig Nulan: Google Apps for Education

Craig handed out two documents:

- (1) The Smart Community
- (2) Learning Outcomes.

The latter is a sample of discussions he is having on the internet concerning his interests in this area.

Craig told us that Google Apps for education, is much better than standard content management software, such as Joomla, which requires far too much administration. This talk was a conclusion of a talk first given in October.

20.4 Cecile Lagrande, The Ozarks Through Geologic Time

Cecile gave a summary of geology and geological history, and related it to the specific geology of the Ozark region of Missouri. Because of lack of time, we decided to have her complete her talk at the next meeting. Here are some of her slides:

<http://www.stem2.org/je/preozarks.pdf>

20.5 Stacking Cannon Balls, Bob Williams

Last month Bob Williams talked about stacking Cannon Balls.

<http://www.stem2.org/je/StackingCannonballs.pdf>

<http://www.stem2.org/je/hexcircles.pdf>

This second document is a drawing generated by a computer program showing how cannon balls or molecules can be stacked layer upon layer, with two choices, at each stacking step. Recall from a previous talk about the structure of Iron and Steel, that this is relevant to the BCC (Body Centered Cubic) and FCC (Face Centered Cubic) crystal structures, which have different properties.

20.6 Quantum Mechanics and The Hydrogen Atom, Jim Emery

We intend to spend some time in the future on this material. A preliminary document is:

<http://www.stem2.org/je/hydrogenatom.pdf>

20.7 Bob Kessler, Book Review: The Abacus and the Cross, by Nancy Marie Brown

Title: **The Abacus and the Cross: The Story of the Pope Who Brought the Light of Science to the Dark Ages.**

Questions supplied by Bob Kessler. Answers were to be supplied by Jim Emery and the audience.

1. What is an abacus?
2. The Dark Ages is what period of time?
3. In the year 1000 was the church antiscience or was the study of science considered approaching the mind of God?
4. What was Pope Sylvester II's common name?
5. Did you and Sylvester II abide by the St. Benedict Rule, i.e., to be content with the poorest and the worst of everything, ... like all good monks?
6. In what century was Purgatory invented?
7. How were books made in the early centuries?
8. Did the trivium and the quadrivium combine to make up all the liberal arts of the time?

9. What were the subjects of the trivium? The quadrivium?
10. What was the language of science in the year 1000?
11. What present day country did the Arabic numbering system come from?
12. Where did the essence of modern mathematics, astronomy, physics, medicine, philosophy, and computer science come from?
13. Now, knowing the importance historically of the Astrolabe, will Jim Emery and the **makers** make an Astrolabe?
14. Do you recommend others read this book?

21 MEETING NOTES, 12/14/2010

The December meeting of the STEM Society will take place on the second Tuesday of the month, December 14, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.

The Topics are:

- (1) I had planned to start a talk on quantum mechanics and the mathematical structure of the hydrogen atom. But because we have several other talks, I will just briefly introduce this topic.
- (2) Bob Williams will give a presentation on how his life long pursuit of Physics and Mathematics has made him a rational billionaire. This should prove inspirational to children, especially children of all ages, who have a scientific inclination, and a nonzero interest in pecuniary reward.
- (3) Craig Nulan will give a talk about Google Apps for Education as the ultimate Content Management System, and as a close out to the SMART Community thread that he attempted to start in October.
- (4) There was to be a possible presentation by Jeff Burns of the the KU Med Center Department of Neurology about his research on brain science. However, this will probably occur at a later date.
- (5) There is also a possible presentation by Rich Kauffman on "Why Too Much Algebra is Taught to High School Students." But Rich is quite busy this time of year, so probably won't be able to make the meeting.

21.1 Quantum Mechanics and The Hydrogen Atom, Jim Emery

I outlined what I wanted to do on this subject, which will be presented at a later meeting. My partial document is:

<http://www.stem2.org/je/hydrogenatom.pdf>

21.2 Stacking Cannon Balls, Bob Williams

Bob presented his solution to a cannon ball Stacking Problem. He did this with PowerPoint. It has been converted to pdf.

<http://www.stem2.org/je/StackingCannonballs.pdf>

21.3 The Mathematics of Investing, Bob Williams

Bob presented his mathematical techniques for investing in stocks, which has made him fractionally fabulously wealthy.

21.4 Google Apps for Education, Craig Nulan

Due to a mixup in transportation, Craig was not able to make the meeting. He will present his talk in January. Here is what he had in mind:

Jim,

I'd like to give a talk about Google Apps for Education as the ultimate Content Management System, and close out the SMART Community thread I attempted to start in October. Let me know if I can have some time as the last presenter Thanks.

C.N.

(I'll send you a summary write-up I did in January for the School and for the Library outlining my key points)

22 MEETING NOTES, 11/9/2010

The November meeting of the STEM Society took place on the second Tuesday of the month, November 9, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time was 6PM.

Topics were:

- (1) A presentation on Fibonacci Numbers and their relation to constructing a pentagon with ruler and compass. Some computations on this material are included in the fibonacci document, using Fortran, Java and Python.
- (2) The structure of Postscript. The figures in my LaTeX documents are mostly Postscript files. I shall showed some Postscript files, what some of their properties are, and how the figures in the Fibonacci document were created.
- (3) A review of the book by K. C. Cole called "Something Incredibly Wonderful Happens," which is about Frank Oppenheimer, and the Exploratorium that he created in San Francisco.
- (4) A demonstration of fluorecense of rocks using ultraviolet light by Cecile Lagandre
- (5) Spontaneous topics and surprises by members, and the usual debauchery, with cookies.

22.1 Fibonacci Numbers, The Golden Ratio, and the Connection to Drawing a Pentagon With Ruler and Compass

<http://stem2.org/je/fibonacci.pdf>

22.2 The Structure and Properties of a Postscript File

The figures in my LaTeX documents are mostly Postscript files. I showed what Postscript files look like, what some of their properties are, and showed how the figures in the Fibonacci document were created. This information is also in the fibonacci.pdf document.

22.3 Bob Kessler's Review of the Book "Something Incredibly Wonderful Happens"

The book: **Something Incredibly Wonderful Happens: Frank Oppenheimer and the World He Made Up** by K.C. Cole with Forward by Murray Gell-Mann.

Why did I read it? An email from Jim Benz:

Bob, Just thought I'd let you know, I'm scheduled for a triple bypass on Tuesday at KUMC. I also finished reading "Something Incredibly Wonderful Happens" by K.C. Cole. It's suppose to be coming out in paper back around now. I really think you'll enjoy it. It's a bio about Frank Oppenheimer and his Exploratorium. Chapter 11 Anarch explains everything I believe about science education. Jim

Who's Jim Benz? Jim is a 7th grade life science teacher at Turner Middle School in Turner School District. He was the recipient of the Christa McAuliffe Award in 1996. Jim conceived of and founded the T.R.U.E Blue Program (Teaching Rivers in an Urban Environment) and the Blue River Watershed Association.

Forward:

...Referring to the Exploratorium, Gell-Mann commented.... Its ultimate goal was to get people so addicted to understanding that they would somehow become inoculated against the clever deceptions of some advertisers and politicians.

The book is divided into two parts.

Part I: THE WORLD HE CAME INTO covers Frank Oppenheimer's earlier life from his childhood thru his Physics education, work on the Manhattan Project, the effects on his life of societies fears of communism in the McCarthy era, his work as a rancher in Colorado, and his final return to academia in 1959 at the University of Colorado.

Part II: THE WORLD HE MADE UP covers his move to the San Francisco area and the establishment, workings, and philosophical orientation of the Exploratorium.

Part I: THE WORLD HE CAME INTO

1. Palace of Delights
2. A Little Royal Family
3. The Uncle of the Atom Bomb
4. Un-American

5. Exile
6. An Intellectual Desert . and a Library of Experiments
7. A Museum Dedicated to Awareness
8. A Decent Respect for Taste
9. The Man with the Gold Rimmed Glasses
10. The Sentimental Roots of Science
11. The Anarch
12. The World He Made Up

I found the book quite interesting both from the political history that folks who have been involved in making nuclear weapons tend to relate to, and the educational approaches used that offer good suggestions on what should be considered in the world today. The thoughts that one comes away with relate to Jim Emery tinkerer, explorer, maker, not to teach people to calculate, but to illustrate the extraordinary power and versatility that mathematics has in helping us think about and relate to the behavior of nature. The practical question is can Jim get part of the DOE Bannister Complex converted into a Kansas City Exploratorium? And who might be willing to help?

Bob Kessler
11/9/2010

22.4 Cecile Lagandre's Ultraviolet Light and Rocks

Cecil demonstrated the effect of ultraviolet light on some rock samples. She used a plant ultraviolet light and an LED source of ultraviolet light.

From wikipedia:

"Fluorescence is the emission of light by a substance that has absorbed light or other electromagnetic radiation of a different wavelength. In most cases, emitted light has a longer wavelength, and therefore lower energy, than the absorbed radiation.

Phosphorescence is a specific type of photoluminescence related to fluorescence. Unlike fluorescence, a phosphorescent material does not immediately re-emit the radiation it absorbs. The slower time scales of the re-emission are associated with "forbidden" energy state transitions in quantum mechanics." Other related topics include chemiluminescence, persistent luminescence, and fluorescence spectra.

Some of Cecil's rock samples:

<http://www.stem2.org/je/DSCF1627.JPG>

A stromatolite:

<http://www.stem2.org/je/DSCF1629.JPG>

From Wikipedia:

”Stromatolites (from Greek stro-ma, mattress, plus lithos, rock) are layered accretionary structures formed in shallow water by the trapping, binding and cementation of sedimentary grains by biofilms of microorganisms, especially cyanobacteria (commonly known as blue-green algae). They include some of the most ancient records of life on Earth.”

23 MEETING NOTES, 10/12/2010

The October meeting of the STEM Society took place on the second Tuesday of the month, October 12, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time was 6PM.

Topics are: (1) *A presentation on Polyvision by Craig Nulan*, (2) *A presentation on Missouri rocks and Geology by Cecile Lagandre*. (3) *Pentagons, and Fibonacci* (4) *A possible visit by members of an English research laboratory*. (5) Spontaneous topics and surprises by members, and the usual debauchery, with cookies.

23.1 Craig Nulan’s Presentation on Education and Technology

Craig presented some of his views on technology and the future of education as well as some information about Polyvision, an interactive whiteboard competitor to the Smartboard. His topic was ”The Smart Community,” a system of interactive and open source learning based on the open ideas of the internet and the world wide web, and also using the model of Hip Hop Music, which Craig claims is also an open and collaborative creation. Here is his document:

<http://stem2.org/je/smartcommunitysystem.pdf>

23.2 Cecile Lagandre's Presentation on Some Missouri Rocks and Geology

Dave and Cecile have an estate, a sort of nature preserve, located near Warsaw Missouri. Cecile had collected various rocks and geological specimens there. She discussed the various measurements that she had made on the rocks and speculated on the geological period to which they belonged. She brought a beam balance to the meeting and demonstrated how she had measured the specific gravity of the rocks. Links to some pictures and information will appear here in the future.

Below is a link to information on how to measure specific gravity using the buoyant force of water.

<http://stem2.org/je/specificgravity.pdf>

23.3 Rick Hines' Cave Pictures

Rick presented some pictures of a Missouri cave with interesting Stromatolites. Below is a Wikipedia link to an article on Stromatolites.

<http://en.wikipedia.org/wiki/Stromatolite>

23.4 Fibonacci Numbers, The Golden Ratio, and the Connection to Drawing a Pentagon With Ruler and Compass

<http://stem2.org/je/fibonacci.pdf>

23.5 Visit of English Researchers

This group, guided by Maurice Smith, did not make it to the meeting in time due to their overindulgence in Barbecue at a certain well known south side Kansas City restaurant.

24 MEETING NOTES, 09/14/2010

The September meeting of the STEM Society took place on the second Tuesday of the month, September 14, 2010, at the Trailside Center at 99th and

Holmes in Kansas City, Missouri. The starting time was 6PM.

Topics were: (1) *Pictures from the Mini-Maker Faire*, (2) *A review of the latest book by Richard Rhodes (Rhodes will be giving a talk at Linda Hall in October.)* (3) *Presentation of some work on cave modelling*, (4) *Using the Smartboard*.

The Stem Society WEB link is:

<http://stem2.org/>

24.1 The MiniMaker Faire

The MiniMaker Faire was held on Sunday August 21st 2010 in Parkville Missouri. There were about fifty exhibitors. The material I exhibited is summarized in the document

<http://stem2.org/je/minimaker.pdf>

We viewed a youtube video of the faire made by Roger Dodger Aviation. Search on youtube for "Mini-Maker Faire 2010: Kansas City" rogerdodger-aviation.

24.2 Review of Rhodes Book

Bob Kessler gave a review of the new book by Richard Rhodes, *Twilight of the Bombs*. Rhodes will speak at linda hall in October. See the Linda Hall Library website for details.

24.3 Cave Modeling

I summarized my preliminary work on a model for studying the cave flooding. It consists in defining sections of the cave through surveying as hexahedrons, triangulating, and defining transition hexahedrons, then intersecting the triangulated model with a plane representing the water level, retriangulating the model, calculating the new volume by integrating the surface area via the divergence theorem, and so on. Rick Hines pointed out that my understanding of the surveying process was not quite correct. There is ambiguity in the models derived from surveying and so an approximation.

My preliminary model is outlined in the document

<http://stem2.org/je/cavemodel.pdf>

And preliminary calculations done in the program

`cavevol.ftn`

24.4 The Smartboard

We looked at using the Smartboard software. Specifically at the Notebook program. This allows one to draw on the smartboard and capture this in a notebook file on the connected computer. One can capture the the notebook pages as a pdf file, paste in external files and graphics, draw freehand or with graphics objects and so on. There are many interesting and useful features. I downloaded the notebook software which allows a month or so trial before a license number must be entered. We should be able to obtain a license number through the Trailside Center.

Craig Nulan pointed out that there is a perhaps better system called Polyvision. He will give a talk on this at our October meeting. There was a discussion of the importance of technology or the lack of its importance in education and at libraries.

25 MEETING NOTES, 08/10/2010

25.1 Carroll Cave Slide Show

Rick Hines commented on Carroll cave and the project to study the path of water through the cave and the problem of cave flooding. Unfortunately, the creators of the slide show do not want the show made public at this time because it is part of an academic thesis and may be published.

25.2 Fluid Mechanics

We went through the **Fluid Mechanics** document quickly and related it to the flooding problem.

The document is available at

<http://stem2.org/je/fluidmechanics.pdf>

25.3 Ed Welch Presentation On Celestial Globe

Ed brought in a transparent globe that allows astronomical objects to be viewed and located. Various calculations can be done with this globe/planetarium from the Smithsonian.

26 MEETING NOTES, 07/13/2010

The July meeting of the STEM Society took place on the second Tuesday of the month, July 13, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time was 6PM.

Topics included *Sirius, the Dogons, Astronomy, Cave Flooding, and Lighting LEDs*

The Stem Society WEB link is:

<http://stem2.org/>

26.1 Announcement of the Meeting

The July meeting of the STEM Society will take place on the second Tuesday of the month, July 13, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time will be 6PM.

One topic is: *The brightest star in the sky, Sirius, the Dogons, and some Astronomy Definitions*. Rich Kauffman has suggested that we go through the derivation of the structure of the hydrogen Atom using Quantum Mechanics. So I invite anyone to make a start on this. Last week I viewed a C-Span book TV talk on a book about the philosopher Spinoza. He lived around the same time as Descartes, who believed that both the mind and body exists. Spinoza on the other hand believed that only the body exists. Spinoza presented much of his philosophy in a logical way in the style of Euclid. Spinoza was excommunicated from the Jewish community of Amsterdam for his views. He earned his living grinding lenses.

The Spinoza book is: "Betraying Spinoza: The Renegade Jew Who Gave Us Modernity" by author Rebecca Goldstein.

So I invite someone to talk about Spinoza.

There was a recent series of talks at Linda Hall Library called something like "Are we Alone?" It concerned the possibility of intelligent life in other

parts of the universe. One talk on time travel I found especially interesting was given by Sean Carroll of Cal-Tech. He is a young leading expert on General Relativity. He works with Kip Thorne. I had a brief but interesting conversation with him. He has a semi-popular book on time travel called "From Infinity to Here." And I actually bought it for 26.95, which is saying something, since I very seldom pay more than a buck or two for books. He also has a general relativity book which I have not looked up yet. I asked him how it compared to the classic book "Gravitation." He said his book is shorter.

As always, all are encouraged to bring topics and projects to the meeting for discussion. That actually is the real purpose of our group.

I have recently updated the meeting notes archive:

<http://stem2.org/je/archive.pdf>

The Stem Society WEB link is:

<http://stem2.org/>

26.2 Topics

Dixon: the Dogons

Emery: Astronomy and a device to illustrate right ascension and declination.

Rick Hines: (1) Powering a very bright LED giving off very bright light. Perhaps these LEDs will become the new standard lighting devices.

(2) The Flooding of Carroll Cave.

26.3 Les Dixon: The Dogons and Their Advanced Knowledge of Sirius

Les gave a talk on the Dogon people of Mali and their advanced knowledge of the star Sirius, the brightest star in the sky. See "The Amazing and Intriguing Dogons," By Leon Dixon (2010), by clicking below.

<http://stem2.org/je/dogonsdixon.pdf>

The main Dogon village at the present time is Bandiarara Mali, which is at latitude 14.349328 degrees north and longitude -3.610765 (west).

26.4 Jim Emery: Sirius

The star Sirius is at Right Ascension 6 hours 45 minutes and 9 seconds and Declination -16.71 degrees. Sirius is actually a pair of stars called Sirius A and Sirius B. Sirius B is a white dwarf. Bessel in the 19th century provided indirect evidence that Sirius was a pair of stars, but a clear image of the pair has only been gained in recent years using the space telescope.

26.5 Jim Emery: An Astronomy Device for Locating Stars

26.6 Rick Hines: Demonstration of a New Very Bright LED; Discussion of The Carroll Cave Flooding

27 MEETING NOTES, 06/08/2010

The June meeting of the STEM Society took place on the second Tuesday of the month, June 8, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time was 6PM.

Topics included *Palaeobotany* and *Linear Algebra and Its Applications*.

The Stem Society WEB link is:

<http://stem2.org/>

Severe weather perhaps limited attendance.

Cecil Lagrande gave a talk on Palaeobotany. See below for her Excel files.

Jim Emery gave a talk on Linear Algebra. This proved to be much too big a subject for a succinct and transparent summary. We should present little topics in Linear Algebra rather than attempt a complete summary.

27.1 Palaeobotany, Cecil Lagrande

Palaeobotany deals with the recovery and identification of plant remains in fossils: it allows the reconstitution of the evolutionary history of plants and the reconstruction of ancient ecological systems and climate.

Cecil's Excel file is located at

<http://stem2.org/je/paleobotany.xls>

Older versions of Excel may have trouble with this file.

27.2 Linear Algebra, *Jim Emery*

<http://stem2.org/je/lineara.pdf>

28 MEETING NOTES, 05/11/2010

The May meeting of the STEM Society took place on the second Tuesday of the month, May 11, 2010, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time was 6PM.

I recently came upon an old issue of the California Institute of Technology magazine "Engineering and Science", October 1980, and an article by Judith and Davis Goodstein titled "The Scientific Method." This prompted me to consider having a discussion on the scientific method and whether scientists really use it. Science fairs put emphasis on the scientific method and require that participants follow the steps of the method, so as to suggest that if these steps are followed accurately truth results. However, the usual results found at science fairs, and results found in elementary physics labs, taken by themselves, would refute much of classical science, and call into question the scientific path to truth. Science fairs are no doubt a good educational experience, but conceivably could lead to the participants questioning the validity of science. I suggest that everyone read the Wikipedia article "Scientific Method" to prepare for the discussion.

Joel Kershner talked about Amateur Radio and the various digital ways of sending information.

If there had been any time left I might have raised some topics in Linear Algebra, Functional Analysis, and maybe talk about some of the history of these subjects.

The Stem Society WEB link is:

<http://stem2.org/>

Joel Kirshner gave a talk on Amateur Radio and the Digital Mode. There was a lot of interest in the talk.

We had a discussion about the scientific method.

Greg Hodes gave a talk on the Generalized Empirical method. He started his talk with a discussion of Plato's dialog Meno and the problem of constructing a square of double the area of a given square.

<http://en.wikipedia.org/wiki/Meno>

This illustrated according to Greg that everyone naturally wants to know, and that learning takes place only when this desire is made manifest. Greg went on to discuss the Generalized Empirical method in more detail and how it relates to the scientific method.

28.1 Amateur Radio and the Digital Mode, *Joel Kirshner*

Informative resources:

<https://docs.google.com/Doc?docid=0AdEyX8sSjmYHZGNtMnIOYzhfMTA5ZjhYeGpuZmo&hl=en>

Presentation:

<https://docs.google.com/fileview?id=0B9EyX8sSjmYHM2E3Njk0MzMtMTgyNC00M2EzLTlhMDMtODEzMzg5MWNiNzg4&hl=en>

28.2 The Scientific method, *Jim Emery*

<http://stem2.org/je/scientificmethod.pdf>

28.3 The Generalized Empirical Method, *Greg Hodes*

The natural world is what is or could be known by the intelligent application of the scientific method. Reality in general is what is or could be known by the intelligent application of the method of intelligence.

AN EPISTEMOLOGICAL EXPERIMENT

- Knowing something
- Knowing knowing
- Epistemic generalization of above: Theory L
- Proof.
- Unrevisability claim
-Proof.
- Ontological generalization of above
- Proof.
- Locus of method: Rational self-appropriation

29 MEETING NOTES, 04/13/2010

The April meeting of the STEM Society took place on the second Tuesday of the month, April 13, 2010, at the Trailside Center at 99th and Holmes in Kansas City Missouri. The starting time was 6PM. Topics were: Stereolithography Molecular Models, Linear Algebra and Functional Analysis, Quaternions, Octonions, and their application to rotations and to Physics. Bob Kessler demonstrated the new Macintosh I-Pad. The Stem Society WEB link is:

<http://stem2.org/>

We discussed Stereolithography and molecular models only briefly. We shall get back to this at a future meeting.

We also did not get to the topic of Linear Algebra and Functional Analysis, again we shall visit this in the future.

We did present material on quaternions and octonions. The document presented was:

<http://stem2.org/je/quaternions.pdf>

John Gamble talked about his interest in these things and their possible application to particle physics. He has been pursuing this interest for some time.

I presented my matrix class created in Python. Noel Christiansen gave an explanation of object oriented programming. Python has a very clean way to do object oriented programming, and operator overloading. My class appears in the document:

<http://stem2.org/je/sciprog.pdf>

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30 MEETING NOTES, 03/09/2010

The March meeting of the STEM Society took place on the second Tuesday of the month, March 9, 2010, at the Trailside Center at 99th and Holmes in Kansas City Missouri. The starting time was as usual 6PM. Topics were: Particle Physics, Time Series Analysis, Regression Analysis, and an introduction to Digital Filtering. The Stem Society WEB link is:

<http://stem2.org/>

Richard Peters gave a talk on geometric structure and elementary particles.

Jim Emery gave a talk on Regression, Time Series, Norbert Wiener, and a brief mention of the Kalman Filter. See the document **Regression** in the STEM documents list, or click below

<http://stem2.org/je/regression.pdf>

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31 MEETING NOTES, 02/09/2010

The February meeting of the STEM Society took place on the second Tuesday of the month, February 9, 2010, at the Trailside Center at 99th and Holmes in Kansas City Missouri. The starting time was 6PM. The topic was Static Electricity and Static Electricity Machines. These include the Wimshurst Machine, the Tesla coil, and the Van de Graaff generator. We may discuss the lives of the European immigrants who founded the electrical industry in America, namely Tesla, Steinmetz, and Puppin. I remember meeting a guy at the General Electric Research Laboratory in Schenectady, who had worked directly with one of Steinmetz's assistants at General electric. Charley, maybe you remember this guy's name? We visited him in connection with piezoelectricity, as I remember, or perhaps Finite Element Analysis of electrical problems. People are always interested in Tesla. The Stem Society WEB link is:

<http://stem2.org/>

Meeting subject: Static Electricity

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31.1 Static Electricity

<http://stem2.org/je/staticelectricity.pdf>

32 MEETING NOTES, 01/12/2010

The January meeting of the STEM Society took place on the second Tuesday of the month, January 12, 2010, Trailside Center at 99th and Holmes in Kansas City Missouri. The starting time was 6PM.

Dave VanDyne is tentatively scheduled to gave a talk on **Bernoulli Levitation** and the forces generated by fluid flow.

There are many organizations in Kansas City devoted to Science, Mathematics, Engineering, Making, and Creating. These are of interest to both professionals and hobbyists. With the internet the distinction between amateurs and professionals is becoming a little blurred. At one level professionals do it for money, while amateurs do it for pleasure. Money and pleasure itself is a possible discussion topic.

We may also discuss again "Scientific Calculation and Scientific Programming." I am proposing that we might have a workshop on this topic, perhaps at the CCKC cave. I think Wednesday evening is open there. We can discuss tools of calculation. This may range from calculators to available programs, libraries, and suitable languages. This could include obtaining tools, tutorials, and help in installing software. An introduction to LaTeX and so on. We will do a little Python programming. I am putting material about this topic in a document called **Scientific Calculating, Programming, and Writing**. It is currently in preliminary outline form at

[/http://stem2.org/je/sciprog.pdf](http://stem2.org/je/sciprog.pdf)

I welcome suggestions on this workshop idea. Contact me at:

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jdemery1@yahoo.com

32.1 Bernoulli Levitation

Bernoulli Levitation, Chris Waltham, Sarah Bendall and Andrzej Kotlicki
Department of Physics and Astronomy, University of British Columbia, Van-
couver B.C., Canada V6T 1Z1 Email: waltham@physics.ubc.ca Revised for
submission to Am. J. Phys. (2002/06/10)

32.2 Online Equation Editor

<http://www.codecogs.com/components/equationeditor/equationeditor.php>

33 MEETING NOTES, 12/8/2010

The December meeting of the STEM Society took place on the second Tues-
day of the month, December 8th, at the Trailside Center at 99th and Holmes
in Kansas City Missouri. The starting time was be 6PM.

John Gamble presented a discussion of Astrophysics. The book he is using
in his UMKC class is "Astrophysics in a Nutshell" by Tel Aviv University
professor Dan Maoz. John talked about Black Holes, the Hertzsprung-Russell
Diagram, the random walk of a photon from the center of the sun and how
long it takes such a photon to reach the surface, dark energy, and several
other topics in Astrophysics. Below is a review of the book and a list of the
table of contents.

A second topic was introduced briefly. This was "Scientific Calculation
and Scientific Programming." I am proposing that we might have a workshop
on this topic, perhaps at the CCCKC cave. I think Wednesday evening is
open there. We can discuss tools of calculation. This may range from cal-
culators to available programs, libraries, and suitable languages. This could
include obtaining tools, tutorials, and help in installing software. An intro-
duction to LaTeX and so on. We will do a little Python programming. I am
putting material about this topic in a document called **Scientific Calculat-
ing, Programming, and Writing**. It is currently in preliminary outline
form at

[/http://stem2.org/je/sciprog.pdf](http://stem2.org/je/sciprog.pdf)

I welcome suggestions on this workshop idea. Contact me at:

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33.1 Review and Table of Contents of "Astrophysics in a Nutshell."

A concise but thorough introduction to the observational data and theoretical concepts underlying modern astronomy, *Astrophysics in a Nutshell* is designed for advanced undergraduate science majors taking a one-semester course. This well-balanced and up-to-date textbook covers the essentials of modern astrophysics—from stars to cosmology—emphasizing the common, familiar physical principles that govern astronomical phenomena, and the interplay between theory and observation.

In addition to traditional topics such as stellar remnants, galaxies, and the interstellar medium, *Astrophysics in a Nutshell* introduces subjects at the forefront of modern research, including black holes, dark matter, gravitational lensing, and dark energy, all updated with some of the latest observational results. To aid physical understanding, mathematical derivations are kept as simple, short, and clear as possible, and order-of-magnitude estimates, dimensional analysis, and scaling arguments are frequently used. These no-nonsense, "back-of-the-envelope" calculations train students to think like physicists. The book is amply illustrated with simple, clear figures and each chapter ends with a set of problems.

In addition to serving as a course textbook, *Astrophysics in a Nutshell* is an ideal review for a qualifying exam and a handy reference for teachers and researchers.

The most concise and up-to-date astrophysics textbook for science majors
Contains a broad and well-balanced choice of traditional subjects and current research topics
Uses simple, short, and clear derivations of physical results
Trains students in the essential skills of order-of-magnitude analysis
Includes teaching problems with each chapter

Dan Maoz is Professor of Physics and Astronomy at Tel-Aviv University. His main research interests are supermassive black holes, gravitational lensing, and supernovae.

Reviews:

"Tel Aviv University professor Dan Maoz aims to provide a concise guide to the subject for advanced science undergraduates. The essentials of modern astrophysics are covered, from traditional topics such as stellar remnants and galaxies to recent research including dark matter and dark energy, while training students in order-of-magnitude analysis."—Times Higher Education

"[M]aoz makes generous and excellent use of back-of-the-envelope calculations and approximations to the more complete theory, accurate enough to both illustrate the physics and to arrive at decent numerical answers...Lots of material is squeezed into this thin volume. The treatment of stellar physics is particularly insightful; other topics—galaxies and galactic structure and cosmology, are also very well done."—K.L. Schick, Choice

"The presentation of so much material within 250 pages is done very skillfully, with a judicious balance between mathematical discussion and physical argument. The pedagogic value of the text is greatly enhanced by the problems given at the end of each chapter. Altogether, the book lives well up to the publisher's declared aims."—Leon Mestel, The Observatory

Endorsements:

Praise from professors who have adopted the book: "Astrophysics in a Nutshell is a wonderful addition to the advanced undergraduate textbook literature. It covers the important physics with sufficient depth to capture the students' curiosity without getting them lost in too much detail. The book is extremely broad, reaching from stellar to extragalactic to cosmological physics. Nevertheless, from the instructor's point of view, the book is constructed in a convenient modular way, so that one can easily select the relevant parts for one's specific course in any of those areas. Finally, the book emphasizes to the student the fundamental interconnectedness of the different astrophysical subfields."—Volker Bromm, University of Texas at Austin

33.2 Contents of "Astrophysics in a Nutshell."

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34 MEETING NOTES, 11/10/2009

The November meeting of the STEM Society took place on the second Tuesday of the month, November 10th at the Trailside Center at 99th and Holmes in Kansas City Missouri. The starting time was 6PM.

We discussed Spline curves and surfaces in computational geometry. We started with a discussion of the physical spline, which is a device for drawing smooth curves. It was originally used to design ship hulls, and later to design airplanes. This spline is essentially a thin beam of wood forced to go through interpolation points by forces supplied by lead weights called "ducks." I demonstrated a physical spline made of plastic, with ducks made of wood with sheet metal hooks. Plastic jars filled with water were used as weights to rest on the wood platform. Maurice Smith brought an actual spline "duck" used by draftsman in the 50's and 60's.

I presented a document called **The Cubic Spline**. It is available as

<http://stem2.org/je/cs.pdf>

Next we considered Bezier curves and looked at the document called **Bezier Curves**, which is available as

<http://stem2.org/je/bezier.pdf>

Then we talked briefly about B-Splines and the document called **B-Splines and Divided Differences**, which is available as

<http://stem2.org/je/bspline.pdf>

I introduced the idea of constructing a short course on computational methods applied to science and engineering. This material gives an opportunity to demonstrate useful and interesting computer programs. When teaching computer programming, often completely boring and tedious examples are presented. For example, creating a list of names, addresses, and phone numbers. I would like to have a discussion about what computer language should be used for such a course. Programming computational methods and algorithms can be quite interesting and fun and I recommend it.

34.1 What is Calculus?

I gave an introduction to Calculus at a CCKC meeting Thursday November 12 in the CCKC headquarters underground in the cave at 31st and Mercier. That document **What is Calculus?** is available as

<http://stem2.org/je/calcwhat.pdf>

35 MEETING NOTES, October, 2009

The October meeting of the STEM Society took place on Tuesday October 13th at the Trailside Center at 99th and Holmes in Kansas City Missouri. The meeting started at 6PM.

35.1 October 2009 Meeting Topics

The meeting started with a demonstration I gave on optical lenses. I used a convex lens to project an image onto a small screen. The positions of the object and image were noted and the focal length deduced. The object consisted of a transparent sheet upon which were written some alphabetic characters. I noted that the image was unreadable. I showed how one could determine whether eyeglasses were positive or negative lenses by observing how the image moved as the lenses were moved. For a positive lens, a convex

lens, namely a magnifying glass, the image moves opposite the direction of the lens motion. For a negative lens the opposite occurs. These facts can be explained by the fact that a positive lens enlarges and a negative lens reduces. So if the lenses of a pair of glasses produces an opposite moving image as the glasses are moved, the glasses are for correcting far sightedness, and the opposite observation tells us that the glasses are for correcting near sightedness. The last optics demo was done with a transparency projector. Such a projector has a large positive lens for projecting a brightly illuminated transparency object to a real image. Such a projector uses a mirror for turning the image so that it is projected onto a vertical screen. By removing the mirror I showed that the mirror is also needed to invert the image in one dimension to make the transparency readable. See my latest version of the Optics document at:

<http://stem2.org/je/optics.pdf>

Next we viewed our website on the internet and discussed some of the documents and material we have covered in the past 3 years, and showed that most of what we have covered is available on the website. Link:

<http://stem2.org/je/documents.htm>

Also see the archive document:

<http://stem2.org/je/archive.pdf>

We had a discussion of the 2009 Nobel Prizes in Physics, and so discussed the CCD, and Fiber Optics.

<http://stem2.org/je/nobelphysics2009.pdf>

The Makerbot being constructed by CCKC is progressing. A first part has been produced. Bugs are still to be worked out. The motion of the Makerbot is controlled by G-code produced by the program ReplicatorG. The program Skeinforge produces the G-code file from an STL file. The Makerbot can use the thermoplastic ABS (Acrylonitrile Butadiene Styrene) for extrusion. Craig Berscheidt showed us a movie of the MakerBot operating from his website:

<http://www.built-to-spec.com/blog/>

We did not have a presentation on the history of the National Labs.

I have been adding to a document called Quick Calculus. I can present material about this in the future.

<http://stem2.org/je/calcq.pdf>

We put a discussion of Game Theory off to a later date.

We showed some pictures of Dave and Ce'cile's new forge and showed objects they have fashioned using it. Maybe in the future we can talk about the metallurgy involved, the production of coke, welding and so on.

We did not talk about drilling a hole through the earth with a giant drill bit, holding the bit fixed and letting the rotating earth do the work so as to get a perfect hole through the center from the north pole to the south pole.

John Gamble was not present so did not discuss his class on Astrophysics.

We mentioned the new book by Pickover called "The Mathbook." This is a beautiful book on mathematics. A topic is presented on two pages, the first page introduces the topic, and the second page is an image or picture. Some did dismiss it as just a coffee table book. Here is a link supplied by Alietia Caughron

<http://sprott.physics.wisc.edu/pickover/math-book.html>

In the future I would like to talk about the work of Emmy Noether, her contribution to Ideal theory and Commutative Algebra, as well as her contribution to Quantum Mechanics. Noether was one of the great mathematicians of the 20th century.

Other topics we might get to in the future are Galois Theory, Analytical Mechanics, Quantum Mechanics, Computational Geometry, the Theory of Spline curves and surfaces, Projective Geometry, Algebraic Geometry, and the structure of proteins.

35.2 Mathematical Software

Included in the summary of mathematical software were the general programming languages,

Perl, PHP, Fortran, Borland C++, C, C#, Java, and Python.

We did not talk about Lisp or Scheme, but the latter language was discussed a bit in a presentation on Artificial Intelligence by Noel Christensen. We summarized the mathematical programs Matlab, MathCad, Maple, Mathematica, Octave (a free Matlab clone), and Studyworks. We showed how Excel can be used for scientific problems. We considered the Mathematical typesetting language TeX and Latex, including the commercial program PCTeX. Later we had a presentation on the free Latex version called MikTeX and the editor called Winedt. We discussed numerical software libraries such as Numerical Recipes, which has Fortran, C and Pascal versions. We discussed the free statistics package called the R Language.

Packages not discussed include versions of the circuit analysis software Spice, such as PCSpice, PLT Scheme a nice feature of Scheme and Lisp is the ability to handle integers of arbitrary length which is necessary for dealing with Number Theory and Cryptography. GNU Scientific Software is a free collection of scientific subroutine packages, as is Linpack and so on. We have not talked about plotting packages such as GNU Plot, Gimp, and Ghostscript. I have meant to give a demonstration on Postscript programming. Postscript is actually a programming language. MuPad Light is a free clone of Maple that we have become aware of in the last few months. Some of the free packages are being bought up by commercial competitors so as to take them out of circulation, an example of this is MuPad, which has been purchased by Mathworks, the company that makes Matlab. But the free MuPad Light can still be found.

35.3 Linear Algebra

I have been thinking about recommending a linear algebra book. The book I was thinking of is called "Applied Linear Algebra," by Noble. The Schaum Outline on Linear Algebra is not a bad book. I have a French copy that I bought in Paris. This book introduces linear transformations in chapter five. I would introduce the concept of vector space and linear transformation at the beginning of a course on linear algebra because this is most important. The concept of a linear transformation is much more important than matrix techniques for solving of linear equations.

The classic book on linear algebra is called "Finite Dimensional Vector Spaces," by Halmos. It may be a little too much pure mathematics. But Halmos is the author of the famous essay, "Applied Mathematics is Bad Mathematics. Halmos was an assistant of John Von Neumann at The Institute for Advanced Study in Princeton. So "Finite Dimensional Vector Spaces," follows closely the ideas of Von Neumann on Vector Spaces and Functional Analysis. There are also books on Numerical Linear Algebra that treat algorithms and calculation techniques. The program "Matlab" was originally developed at the University of New Mexico and Sandia Labs for a linear Algebra Course. The free program Octave is almost a clone of Matlab. So Matlab stood for "Matrix Laboratory."

36 MEETING NOTES, September 15,2009

The September meeting of the STEM Society took place at the Trailside Center at 99th and Holmes. The meeting started at 6PM. Topics included the single lens microscope and an overview of Geometrical Optics and the use of lens matrices. We very briefly talked about game theory, John Nash, and Jon Von Neuman. Linda hall library has had an exhibition of single lens microscopes all this summer. Bruce Bradley in rare books has a replica of the original Leeuwenhoek single lens microscope, which can be demonstrated on request. I made a very simple version of a single lens microscope and passed around for viewing. I broke a glass jar, then found thin pieces of glass. Two of these were melted together in the flame of a propane torch, then pulled out into a thin filament. The filament was broken and the end melted in the flame forming a small sphere of glass that served as a lens. A small hole was drilled in a small sheet of aluminum and the lens mounted at the hole using epoxy glue. The lens was about 3 mm in diameter.

The presentation on geometrical optics was based on the document:

<http://stem2.org/je/optics.pdf>

36.1 Maker Spaces

Kansas City's maker space is called CCKC. It is located in an underground cave down the hill from 31st and Southwest Trafficway. Search the Internet for details. Open meetings occur every Thursday evening. An interesting

project being done is the construction of a Makerbot. This is a 3d printer for manufacturing physical objects from plastic. The machine will make objects from STL files that can be generated in various 3d CAD programs. Craig Berscheidt craig.berscheidt@gmail.com has made many of the parts with his CO_2 laser cutter. Craig's laser cutter takes as input CAD and drawing files such as dxf, Eps and CorelDraw files. I am thinking about having him cut and etch a sundial for the local latitude as described in the document

<http://stem2.org/je/astronomy.pdf>

There are some Javascript script programs that I should also add to the site, for example one computing values of the equation of time.

Another project for the laser cutter might be the generation of involute gears from one of my gear programs that output postscript files. Perhaps the reader has some interesting projects for the laser cutter or the Makerbot.

Another maker space just starting has meetings on the first Tuesday of each month at the HMS Beagle store in Parkville, which see for more details.

O'reilly publications publishes a magazine called **Make** as well as many books. Also there are Make TV programs that come on KCPT around 4 or 5 on Sundays. I do have trouble remembering to watch them though.

36.2 The Single Lens Microscope

Email:

From: "Bruce Bradley" <bradleyb@lindahall.org>

Jim,

I borrowed the replica from friends at the Huntington Library in California. They had given me a reference to the man who makes them, but according to his website, he is not currently taking orders. I believe he has instructions on the website for making one, if you want to try your hand at that! Here is my note from the Huntington, with the URL:

Dan Lewis asked that I send you information about our Leeuwenhoek

replicas. Al Shinn in Berkeley made them for us. His info can be found on this website:

<http://www.mindspring.com/~alshinn/>

I'm glad you got to see the replica. I think it is quite interesting, too.

Bruce

Bruce Bradley
Librarian for History of Science

-----Original Message-----

From: jim emery [mailto:jdemery1@yahoo.com]

Sent: Friday, August 28, 2009 5:30 PM

To: Bruce Bradley

Subject: Leeuwenhoek

Bruce,

I stopped by today and Cindy Rogers showed me your replica of the Leeuwenhoek microscope. Very interesting. Where did you get the replica?

Jim Emery
(816)444-7895
jdemery1@yahoo.com

37 MEETING NOTES, August 11, 2009

Meetings of the STEM Society are on the second Tuesday of each month. The August meeting was held on Tuesday August 11, 2009 at the Trailside center at 99th and Holmes. The start time was 6PM, as usual.

Charlie Mentasana gave a talk about using Excel to compute signals using the Fast Fourier Transform. These signals will be used to drive a piezoelectric motor.

Cécile Lagandré described a calculation she has done concerning the cal-

culatation of products of numbers using an alphabetical base 26. She demonstrated some of the functions available for Excel programming.

Rich Kaufman talked about the latest research that he has done at KU Med Center.

As usual, we had some open discussions of topics of interest to the audience.

I was thinking of presenting certain review topics in science and mathematics at each meeting. I did not get to this at this meeting.

We should perhaps return to our Experiments and Education project.

Notes on previous meetings, and many pdf documents are available on our website:

<http://www.stem2.org>

Is it a paradox that in drilling a hole in an object, it matters whether one rotates the drill bit, or holds the bit fixed and rotates the object?

37.1 Charlie Montesana Presentation

Charlie presented his work on generating signals for driving a piezoelectric motor. There is a paper listed below that makes the claim of greater efficiency in driving motors with square waves. Goldwave is a program for editing and generating digital audio signals. One of its capabilities is to accept input in the form of an algebraic expression. A modified square wave is defined piecewise and so does not lend itself to being defined by a single algebraic expression. However, we can do a Fourier analysis and get a single trigonometric expression for a piecewise defined wave. This then can be input into Goldwave to generate an audio output from the computer. This in turn can be fed to an audio amplifier to get a signal suitable for driving a motor. There is a document on piezoelectric motors on our website.

Piezoelectricity: <http://stem2.org/je/piezoelc.pdf>

Files for Charlie's presentation are available here. The first two files contain the same information in two different file types.

Charlie's paper on using Goldwave and the Excel FFT to generate signals for the piezoelectric motor.

http://stem2.org/je/Excel_&Goldwave_Old_Ver.pdf
http://stem2.org/je/Excel_&Goldwave_Old_Ver.doc

Instruction for using the Excel FFT.

http://stem2.org/je/Excel_FFT_Instructions.pdf

Paper on the advantage of square waves in place of sinusoidal waves in a piezoelectric motor.

http://stem2.org/je/Charge_Recovery_mfi_uffc_02.pdf

37.2 Rich Kaufman Presentation

Rich talked about the latest project he is working on at KU Med Center involving computerized image analysis in a lab which studies early-stage bird embryo development, especially cardiac vasculature development, using light microscopy with CCD image capture. The original stem cells develop their specific character, function, and location in the organism as the embryo develops. The study involves the tracking of the cells and the substrate using light microscopy and computer graphics. Local cell areas are specified using Delaunay triangulation techniques. As the embryo develops these areas of cells are displaced and the method of embryo development is analyzed. Matlab is one of the tools used. Rich invited us to tour his lab, and some of us took him up on that. His slides are not available yet because this is research that has yet to be published. The research will give insight into human embryology. Some of the software used in the research is the Matlab Image Processing Toolkit.

We toured the imaging lab at KU on Thursday the 27th of August. The principal investigators for the project are
Charles Little

<http://www.kumc.edu/anatomy/little.html>

and Brenda Rongish

<http://www.kumc.edu/anatomy/rongish.html>

They are members of the Department of Anatomy and Cell Biology at Kansas University Medical center.

Additional Information:

brenda rongish and charles little
computational imaging laboratory
university of kansas 913-588=1878 or 1857
brongish@kumc.edu
<http://oz.bs2.kumc.edu>
dept of anatomy and cell biology
czirok, andras pub med
zamil, evan
plos biology / 2008
transgenic development

They interact with Stowers Research:

<http://www.stowers-institute.org/labs/PourquieLab.asp>

Here is a sample of publications:

1. Czirok, A., Rongish, B.J., and Little, C.D. Extracellular matrix dynamics during vertebrate axis formation. *Developmental Biology*, 268:111-122, 2004
2. Zamir, E.A., Czirok, A., Rongish, B.J., and Little, C.D. A digital image-based method for computational tissue fate mapping during early avian morphogenesis. *Annals of Biomedical Engineering* 33:854-865, 2005.
3. Kozel, B.A., Rongish, B.J., Czirok, A., Zach, J., Little, C.D., Davis, E.C., Knutsen, R.H., Wagenseil, J.E., Levy, M.A., and Mecham, R.P. Elastic fiber formation: a dynamic view of extracellular matrix assembly using timer reporters. *Journal of Cellular Physiology* 207:87-96, 2006.
4. Czirok, A., Zach, J., Kozel, B.A., Mecham, R.P., Davis, E.C., and Rongish, B.J. Elastic fiber macroassembly is a hierarchical, cell motion-mediated process. *Journal of Cell Physiology* 207:97-106, 2006.

See **rongish.pdf** for a more complete list of publications.

Andros Czirik is a Hungarian physicist who has worked with them and has developed important software.

37.3 Cécile Lagandré Presentation

Cécile demonstrated a calculation she has done that uses Excel programming. She creates a multiplication table in base 26 that uses the letters of the alphabet as digits. She uses a for 1, b for 2, c for 3, and so on up to, using y for 25. She uses z for the 0 digit. Thus dzb represents the number

$$4 \times 26^2 + 0 \times 26^1 + 2 \times 26^0 = 2706$$

A base conversion from base 10 to base n may be accomplished by repeated division by n . Thus suppose we wish to convert the number p to base n . We divide p by n getting a quotient q and remainder r . So r is the rightmost digit of the number in base n . Now substitute the quotient q for p . Then the new remainder is the second digit of the converted number, and so on. To evaluate a number in base n we are essentially evaluating a polynomial in n of the form

$$a_k n^k + a_{k-1} n^{k-1} + \dots + a_0 n^0.$$

Evaluating all of the powers of n can be avoided by using the so called synthetic division method. This is the efficient and preferred method to evaluate polynomials on a computer. A variation of the method can be used to evaluate polynomial derivatives.

Cécile used various Excel functions and some comparisons to compute the table. In particular she needed a substitution function to go between numerical digits and alphabetical digits, and she needed a concatenation function to build numbers of more than one alphabetical digit. To see the table click this:

http://stem2.org/je/stem_alpha_table.xls

37.4 Drilling an Axial Hole?

In an email to the society, I introduced an apparent paradox, namely, that the action of drilling a hole in the center of a fixed object by aiming down

its axis, gives a different result than the action of holding the drill fixed, and then drilling by rotating the object against the fixed drill bit. In the first case the drill will almost certainly not go down the axial center, whereas in the second case it does.

Consider this thought experiment: Suppose we had a giant drill bit that we could somehow hold fixed and so were able to drill through the north pole to the south pole, using the earth's rotation. Would this work only if the drill were held fixed in absolute space? Is the earth rotating in 24 four hours in absolute space? What about a possible rotation of our whole galaxy? What is absolute space? Is there a paradox?

Below is a video about drilling a tiny hole using a lathe.

The YouTube video is called "Drilling an Orifice on the Lathe." (Unfortunately this video seems to have been removed from YouTube.)

<http://www.youtube.com/watch?v=q6-4oyIoku4>

The video is done by a guy who makes carburetor jets from brass. He chucks a small brass cylinder in a three-jaw chuck and sets it spinning. First he finds the center of the rotating cylinder by using a sharp engraver tool. When the point of the tool contacts the exact center of the cylinder it stops wobbling. Then applying pressure he makes a small starter hole with the tool. Then he places a very small drill bit in a pin vice and holds the bit and vice steady while forcing it in the starter hole. He does what is called "peck drilling" that is he pushed the bit in then pulls it out repeatedly to clear the flutes of the drill bit and thus prevents binding and the drill bit breaking. The drill bit automatically follows the axis of the cylinder and produces a concentric hole. Why is this? If the brass cylinder were fixed and the bit rotated with a drill, it would never follow the axis.

38 MEETING NOTES, July 14, 2009

Meetings of the STEM Society are on the second Tuesday of each month. STEM stands for Science, Technology, Engineering and Mathematics. The July meeting was held on Tuesday July 14, 2009 at the Trailside center at 99th and Holmes. The start time was as usual 6PM.

38.1 Adding Feet and Inches

Dave Van Dyne demonstrated a technique for using a calculator to add feet and inches without converting to a common unit.

A link to a document describing this technique is:

<http://www.stem2.org/je/afic.pdf>

38.2 Google Sketchup

Gene Jakobe demonstrated the use of Google SketchUp in his engineering design work. Sketchup is available in a professional version and in a downloadable free version. Sketchup is a 3d modeling and graphics display program. There are online tutorials available. Some of Gene's models were quite complex. He said that one of the uses of the models is to reduce the time it takes vendors to build his machines by them gaining an understanding of the design faster than can be done with engineering CAD drawings alone.

Sketchup can be used to add 3d models to Google Earth. Here is an example:

<http://sketchupdate.blogspot.com/2009/06/land-of-rising-sun-in-3d.html>

38.3 Laser Fusion, The NIF, the NOVA Laser, and the Manufacture of Microspheres

Maurice Smith was not able to attend the meeting. However, Rick Hines did attend and was familiar with the topics. Glass Microspheres are manufactured by heating water glass. The glass microspheres project involved various interesting processes for selecting microspheres of the proper size and those having uniform wall thickness. These processes were developed in Kansas City and at Los Alamos. The processes were patented and a link to the patent is given below.

The selected microspheres were filled with deuterium and tritium by diffusion. Unfortunately this diffusion process is very slow. This was done for the NOVA laser fusion machine.

The new Laser Fusion device at Lawrence Livermore called the NIF is just coming on line. There is a similar device located in France. Rick Hines was involved in a similar microsphere project that involved a plating process to manufacture metal microspheres.

Maurice smith selected some documents related to laser Fusion. We will post some of the pdf's on our web site at

<http://www.stem2.org/>

These are listed in the next section.

38.4 Laser Fusion Documents

I have abbreviated the original document files as follows:

1975-09 LASL-6046-MS Laser Fusion of Glass Microspheres.pdf	lf1.pdf
1976-12 MLS Patent 1-Method_for_selecting_hollow_microspheres.pdf	lf2.pdf
1979-29 LASER Fusion Program at LASL.pdf	lf3.pdf
1985-06 LASL Antares ICF Project.pdf	lf4.pdf
1999-10 ICF Target Support Highlights.pdf	lf5.pdf
2007-11 An Overview of DOE Research in Laser Fusion.pdf	lf6.pdf
2009-05 The National Ignition Facility On target, finally	lf7.pdf

Here are the links to the files:

<http://www.stem2.org/je/lf1.pdf>

<http://www.stem2.org/je/lf2.pdf>

<http://www.stem2.org/je/lf3.pdf>

<http://www.stem2.org/je/lf4.pdf>

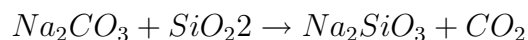
<http://www.stem2.org/je/lf5.pdf>

<http://www.stem2.org/je/lf6.pdf>

<http://www.stem2.org/je/lf7.pdf>

38.5 Glass Micro Spheres

Glass micro spheres can be made by spraying and heating water glass. Sodium silicate is the common name for a compound sodium metasilicate, Na_2SiO_3 , also known as water glass or liquid glass. It is available in aqueous solution and in solid form and is used in cements, passive fire protection, refractories, textile and lumber processing, and art. Sodium carbonate and silicon dioxide react when molten to form sodium silicate and carbon dioxide:



Anhydrous sodium silicate contains a chain polymeric anion composed of corner shared SiO_4 tetrahedra, and not a discrete SiO_3^{2-} ion. In addition to the anhydrous form there are a number of hydrates with the formulae $\text{Na}_2\text{SiO}_3 \cdot n\text{H}_2\text{O}$ (where $n = 5, 6, 8, 9$) which contain the discrete approximately tetrahedral anion $\text{SiO}_2(\text{OH})_2^{2-}$ with water of hydration.

38.6 Education and Robotics Projects

George Walker talked about some education projects for students. George handed out some brochures.

George heads the BFTAA:

Black Family Technology Awareness Association
P.O. Box 300166
Kansas City, MO 64130
www.bftaa.org
email: bftaa@sbcglobal.net
(816)781-4050

George talked about the new **You Tech** program. The **You Tech Club** will start in October 2009 and consists of:

Introduction – Students will learn basic robotics concepts and principles.

Hands On – Students will learn how to build a "competition ready" robot, based on the VEX Robotics Design System.

Advanced – Students will continue studying robotics engineering, earning over 160 hours of hands-on-experience.

39 MEETING NOTES, June 9, 2009

Meetings of the STEM Society are on the second Tuesday of each month. We like the ring of "STEM Society" rather than STEM2, and we shall now call ourselves the STEM Society. Recall that STEM stands for Science, Technology, Engineering and Mathematics. The June meeting was held on Tuesday June 9, 2009 at the Trailside center at 99th and Holmes. The start time was a bit after 6PM.

Dave Van Dyne give a presentation on the design of machinery and technology for fiberglass manufacture. This manufacture involves quite sophisticated engineering. Dave's slides are unfortunately not available.

Rick Hines and I traveled to Columbia Missouri Friday the 29th of May for a University of Missouri sponsored seminar titled "Excess Heat and Particle Tracks from Deuterium-Loaded Palladium." Rick was especially interested because he has a lot of experience electroplating Palladium. There was a recent "60 Minutes" program with a segment devoted to the resurgence of interest in "Cold Fusion." Also the NIF (National Ignition Facility) at Liver-

more National laboratory is coming on line. Some of us recall the predecessor, the NOVA Laser Project. We discussed nuclear fusion and we will probably continue this discussion at the next meeting of the STEM Society.

40 MEETING NOTES, May 12, 2009

Meetings of STEM2 are on the second Tuesday of each month. The may meeting was held on Tuesday May 12, 2009 at the Trailside center at 99th and Holmes. The start time was 6PM. Topics for this meeting were Cherenkov Radiation and the life of Joseph Fourier, including an introduction to Fourier Analysis.

Bob Williams talked about his project to design a Cherenkov detector that would detect magnetic monopoles. This was his first dissertation topic, before he switched to a second one after his PhD advisor left LSU for another University. As I remember he worked with fellow graduate student Phil Green on this project. The idea is that the motion of an electrically charged high energy cosmic particle produces Cherenkov radiation. If magnetic monopoles exist, then there would be a Coulomb law for magnetic charges and the Maxwell equation for the divergence of the magnetic vector \mathbf{B}

$$\nabla \cdot \mathbf{B} = 0$$

would be replaced by

$$\nabla \cdot \mathbf{B} = \rho_m,$$

where ρ_m is the magnetic charge density. So these magnetically charged particles would produce Cherenkov Radiation also, with a distinct character. If detected, this would establish the existence of magnetic monopoles.

A summary of the Cherenkov Radiation discussion is at

<http://www.stem2.org/je/cherenkov.pdf>

The Fourier presentation is at

<http://www.stem2.org/je/fourier.pdf>

A report was given on the progress of various projects involving robotics, microcontrollers, creating an interactive white board and such.

40.1 Items of Interest

arduino microcontroller board: <http://www.arduino.cc/>
Projects using the Wii remote:
(Johnny Chung Lee)
Head tracking for a 3d graphics display: Johnny Lee
<http://www.youtube.com/watch?v=Jd3-eiid-Uw>
An interactive white board: <http://www.youtube.com/watch?v=Jd3-eiid-Uw>
Creating your own CNC machine.
<http://www.instructables.com/id/How-to-Make-a-Three-Axis-CNC-Machine-Cheaply-and-/>
The Labyrinth Project for Science City.
Laptop Oscilloscope:
Parallax USB Oscilloscope:
<http://parallax-usb-oscilloscope.software.informer.com/>
Tracking a rolling ball.
Digital Image Processing with OpenCV.
CO2 Laser Cutting:
<http://www.epiloglaser.com>

mitch altman tv-b-gone
http://en.wikipedia.org/wiki/Mitch_Altman
<http://video.google.com/videoplay?docid=-4600578110948529551&hl=en>
<http://gadgets.boingboing.net/2009/01/19/mitch-altman-complet.html>
Getting Here: We're at 83C Wiese Street between Mission and
Valencia just off 16th Street in San Francisco's
Mission district. [openstreetmap](#) [Google Maps](#)
Planet Noisebridge: Our blog aggregation service
<https://www.noisebridge.net/wiki/Noisebridge>

41 MEETING NOTES, April 13,2009

Meetings of STEM2 are supposed to be on the second Tuesday of the month. However, for this month only we met on Monday the 13th of April. This is because there was a screw-up at the Trailside center and another meeting had been scheduled in our spot. So we will met at 6pm on the 13th at the Trailside Center at 99th and Holmes. Greg Hodes gave a talk on consciousness. He discussed such things as Schrodinger's Cat, and the mind body problem. He apparently believes that there is something called mind that is independent of matter. The mind is that which produces conciousness, and in his theory, by definition conciousness, has no affect at all on matter. A pdf version of his slides can be viewed by clicking on the following link:

<http://www.stem2.org/je/stemfinal1.pdf>

We will talk about Cherenkov Radiation next month.

I gave only a very brief outline of my introduction to Fourier Analysis. I will probably return to this topic next month. One can view my introduction

by clicking on

<http://www.stem2.org/je/fourier.pdf>

There is also a more extensive document on Fourier Analysis that I shall put up later.

41.1 CCCKC

I have joined the Cowtown Computer Congress (CCCKC), and have met many very interesting people there, and have been introduced to some of their projects. The CCCKC is a "maker space," and physically is located in a cave off of 31st street down the hill west of Southwest Trafficway. A "maker space" is a place where members may meet and pursue their creations, experiments, and projects. There is an article in a recent Wired Magazine about these "maker spaces" located around the country. The CCCKC is open 24 hours a day. There are many people in the group with great technical expertise, who are willing to share their knowledge. One person is an expert on computer networks and handles the Olathe Public School network.

Another works on digital image processing of brain NMR images at KU medical center. He is giving a tutorial on Digital Image Processing to a group interested in OpenCV. OpenCV is an open source digital image processing library created originally by Intel. It is available for the Macintosh, Linux, and Windows. I have loaded Ubuntu Linux on my laptop. Someone at CCCKC has helped me in installing OpenCV and Eclipse. OpenCV has functions for the Hough Transform, Delaunay Triangulation, and many other algorithm of this type for processing images and for identifying objects in images. Some in the OpenCV group are working on a project for Hallmark, for their Kalaidoscope, which is an art, creativity, and science project, for kids, and which I think is located on Main street near Crown Center.

Another guy, who works for Garmin, is teaching a practical tutorial on electronics including the demonstration of circuits on breadboards. He also has his own CO2 cutting laser, and has cut rack and pinion gears in acrylic plastic.

Another does robotics and has built a robot kit that is controlled by computer and is able to do amazing tricks.

Another does solar energy with high tech solar heat transfer tubes.

Many of the people belong to other groups, such as the Kansas City Linux Users group, which meets at the Downtown Kansas City Library, and

the Kansas City Robotics Society, which has a space at Union Station.

Some are interested in the Arduino, a micro controller, that interfaces to a computer via USB, and for which there is free downloadable software.

To reach the CCCKC one goes down the hill at Southwest Trafficway until one sees a parking lot with a small building sticking up. This is an elevator building. One descends down to the underground lobby, then turns left and walks down two or three doors, and there is the CCCKC.

41.2 References Links

DIY Freaks Flock to 'Hacker Spaces' Worldwide

By Dylan Tweney March 29, 2009 | 10:59:20 PM Categories: DIY

<http://www.stem2.org/je/Nuke309.pdf>

<http://blog.wired.com/gadgets/2009/03/hackerspaces.html>

Maker Faire video

http://www.pbs.org/kcet/wiredscience/video/324-maker_faire.html

42 MEETING NOTES, March 10,2009

The March meeting of STEM2 took place on the second Tuesday of March, the 10th, at 6pm, at the Trailside Center at 99th and Holmes. Suggested topics for the meeting were a few among the following:

Some people like to distinguish blue collar workers from white collar workers as those who work with their hands rather than with their brains. But how much of technology and science was created by blue collar workers, especially during the beginning of the industrial revolution? Michael Faraday was certainly a blue collar worker having little formal education. If blue collar workers are those who work with their hands, then are concert pianists and surgeons blue collar workers? How much of this blue collar white collar dichotomy is due to the class structure of England and the concept of the gentleman as a man of leisure who is not required to do anything for him-

self? How is this all connected with the book "The Tradgicomical History of Thermodynamics," by the mathematical physicist Clifford Truesdell. Is the second law of thermodynamics more important than the works of Shakespeare?

What is cherenkov radiation and why is it blue?

What is mathematical probability theory and how is it related to statistics? What is Bayesian statistics and why can it lead to a surprising result in drug testing? The error function, written as $\text{erf}(x)$, is related to the standard normal distribution function. How can one use numerical methods to compute the function $\text{erf}(x)$ and its inverse. How in general can one compute the inverse of a function? What is the relation of statistical mechanics to statistical theory? What is the difference between Bose-Einstein statistics, Fermi-Dirac statistics, and Maxwell-Boltzmann statistics. What is the connection with the Pauli exclusion principle? What is the character of statistical noise in electronic circuits? What about statistics in social science, medical biology, agriculture, experimental errors, metrology, and survey sampling.

Yudell Luke was a professor of Mathematics at UMKC and an expert in certain areas of analysis and numerical analysis. Before he joined UMKC he was at the Midwest Research Institute for many years. He was an expert on special functions and classical analysis. The Russian mathematicians also had much interest in this area. He worked with many Russian mathematicians and died of a heart attack in Moscow while attending a conference there.

What ever happened to discrete event simulation? For that matter what ever happened to "Operations Research?"

Are Americans more irrational than they used to be? Is this part of the reason that students have trouble with science? What do the books books "Fads and Fallacies in the Name of Science," by Martin Gardner, and "The Demon Haunted World," by Carl Sagen have to say about this.

How much responsibility do students have for the alleged incompetence of teachers?

The winter is waning, is there still time for static electricity experiments?

42.1 Cowtown Computer Congress

We have recently discovered another science oriented group operating in the Kansas City Area. They are more oriented toward computers than we are. They have recently opened a laboratory underground in one of the caves located near 31st and Southwest traffic way. They also do robotics and electronics. We may do some collaboration with them. Here is their website:

<http://blog.cowtowncomputercongress.org/>

There is also an article about the opening of their new lab at

<http://edge.i-hacked.com/>,

which I think is a website for a non-local organization.

42.2 Bob Kessler Information on the Department of Energy

Bob Kessler reported on the latest developments in the department of energy and its possible consequences for Kansas City.

42.3 Cherenkov Radiation

Cherenkov radiation is caused by a shockwave effect in a material when particles move faster than the velocity of light in the given material. Photons travel slower in a material because they interact with the atoms. A nuclear reactor produces this radiation and it can be viewed as one looks down into the water covering the reactor. This effect is a continuous effect giving radiation in a range of wave lengths. However, wavelengths produced tend toward the blue and ultraviolet. Bob Williams was unable to attend the meeting in March, but some of his PhD research involved the detection of cosmic rays by measuring the Cherenkov radiation produced. He will probably give some information on this technique at a later meeting.

42.4 Joe Aurther Presentation

Joe Aurther of the Harrisonville High School and the Cass Learning Center presented some pictures and videos of the activities of his students. They do a lot of interesting work with electronics and computers. One thing that they have done recently is to immerse a motherboard in a fishtank of oil in order to cool the operation of the computer. They do robotics and other interesting things.

42.5 Probability Theory

Jim Emery presented material on probability theory. A paper on this material is available as

<http://www.stem2.org/je/probabilitytheory.pdf>

42.6 Discrete-Event Simulation

Actually discrete-event simulation still exists and here is some information about it:

http://en.wikipedia.org/wiki/Discrete_event_simulation

<http://simulation123.com/index.php?topic=512.0>

http://en.wikipedia.org/wiki/List_of_computer_simulation_software

http://en.wikipedia.org/wiki/Software_choice_for_discrete_event_simulations

Available open source software for discrete-event simulation includes the following:

ASCEND (open source NLA/DAE modelling environment)
Facsimile - a free, open-source discrete-event simulation/emulation library
NS2 a popular Open Source network simulator
SimPy - an open-source discrete-event simulation package based on Python
Physics Abstraction Layer - an open source physics simulation package
Tortuga_(Discrete_Event_Simulation_engine) - An open source frameeework in Java.

Simulation Languages GPSS was the first simulation language that appeared in the 60s and soon more able languages followed it such as SIMSCRIPT. The expressive power of the languages differ considerably: there are as expressive languages as general purpose languages and there are ones that beyond

simulation chores hardly can do any extra. Expressive power is important if more involved logic is required.

Another basic feature that may differ among simulation languages is with the general world view inherent in language design. There are several such views possible:

Event oriented view: the model centers around the discrete events. Process oriented view: the model is described as a sequence of time-delays due to processes and waiting times. Cycle oriented view: the simulation is described as interaction of cycles. An example of a cycle is the state of a machine alternating between states of being busy and being idle. Net oriented view: the simulation is considered as a network. The problem with simulation languages is that the simulation builder has to memorize the syntax and be familiar with the world view. Therefore, their use might be considered only if the user has already gone over an intensive course or it is worthwhile to invest in such a course.

43 MEETING NOTES, February 10,2009

The February meeting of STEM2 took place on the second Tuesday of February, the 10th, 6pm, at the Trailside Center at 99th and Holmes. The subject of the meeting was Boron. This was the first time an element had been the subject of our meeting. Boron is the 5th element in the periodic table.

<http://www.webelements.com/nexus/files/WEBELEM2.pdf>

This topic of Boron is justified because Boron is in the news. A new form of Boron crystal has just been announced.

http://www.nytimes.com/2009/02/03/science/03boron.html?_r=2&ref=science

This new crystal form is nearly as hard as diamond.

A genetic computer algorithm was used to decipher the structure of the new boron crystal. How in the world can a genetic algorithm be used to find the structure of a crystal? And for that matter what is a genetic algorithm?

A second item of Boron research is Boron Neutron Capture, BNC. Boron 10 has a very large cross section for neutron capture by slow neutrons. Boron

Neutron Capture Therapy, BNCT, is a subject of intense and promising research at the new University of Missouri Research Institute: The International Institute of Nano and Molecular Medicine, which is led by the celebrated research chemist M. Frederick Hawthorne.

<http://nanomed.missouri.edu/researchpapers/BNCT.pdf>

The chemistry of Boron has similarity with some of the chemistry of carbon. We have the Boron Hydrides (Boranes), first manufactured by General Electric, and involved in an explosion that destroyed the manufacturing plant.

A form of Boron Nitride is a very hard material with properties similar to diamond, and is used for cutting tools.

http://en.wikipedia.org/wiki/Boron_nitride

One of our members, Maurice Smith, has a patent on a very important Boron reclamation process.

Borax can be used to demonstrate the cross-linking of polymers. Refer to our document "experiments.pdf," which is on our website

<http://www.stem2.org>

and clicking "documents and downloads," then "documents" to see a list of pdf files. Finally click on the document "experiments.pdf"

Boron experts and friends, as well as ceramic engineers and crystallographers, were invited to this meeting for this discussion.

43.1 A Talk by Maurice Smith With Some Words by Jim Emery and Others

Maurice started with a review of the atomic orbital theory, and the way that the first few elements are built with s and p orbitals. Then he went on to describe how Boron is especially interesting having properties between those of metals and nonmetals, and how it is a Carbon want-to-be.

Maurice had distributed two excellent handouts. The first contained some information from the web about various interesting aspects of Boron and its

applications. The second handout contained a copy of his patent on a Boron reclamation process.

He talked about the the three forms of Boron, and the new recently discovered fourth form. He related several anecdotes about his relation with boron over the years, and specifically talked about the humorous goings on around a "Boron Shot Tower" used to produce Boron shot. He gave some stories about how the unit of area called the barn was named. Jim Emery added some material about the definition of the cross-section in nuclear physics, which is ultimately an experimentally determined nuclear reaction rate constant, but bears some relation to throwing a baseball at a barn door, à la Grover Cleveland Alexander.

Jim Emery talked a bit about the very interesting Boron Neutron Capture Therapy being developed at the University of Missouri.

Jim Emery and Bob Williams gave a brief explanation of genetic algorithms. As usual the audience had plenty of comments and questions.

43.2 Cross-Linking a Polymer

Cécilè Lagandre busied herself with performing the cross-linking experiment, producing a silly-putty like material from polyvinyl Acetate (White Glue) and borax (20 Mule Team), which became an object of art, and was thrown about the room.

This experiment is described more fully in our document

<http://www.stem2.org/je/experiments.pdf>

43.3 Kansas City Public Library

About five people before the meeting had shown interest in being part of a technical committee for the Kansas City Public Library. This committee was suggested by Leon Dixon, who is a member of the library board. This committee is in the process of being formed and a mission for it created.

43.4 Future Topics and Speakers

We are always open for suggestions in this area. As we all know, one really learns something by teaching it. University professors who want to learn a

new area often do this by signing up to teach a course on a subject that they are not completely familiar with. So suggest a subject that you would like to learn and give a talk on it.

43.5 Boron Document

I have written up a small document on Boron:

<http://www.stem2.org/je/boron.pdf>

43.6 Archive of Meeting Notes

An archive of meeting notes is available in our list of documents by going to our web site and looking in the document list. Or one may click on the following:

<http://www.stem2.org/je/archive.pdf>

44 MEETING NOTES, January 13, 2009

The January STEM2 meeting was held on Tuesday January 13th at the Trailside Center at 99th and Holmes, at 6PM.

We discussed a special January issue of Science magazine that deals with education in science.

Jim Emery talked about the use of the terrific editor called `winedt`. This editor works very nicely with the LaTeX and TeX version called MikTeX. It has a very good spell checker. One can click on symbols to paste in appropriate LaTeX commands. One can build the dvi file by clicking a LaTeX button, then can produce the PDF file directly by clicking another button, and then click a third button to call Acrobat Reader for viewing. Here are a few links to information on `winedt`, as well as MikTeX:

<http://www.math.uic.edu/computing/Documents/install.htm>

Compressed download name is: `winedt5.exe` from

<ftp://math.uic.edu/pub/windows/TEX>

Type `winedt5.exe` to expand, then type `setup` to install.

Jim Emery presented an introduction to abstraction in Mathematics, including the real numbers as Cauchy sequences, transfinite numbers, the concept of completeness, inner product spaces, and Hilbert space. The document on this is available on the stem2 website as:

<http://www.stem2.com/je/infinity.pdf>

We had a very brief mention of experiments, where one person, expressed the opinion that students don't get much out of doing experiments. They think of an experiment as a task to get done without doing much thinking, and asking their fellow students questions like, "What is the answer supposed to be?" But others thought some exposure to experiments is necessary to show how science actually operates.

45 MEETING NOTES, December 9, 2008

The December meeting of STEM2 was held on Tuesday December 9th, at the Trailside Center at 99th and Holmes, at 6 PM. This was the second Tuesday of the month as usual.

The possible topics were: (1) Infinity and Eine Kleine Nacht Mathematics, (2) Some interesting free software that I have recently discovered including, muPAD, a symbolic mathematics program that appears to be a Maple clone, and will be the symbolic part of a new Matlab release, a Chemical diagramming tool called ChemSketch, which is widely used by chemists; MikTeX, a free version of the mathematical word processing tool TeX and LaTeX, (remember: Tau Epsilon Chi, as in Technology). (3) A demonstration of using MikTeX to compose some mathematics, to produce a Postscript output, then convert to PDF. Perhaps this can be used to help people make presentations and to publish on our website. (4) A start on a discussion of particle physics, perhaps starting with the history, (5) The ethics and morality of engineering design: Why do American companies produce such crap? As professionals shouldn't engineers protest against this? Maybe then our manufacturing companies would not be facing bankruptcy? (5) What is the greatest computer language, and how should it be taught? (6) Your topic of interest? (7) If you have a cold fusion experiment or a perpetual motion machine that really works, bring it to the meeting, and we will publish it in our new journal called "Improbable Results Monthly."

A snow storm, slippery streets, and traffic jams kept the attendance down. About 7 people attended. We spent a little time on topics (2), (3), and (4). To download, install, and run a simple latex file, read the document

<http://www.stem2.org/je/miktex.pdf>

Here is an even simpler latex document to be typeset with latex:

```
\documentstyle[12pt]{article}
\title{A Simple Latex File}
\author{Your Name}
\date{12/5/2008}
\begin{document}
\maketitle
\tableofcontents
\subsection{Quadratic Formula}
Given a polynomial  $Ax^2 + Bx + C = 0$ , the
roots are

$$\left[ \frac{-B \pm \sqrt{B^2 + 4AC}}{2A} \right]$$

\end{document}
```

A few example latex documents are zipped up at

<http://www.stem2.org/je/latexje.zip>

This includes the file sample.tex mentioned in miktex.pdf

We briefly showed off muPAD light, a free program very similar to Maple, with many of the same commands.

Obtaining muPAD light:

<http://archives.math.utk.edu/software/multi-platform/MuPAD/distrib/windows/>

Program Chems sketch is a chemistry formula molecule drawing program. There is a free version and a more elaborate commercial version. It has animation, a molecule properties calculator, NMR function, 3d viewer, and so on. I looked at it briefly. Perhaps some one will give it a good work out and tell us about it. The free version comes from the company website, which can be found with Google.

Richard Peters gave us an overview of his theory of the internal structure of the elementary particles including quarks and leptons. He illustrated his theory with physical structures, such as a chemistry molecule set, tinkertoys, marshmallows and toothpicks and so on. His models of the elementary objects making up the various quarks and leptons, are 3d geometrical structures. Shifting parts of a model represent a change of spin and so on, converting one particle to another. How this is to correspond to the quantum mechanical wave functions and fields that represent the elementary particles and to the symmetry and gauge transformation properties of them is not clear.

46 MEETING NOTES, November 11, 2008

The November meeting of STEM2 was held on Tuesday November 11 at the Trailside Center at 99th and Holmes, at 6 PM. This was the second Tuesday of the month as usual.

The topics discussed were: (1) Soil Analysis, (2) A NNSA Environmental Impact Study, (3) Scheme, (4) Maple, and (5) The question: " How useful are computers?"

46.1 Soil

Cécil Lagndré gave a talk on soil science and presented experiments and analysis. Samples of separated soil were passed around for examination. An Excel image is at:

<http://www.stem2.org/je/soiltexture.pdf>

46.2 NNSA

Bob Kessler talked about and presented for inspection the 5 volumes of the "Final Complex Transformation Supplemental Programmatic Environmental Impact Statement" from NNSA.

All of the information is available on the web site...

<http://www.complextransformationspeis.com/>

46.3 Scheme

We ran some Scheme example using the Scheme version called Dr Scheme. There are free versions of Scheme such as Dr Scheme. We demonstrated Scheme as well as Maple. PLT Scheme contains Dr Scheme. Free versions may be downloaded for Windows, Linux, and Mac OSX. Scheme is a symbolic computing language, a variation of Lisp. One of the oldest computer languages is LISP, which is about the same age as FORTRAN. Lisp is a symbol manipulating language and was used to create one of the first symbolic mathematics program called MACSYMA. LISP and MACSYMA were developed at MIT.

Here is a preliminary document on Scheme:

<http://www.stem2.org/jdemery/scheme.pdf>

46.4 Maple

We discussed symbolic computing and symbolic mathematical calculating. In particular we presented material on the Maple language. Maple was developed at the University of Waterloo in about 1980. I first used Maple with a text interface at UMKC on their VAX computers in the 1980's. I have used several other such systems including Mathematica, its predecessor SMP, Reduce, MU-Math, Derive, and possibly others that I have forgotten about. There is a very good Wikipedia article titled "Maple (Software)."

[http://en.wikipedia.org/wiki/Maple_\(software\)](http://en.wikipedia.org/wiki/Maple_(software))

This gives the history of Maple, and gives examples of its use. Recall that we sent out an email about how a trial version of Maple 12 and Maple SIM can be obtained by contacting:

Mark Anderson
Territory Manager
Maplesoft
615 Kumpf Dr, Waterloo , ON (Canada) N2V 1K8
T: 1-800-267-6583 ext.421
F: 519-747-5284
manderson@maplesoft.com

I have downloaded the 2 month trial version and loaded it on my MAC OSX laptop. Maplesoft developed a graphical user interface for Maple in the late 1980's. I used Maple 5, version 4 extensively in the 1990's, mostly with a version that ran on a Silicon Graphics Workstation, but I also had a PC version. Currently I use Maple 6 on an XP system. Maple 12 differs a bit from Maple 6. The programming language seems to have changed some. Maple was written in C, and the kernel is still C, but later graphical user interfaces are written in Java. I have a document on Maple that was written in about 1995. It is now titled **Quintessential Maple Twelve**, although it is mostly the Maple V 1995 document. I will update it as I get time. The document is on the STEM2 website:

<http://www.stem2.org/jdemery/mapletwelve.pdf>

We talked about using Maple to eliminate variables in order to get an implicit representation of a rational curve or surface. I meant to talk about deriving the representation of the Hermite cubic curve, but did not get to it. Both of these things are in the Maple document.

46.5 Computers Useful?

Computers are clearly useful, but we have all wasted a lot of time messing with them. Does all of the work that goes into learning software really pay off? How much time is wasted in learning say five computer languages? Are computers really that useful in education? Do students really have the time to take away from their studies to learn a complex software application? Can one actually get students to learn and use say Maple? I was pretty unsuccessful in doing this when I taught a course in Electromagnetic Theory at UMKC. It was concluded in the discussion that high school students are better off using their time studying traditional material rather than in trying to learn a complex language like Maple. Students believe that they are the computer generation and know all about computers, and many adults concur, believing themselves woefully inadequate at computers. However, ten or fifteen years ago high school students were taught programming languages, such as Basic or Pascal. This is no longer done. Current students know a lot about using the Internet, but I think their real knowledge of computers is pretty limited.

47 MEETING NOTES, October 14, 2008

This meeting was announced as follows: The next meeting of STEM2 will be on Tuesday October 14, at the Trailside Center at 99th and Holmes, at 6 PM. This is the second Tuesday of the month as usual.

Rich Kaufman will talk about some work he did on proteins at Kansas University Medical Center. This work involved a computer program concerning the folding of proteins. A protein is a string of amino acids. A protein has various substructures such as alpha helices and beta sheets. The folded protein has a shape, and has surface charges, that cause it to bind with other biochemical molecules in the living organism.

I will present material on a heated iron wire experiment. This involves, metallurgy, thermal expansion, variation of resistivity with temperature, crystallography, change of phase, and a VRML animated image of atoms generated by a C++ computer program. Maxwell's equations are introduced and applied to an understanding of the electrical clamp meter, which was used to measure the alternating current in the experiment. A writeup may be perused with the link

<http://www.stem2.org/je/hotwire.pdf>

Lastly our discussion topic for the meeting will be Chaos Theory. For a summary of Chaos Theory see the online Wikipedia article "Chaos Theory." Go to the STEM2 web site

<http://stem2.org>

to view notes of past meetings, an archive of these notes, and various documents. The latter are obtained by clicking downloads, and then documents. STEM2 stands for Science, Technology, Engineering, and Mathematics. The "2" was added because the word STEM was already registered on the Internet.

47.1 Protein Fitting

Rich Kaufman displayed a poster summarizing the work he did at Kansas University Medical Center on protein folding and structure. This poster had originally been presented at an educational conference in St Louis. Rich gave a very interesting talk. Pictures of the poster have been gathered into a power point document

<http://www.stem2.org/je/kaufmanposter.ppt>

Rich worked under Mark Fisher at Kansas University Medical Center. Here is a link to the Mark Fisher web site.

<http://www.kumc.edu/biochemistry/mfisher.html>

Here is some information from the Fisher web page:

Mark T. Fisher, Ph.D., Professor
Department of Biochemistry and Molecular Biology
University of Kansas Medical Center
913-588-6940
mfisher1@kumc.edu

Here is a link to a site on Normal Mode Flexible Fitting:

<http://mmts.org/software/nmff.html>

Normal Mode Flexible Fitting (NMFF) is an evolving package of programs and methods that enable the flexible multi-resolution fitting of large atomically detailed structures into electron density maps from cryoEM, tomography and related lower resolution methods. The theory and methods behind NMFF are described in the papers referenced below and are based on searching along a few lowest frequency normal mode vectors, constructed from a multi-resolution elastic network representation of the atomic structure of interest, to maximize the correlation between the computed electron density for the flexible model and the experimental density.

NMFF is available for download to researchers at academic and non-profit institutions free of charge. You can download a copy the NMFF source suite by completing the licensing agreement. If you are from a commercial enterprise, if you experience problems downloading and accessing NMFF, or if you are interested in interacting with us on problems you think NMFF will be useful, please feel free to contact Charles Brooks

Publications describing NMFF:

Flexible multi-scale fitting of atomic structures into low-resolution electron density maps with elastic network normal mode analysis.

F Tama, O Miyashita and CL Brooks, Journal of Molecular Biology, 2004, 337 (4), 985-99. PubMed

Normal mode based flexible fitting of high-resolution structure into low-resolution experimental data from cryo-EM.

F Tama, O Miyashita and CL Brooks, Journal of Structural Biology, 2004, 147 (3), 315-26. PubMed

47.2 The Heated Wire Experiment

Jim Emery gave a talk on the heated wire experiment. A wire is heated with electric current and demonstrates a phase change in iron or low carbon steel, with change in temperature. Several other phenomena may be observed with the experiment, such as, thermal expansion, change of resistivity with temperature, crystal structure, the Curie temperature point where Iron becomes non magnetic, and an explanation of the operation of a current clamp meter by introducing Maxwell's equations. A demonstration of the atomic structure of Iron was done using marbles as atoms, and also using VRML computer graphic models to show the difference between body centered cubic and face centered cubic crystal structures. A colored VRML model was shown, which showed the octahedral planes in the face centered cubic structure and the close packed spherical arraignment of the atoms. A clamp meter was brought to the meeting and demonstrated. A video of the experiment was also presented. A paper on the experiment is on the STEM2 web site:

<http://www.stem2.org/jde/hotwire.pdf>

47.3 Chaos Discussion

We had a discussion of Chaos Theory. Jim Emery composed a list of Chaos Theory items of interest, which are available on the STEM2 web site.

<http://www.stem2.org/je/chaos.pdf>

Bob Williams talked about some of his favorite books on Chaos Theory, among which are the following

The Predictors: How a Band of Maverick Physicists Used Chaos Theory to Trade Their Way to a Fortune on Wall Street , by Thomas A. Bass

The Eudaemonic Pie, by Thomas A Bass

47.4 New Maple Program

Harry Myers brought his laptop to the meeting and gave Jim Emery a demonstration of Maple 12, and a beta version of the new Maple SIM program. This latter program allows the construction of simulation models for a very diverse set of problems, ranging through electronics, thermodynamics, mechanical, and so on. The models are built in a graphical environment by

selecting modules and linking them together. Harry intends to simulate a Phase Locked Loop and perhaps demonstrate it at a meeting. Phase Locked Loops are feedback circuits that cause an input signal to generate an output signal that has the same frequency and phase as the input. Harry has a stand-alone program for Phase Locked Loops and will compare to the Maple SIM model. Demos of Maple 12 and Maple SIM are available on the Maple web site.

48 MEETING NOTES, September 2008

About 16 people attended this STEM2 meeting. Sue Hallstrom, a Chemistry and Physical Science teacher at Shawnee Mission Northwest, talked about her project with Youth Friends to do email mentoring with adults in one of her Physical Science classes. There is to be an individual mentor for each student in the class. Sue is a former industrial Chemist and formerly taught at a science-oriented high school in Minneapolis. She wants to determine the affect of such mentors on student learning. She has a second class that will not be mentored as a control.

Noel Christiansen gave a talk on Logistica, which is a logic programming language invented by Frank Brown of Kansas University. Frank Brown has written a book on the language. Noel has worked in the area of artificial intelligence for many years. Logistica is implemented on top of a version of Scheme, a Lisp variant. Noel introduced the topic with a Sherlock Holmes problem. He emphasized that Logistica has an advantage over other logic programming languages. It can handle the idea of change of state in problem solving. He illustrated this with the classic Cannibals and Missionaries problem. Lisp is one of the oldest languages and is based on the Lambda calculus, which was invented by mathematicians and logicians Alonzo Church and Alan Turing.

A discussion on Piezoelectricity was lead by Charley Mentasana. Charley lead a research group at Honeywell on piezoelectric motors for several years. Others from the STEM2 group that were involved with the project include Jim Emery, Bob Williams, and Scott Yerganian. Charley brought a few piezoelectric devices to the meeting. There are common piezoelectric lighting devices that drive a spring-loaded device that snaps a mass into a piezoelectric material that creates a voltage of several thousand volts and produces a

spark for ignition of a flame. Also Charley brought a little car that would vibrate and move and travel along a smooth surface, and also could rotate a coke can. The piezoelectric effect (pressure electricity) in a crystal causes a voltage to be generated when the crystal is squeezed or strained. Conversely, applying a voltage causes a small change in the dimensions of the crystal. So piezoelectricity is used to generate very small movements. So piezoelectricity is used in such devices as atomic force microscopes that allow viewing images of atoms. It is used frequently in the new field of Nanotechnology. Piezoelectricity is the usual source of ultrasonic imaging and also of sonar. Charley presented some pictures of piezoelectric motors. These motors work by using piezoelectric material to set up vibrating waves. These waves travel around a ring, called the stator. Extended parts of the stator then execute little elliptic motions that go up and down contacting a friction disk attached to the rotor, which is thus caused to rotate. Charley once made a presentation at the Jet Propulsion Laboratory about using our motors to drive the Lunar Lander. The jet propulsion Laboratory was interested because they are always trying to reduce weight in space travel. Finite Element Methods are required to find the modes of vibrations and the resonant frequencies in the motors. Electric signals at these resonant frequencies drive the motors. There were a huge number of reports generated on this project. The University of Missouri at Rolla participated in the project. I have put a document on Piezoelectricity on the STEM2 site:

<http://stem2.org/je/piezoelc.pdf>

I have written several such reports, and I dont know if this is the most appropriate one. But it has a large bibliography.

Note. Wayne Heubner, the head of the Ceramic Engineering Department at Rolla, who worked with us on the project, will deliver a Linda Hall lecture sometime next year

Here is a picture of a Piezoelectric Motor:

<http://stem2.org/je/piezoelectricmotor.jpg>

49 MEETING NOTES, August 12, 2008

Here is the meeting announcement that was emailed about 1 week before the meeting.

Meeting Announcement The next meeting of STEM2 will be on August 12, 2008, 6PM, at the Trailside Center at 99th and Holmes. This is the second Tuesday of the Month as usual. First We shall have a discussion on video conferencing. Karen Grover of Youth Friends will talk about using video conferencing for mentoring students in science and mathematics, and perhaps how STEM2 can aid in this endeavor. We shall also discuss using video conferencing in our meetings.

Next it has been suggested that we have a discussion on energy use. This is both a technical and political topic. This involves the production of greenhouse gases. Here are a few questions to lubricate the discussion: What is the constitution of our atmosphere, and how has it changed? What are the facts about global warming? What is the current efficiencies of coal power plants, nuclear power plants, solar panels, wind turbines, hybrid cars, natural gas, electric power, electric cars, hydrogen for fuel cells, hydropower, and geothermal energy? Perhaps someone can give a fairly detailed description of the working of wind turbines. How efficient are they? What average wind speed is needed for efficient operation? How are they protected from high winds? What is the best shape for turbine blades? What states pay for electrical energy that is put back into the electric grid by home solar panels?

As usual, information about projects being done by STEM2 members is solicited.

Here are a few topics and presentations that I have been working on. I might have time to say a few words about some of these things, but probably any detailed discussion will have to wait for other meetings. However, there are documents on some of these subjects on our web site www.stem2.org (under downloads, documents). (1) A document called "Fibonacci Numbers and the Golden Ratio." In connection with this I have been collecting material on phyllotaxis, the arrangement of leaves and seeds on plants that follow a mathematical structure. Eric Kessler put me onto a beautiful book on this subject called "The Algorithmic Beauty of Plants." This book involves computer modeling of plants and their growth. It is quite mathematically sophisticated and involves computer graphics and solid modeling techniques. These are subjects which many of us have worked on for years. If anyone has a beautiful example of spirals on a sunflower, on a pine cone, et cetera, please bring it to the meeting. (2) A document called "Continued Fractions." It turns out that an infinite continued fraction may be used to show the convergence of Fibonacci number ratios to the golden ratio. (3) A doc-

ument called "Probability Theory," where I go over some of the probability distributions involved in Don Witte's presentation on Lightning at our last meeting, and also which contains a treatment of Bayes methods in connection with a test for drug use and related to an interesting book review that I saw in the July issue of the Notices of the American mathematical Society. (4) a document titled "Inversive Geometry" which proves some theorems about mechanical linkages, and links inversive geometry to the Mobius transformation and to projective geometry. (5) Because most members have not studied mathematics in its abstract forms, I thought I might introduce such abstraction in a document called "Infinity" which deals with abstract sets, cardinal numbers, set paradoxes, complete metric spaces and things. Also on connection with our ongoing discussion of Artificial Intelligence, I have downloaded a version of the Scheme language and have been exploring algorithms in the famous book "Structure and Interpretation of Computer Programs" by Abelson and Sussman, whose study used to be required of all MIT students. In connection with our document called "Experiments and Demonstrations" I intend to recreate an experiment that clearly demonstrates the phase change that occurs in steel when it is heated to high temperature. This involves heating a small diameter steel wire with an electric current, where a weight is suspended from the middle of the wire. Also I am thinking of making a nice gyroscope from a flywheel that I salvaged from an old tape recorder. Also I would like to write a survey document on Hamiltonian and Lagrangian methods in Physics through a proof of Emmy Noether's famous theorem on conserved quantities in Quantum Mechanics. It would be nice to have members become somewhat acquainted with things like: Groups, Semigroups, Rings, Fields, Hilbert and Banach spaces, Functional Analysis, and so on.

The Meeting Karen Grover of Youth Friends talked about mentoring students in science and mathematics. She passed around a signup sheet for volunteers for this mentoring program. Gwen Farmer, Partnership and Mentor Coordinator for Blue Valley Schools spoke on **CAPS** (the new Center for Advanced Professional Studies program). Also present from YouthFriends were Jennifer Samayoa and Joan Leavens.

We did not have a presentation on video conferencing, because Janice Bartels janice.bartels@skccom.com of SKC Communications was ill and did not attend the meeting.

Jim Emery talked about Fibonacci Numbers, the Golden Rectangle, and Continued Fractions, and the application to Phyllotaxis (the structure of

leaves, stems and seeds in plants), aided by Cecil Lagrandre, who brought pine cones as illustrations. Later she stood on a chair and loudly and expertly sang "The Marseillaise." See the documents on STEM2 called **Fibonacci Numbers and the Golden Ratio**, and **Continued Fractions**.

Lastly we had a discussion of the Earth and Energy. See the document on STEM2 called **Energy**.

50 MEETING NOTES, July 2008

Don Witte and Cecile Lagrandre each made presentations at the July meeting. The title of **Don Witte's** talk was **Lightning Point Process Modeling in the Characterization of Severe Storms and Tornado Genesis**. The subject is spherics, which are the radio signals generated by lightning. Dons father Will Witte, and Dick Fergus, worked on a similar study when they worked at the Kansas City Bendix plant. Will Witte died young and Dick Fergus moved to the Chicago area. He has continued to work on spherics all of these years. Here is a link to Dicks web site:

Dick Fergus W9DTW
rfergus@theramp.net
<http://users.theramp.net/~sferics/>

When he was 6 years old, Don Witte was in the famous Ruskin-Heights tornado of 1957. Ruskin-Heights was a relatively new Kansas City suburb in the 50s. The Witte house was on the corner of the intersection of 109th street and 108th street. The house had a basement, but many houses in Ruskin-Heights did not. The Witte house was not destroyed, but many nearby houses were, as was the Ruskin-Heights High School. This motivated the study of tornadoes and lightning. When Don worked on a Masters degree in Electrical Engineering at the University of Missouri, he worked on several projects relating to spherics.

Hardware.

The hardware that Don used for this research was mostly built by Don following some of the work done by his father and Dick Fergus. A lightning strike is a two step process. First an ionization path travels from the cloud in a jagged step to the earth. Once the path is ionized and thus forms a conducting path, a huge current strike travels back from the earth to the cloud.

The current in the strike oscillates and acts as a giant vertical dipole antenna, thus sending out electromagnetic waves. The radio waves have a very broad spectrum. A system for intercepting the waves consists of two loops, each two or three feet in diameter. The loops are constructed of bent aluminum channels containing loops of copper wire. Aluminum foil is wrapped around the coils so as to shield them from the electric part of the wave. Thus the coils sense only the change in the magnetic field through the coils. There are two coils with the plane of the windings vertical and where the two coils are at 90 degrees with respect to each other. There is also a vertical antenna that picks up the electric field. The coils are connected to a modified oscilloscope. The CRT was replaced with a new CRT with persistent phosphors, so that traces would persist for up to 10 minutes. The horizontal and vertical deflection plates are connected to different loops so that the phase registers on the screen as a tilted line thus indicating direction. The screen is photographed to record the activity over a ten minute interval. Dually, the signals from the loops are connected to capacitors that store the signal energy. Then they discharge through an electronic interface involving integrators and quadrature oscillators. This discharge is recorded when triggered by a 555 timer. The integrators and quadrature oscillators are constructed from op amps. This integrates the signals and gives the initial voltage on the capacitors and so the amplitudes of the strike signals signal. The amplitudes from the two loops give the azimuth of the strike direction. The signals are input into the memory of an 6800 microcomputer, which Don built from a kit. The microprocessor is programmed with assembly language. Eventually the content of the memory is stored onto a cassette tape. The cassette tape was then read into a VAX computer for further processing.

Fitting the data to A Probability Distribution.

The time between events is fit to a gamma probability distribution using several methods including a non-linear least squares technique. The gamma parameters turn out to have some interesting properties. The goal of the research was to characterize storms that produce tornadoes according to the properties of the sensed lightning strikes. Information about Poisson processes and distributions can be found in the document

<http://www.stem2.org/je/probabilitytheory.pdf>

Cecile Lagandre presented the anatomy of the plant **Nigella Damasena**, which the group found quite interesting. This plant came from the herb

garden at the Wornall House, which was built before the civil war, and is located at about 61st Street and Wornall Road. Here is a link to a picture of the autopsy:

<http://www.stem2.org/je/nigella.jpg>

The herb garden also has a nice little sundial. *Nigella* is a genus of about 14 species of annual plants in the family Ranunculaceae, native to southern Europe, north Africa and southwest Asia. Common names applied to members of this genus are Devil-in-a-bush or Love in the mist. The species grow to 20-90 cm tall, with finely divided leaves, the leaf segments narrowly linear to threadlike. The flowers are white, yellow, pink, pale blue or pale purple, with 5-10 petals. The fruit is a capsule composed of several united follicles, each containing numerous seeds; in some species (e.g. *Nigella damascena*), the capsule is large and inflated. Spread some in your yard, and it will reseed itself every year. For more information see the complete Wikipedia article on *Nigella*.

51 MEETING NOTES, June 2008

Written by Jim Emery

Maurice Smith talked about the history he is compiling about the Westinghouse jet engines that were manufactured in the Kansas City plant. He traveled to Oklahoma and located one of the original engines.

We discussed briefly the use of the carbon arc in early radio transmission and the Van Der Pol equation. There is a nice treatment in the book "The Science of radio," by Paul Nahin. The carbon arc has a local region of negative resistance, which allows energy to be fed into an oscillator. This technique was used before the invention of the high power vacuum tube. There is a MatLab solution of the Van Der Pol equation given in that book.

We talked about Artificial intelligence, Lisp and Scheme, Expert Systems applied to machining, and about grid computing using DR Scheme. It turns out that many of the members have done work in Artificial Intelligence, and so perhaps we shall continue this discussion. Noel Christiansen has done much work in the field, but was unable to attend the meeting. He will perhaps give a talk on work he has done using Logistica.

We discussed scientific societies, including the Royal Society, The Lunar Society, Franklin's Junto, and various professional societies. Relevant material is in the document "Scientificsocieties.pdf," which may be found on the STEM2 website. We listened to a small part of a BBC Radio 4 "In Our Time" program about the Lunar society. To listen to the full program go to the "In Our Time" website, and navigate to the science archive.

We talked a bit about inversive geometry, its application to the straight line linkage, its relation to the Mobius transformation, and the fact that the Mobius transformation is actually a projective transformation of 1-dimensional complex projective space. See the document "inversivegeometry.pdf" on the STEM2 website.

Zack Carlin talked about a project he has been assigned to at Honeywell to encourage research and to encourage young engineers. He and Maurice agreed to consult each other on common interests. Bob Kessler talked about his interest in scientific education in the united states and about a new National Academy of Science report on this subject. The report or book is "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future."

Link:

http://www.nap.edu/catalog.php?record_id=11463

We did not get to a discussion of Experiments and Demonstrations, or to selecting volunteers in this area.

Last Updated (Saturday, 14 June 2008)

52 MEETING NOTES, May 2008

Written by Jim Emery

The next meeting of STEM2 is June 10th at 6:30 at the Trailside Center.

Here is a brief summary of our last meeting: Maurice Smith and his wife Brenda gave a talk about their trip to Antarctica. They sailed on a Russian ship called the Akademik Shokalskia. They sailed from Ushuaia Argentina to the Falkland Islands, to South Georgia Island, and to the Antarctic Peninsula, where they spent a night in a tent at 65 deg 10 minutes South and 64 degrees 10 minutes West. There is a lot of history connected with this region, and famous names like Magellan, Drake, and Shackleton. Maurice handed out a document and DVD about the voyage. He is to give the talk again at

the Trailside Center on the 12th of June at 7PM.

I gave a brief presentation on a mathematical analysis of the coupled pendulums (actually on a coupled spring system, which is approximately the same as the pendulums). This can be found on our website <http://www.stem2.org> under downloads as section seven of the document on vibration theory.

We gave a summary of some of the papers presented at the Mid-America Astrophysics Conference.

We showed, very briefly, a spinning bicycle wheel with handles demonstrating the principle of the gyroscope and angular momentum.

We had discussions about science education, and our demonstrations and experiments, and began plotting our next move in this area.

Here is information from Brad Sumners about the "Field Day" amateur radio event coming up. The event this year it is on June 28 and 29. Many local clubs participate and welcome visitors to come by and watch and/or actually talk on the radio. If you enter your address into the following "locator" you can determine where they will be.

www.arrl.org/contests/announcements/fd/locator.php.

Most locations run continually from Saturday morning through early Sunday afternoon. ARRL Field Day is the most popular on-the-air operating event in amateur radio. On the fourth full weekend in June, tens of thousands of amateur radio operators gather for a public demonstration of our service. Field Day is part educational event, part operating event, part public relations event and ALL about FUN! Amateur radio is about knowledge and growth. It is a hobby and service that truly offers something for everyone. Amateur Radio embraces both the old and new. While CW may no longer be a testing element, it is still a strong and favorite operating mode for many. Tens of thousands of operators are embracing digital technologies, from RTTY to newer digital modes like PSK31 and Olivia. Phone operation, probably the largest segment of the hobby, also has new frontiers to be explored with digitized voice, VOIP, and IRLP. And this is why Field Day the largest annual on-the-air operating event is so exciting. It gives all the old timer and the newcomer, the brass-pounder and the computer assisted operator the chance to share and teach the broad range of modes and technologies we find in our hobby.

Field Day is truly the time in which we bring amateur radio to Main Street USA. By setting up in parking lots, malls, Emergency Operations Centers, parks and even at home, amateur operators learn skills that will

allow them to better serve their communities. Setting up in these public venues gives added public relations value their friends and neighbors can see and experience the fun and public service capability that their ham radio neighbors bring to the community. Join in the fun! For more information on amateur radio and the ARRL the national organization for Amateur Radio visit www.arrl.org

Information about the upcoming American Society of Metals course for teachers at UMKC is in the document <http://www.stem2.org/je/ASMPProgram.pdf>

Here are a few possible discussion topics for our June meeting:

- (1) Volunteers to construct demonstrations.
- (2) The history of scientific societies, such as the Royal Society, the Lunar Society, and the beginnings of the societies that became the professional scientific societies of today.
- (3) Artificial Intelligence
- (4) Setting goals for our Experiments and Demonstrations project.

Last Updated (Sunday, 08 June 2008)

52.1 Astrophysics Conference Notes

Astrophysics Conference Notes Written by Jim Emery Saturday, 10 May 2008 The Mid-America Astrophysics Conference was held April 8th and 9th at the auditorium of the Linda Hall Library.

<http://www.stem2.org/je/astrophysics.pdf>

53 MEETING NOTES April 8, 2008

Meeting Notes April 8, 2008 Written by Jim Emery Sunday, 27 April 2008 Youth Friends and Uplink are programs to aid students in seeking careers in Mathematics, Engineering and Science, and to connect students with mentors. Joan Leavens of Youth Friends gave us a presentation of the operation of Youth Friends and a related program called Uplink. We talked about interactions between STEM2 and Youth Friends. For more information go to

<http://www.youthfriends.org/>

Bob Kessler and I later visited Joan and Karen Grover at the Youth Friends office at 1800 Baltimore in downtown Kansas City Missouri. We had an interesting discussion and agreed to meet again.

Richard Peters, who teaches a course on Pharmacokinetics at UMKC, gave us an introduction to this topic. This subject is about the chemical kinetics of drugs that are introduced into the body and the interactions within the body. Richard uses in his course the book "Pharmacokinetics" by M. Gibaldi, and Donald Perrier. Richard formerly worked for a Kansas City company involved in drug testing, safety trials, and statistical validation.

Lastly, I gave physical demonstrations of coupled pendulums and Lissajous figures. I have placed a pdf on Lissajous figures in the Download section of this website:

Lissajous Figures: <http://stem2.org/je/lissajous.pdf>

Also after the meeting, I wrote out the mathematics of coupled mechanical oscillators, and placed it in a document called "Vibration," which I wrote some time ago, it appears as section seven.

Vibration Theory: <http://stem2.org/je/vibra.pdf>

This analysis shows how energy is transferred back and forth between the oscillators. There is a figure showing the separate oscillations of the mass spring system. The pendulums are only approximations to harmonic oscillators, but behave similarly.

Our next meeting will be on the second Tuesday of May, which is the 13th at the Trailside Center at 99th and Holmes at 6PM.

Last Updated (Sunday, 27 April 2008)

53.1 Experiments and Demonstrations

Experiments and Demonstrations Written by Jim Emery Friday, 21 March 2008 Click below for the latest version of the experiments and demonstrations document.

<http://www.stem2.org/je/experiments.pdf>

Last Updated (Monday, 24 March 2008)

54 MEETING NOTES March 11, 08

Meeting Notes March 11, 08 Written by Jim Emery Friday, 21 March 2008
Meeting Notes March 11,2008

We presented an experiment with a corner reflector. This consists of the inside corner of a box made with three mutually orthogonal mirrors. A laser pointed at the reflector returns the ray parallel to the initial ray. Corner reflectors have been placed on the moon in order to measure the changing distance between the sun and moon. The laser is spread out to 4 KM when it hits the moon, so the returning signal is very weak. The time between photon receptions being measured in seconds. A proof that the corner reflector does return a parallel ray may be based on the geometry of orthogonal projections.

I had suggested that the programming application Octave be downloaded. We looked briefly at using Octave, which is largely compatible with MatLab. One can use it on the command line directly. If a mistake is made, one can use the up arrow to backup and correct. But probably the best way to use it is to open an editor, say notepad, and write commands as script files, called m files, say myscript.m. save the file in some designated directory where you save your m files. Then execute it in the Octave command line by typing its name without the m extension. All the commands are executed. If a command ends in a semicolon, then the output is suppressed. When a command is issued, Octave (or Matlab) looks first for built-in commands of that name, and eventually looks for m-files in the current working directory. Type pwd to see the current working directory. If you stored your m-files in a directory called mydirectory, then you need to make that directory the working directory by issuing the command: cd mydirectory. There is a built-in Octave editor supplied that could be used, but I just use notepad. If there is an error in your m-file or if you want to make some changes, then you do that in the open editor window. click save. And then retype the m-file name at the command line, or use the up arrow to avoid typing. I have done more work with Octave after the meeting. I wrote a Fast Fourier Transform program to check how it approximates the Fourier transform by graphing the two results. I did this by creating a MatLab script and using the matlab function fft. I used the identical script with Octave and got identical results.

The remainder of the meeting was devoted to talking about demonstration experiments and how to gain support for building experiments, obtaining apparatus, and finding support for a facility where such demonstrations could

be done.

Again for those who have not downloaded Octave: To download GNU Octave, Google Octave. You will then select <http://www.gnu.org/software/octave> Then select download. You will go to: <http://www.gnu.org/software/octave/download.html> Scroll down to "Windows" and "Octave Forge," which select. You will go to <http://octave.sourceforge.net/> Select "Windows Installer" (or "Octave.app for MacOS X" for macintosh) Note the location of the saved file, which for Windows is called "Octave-3.0.0-setup.exe" Click the file to run it. Take all defaults. It will be installed. To run it select Octave in the program menu, then run it or browse the manual in the html or pdf versions (616 pages).

Last Updated (Friday, 21 March 2008)

55 MEETING NOTES, 2/12/08

February 12, 2008 Meeting Written by Jim Emery Tuesday, 26 February 2008
Here is a summary of the activity at our February 12, 2008 meeting.

(1)Erich Grotheer gave an interesting talk on his trip to Egypt. There was a talk last year at Linda Hall Library by a Caltech professor Jed Z. Buchwald on Napoleon's Scientific Expedition to Egypt. Video's of some of the past Linda Hall Talks are available on the Linda Hall Library Website.

<http://eands.caltech.edu/articles/LXVI4/buchwald.html>

http://www.lindahall.org/events_exhib/exhibit/exhibits/napoleon/

(2)We discussed the availability and use of mathematical software. Much such software is available free. I have uploaded a power point presentation on the discussed software. Here is the link:

<http://www.stem2.org/je/mathsoftware.ppt>

This file is about 6 megabytes, so be patient. It will open up in Explorer if you have Power Point. If not, you can download the free Powerpoint Viewer from microsoft. Our next meeting will be on the 2nd Tuesday of March, March 11, 2008 at the Trailside Center 99th and Holmes at 6PM. Note that this is 6PM, not the old time of 5:30PM.

Last Updated (Tuesday, 26 February 2008)

55.1 February, 2008, Coming Events

Written by Jim Emery Friday, 08 February 2008 Stem2 meeting Feb 12 2008
Trailside Center 6PM

The MID-AMERICAN REGIONAL ASTROPHYSICS CONFERENCE The dates for the MARAC 2008 meeting (the 38th annual conference) have been set at FRI/SAT April 11/12. The meeting will return to the newly renovated facilities of the Linda Hall Library in Kansas City. If you have any immediate questions or suggestions, contact Bruce Twarog at btwarog@ku.edu This e-mail address is being protected from spam bots, you need JavaScript enabled to view it . Please be sure to circulate the meeting dates to all of your students and colleagues!

Bruce, Scott, Jason

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2008 Linda Hall Lectures Featuring Four Professors from Washington University, St. Louis and two Guest Speakers The Friends of the Linda Hall Library are pleased to announce that the 2008 Linda Hall Lecture Series schedule is taking shape. Washington University, St. Louis will be the featured academic institution. Speakers and their likely topics will include:

Dr. Robert Criss - Department of Earth and Planetary Sciences Louis
will speak about the origin, character and behavior
of rivers and flood waters in the Mississippi, Missouri and Meramec River basins.

Dr. Michael Wyession - Department of Earth and Plantary Sciences
Earthquake Hazard and Prediction

Dr. Michael Swartwout - Department of Mechanical, Aerospace and Structural Engineering
Space Mission Failures

Dr. Bill Smart - Department of Computer Science and Engineering
Robots and Human-Robot Interaction

In addition:

Mr. Paul Barber - US Army Corps of Engineers (Retired) and Mr. David L Combs
will discuss the Kansas City levee system

At the final lecture,

Dr. Fred Hawthorne - University of Missouri (formerly the University of Missouri - Columbia) will discuss research on the use of nanotechnology in drug delivery.

Please bookmark this page and check back as we get more information and finalize the dates of the lectures.

To see streaming video presentations of past lectures held in 2007, click on this link.

2008 Linda Hall Book Discussions Saturday, March 1 10:30 am -12:00 pm : Periodic Roundtable: The Door in the Dream

The Charles S. Peirce Center for Philosophy and History of Science

The Charles S. Peirce Center for Philosophy and History of Science is a Kansas City association of persons interested in studying, developing and applying the thought of the American philosopher and scientist Charles S. Peirce. Members meet at regular intervals to study, develop and expand the ideas of Peirce with the aim of relating them to current knowledge, problems and concerns, and of connecting them to the thoughts of other thinkers, past and present. Meetings are held on Saturdays, 2 - 3.30 pm, at the Linda Hall Library. Membership is open to all persons wishing to further the goals of the Group. No allegiance to any particular doctrine or opinion of Peirce is expected over and above a commitment to the Peircean ideal of disinterested, unbarred inquiry, in a spirit of collaboration and sympathy with the free expression and fair confrontation of ideas. For more information please contact: Eliseo Fernandez, Reference Librarian, Linda Hall Library: 816-926-8722 800-662-1545, ext. 722

Periodic Roundtable Book Discussions The Door in the Dream: Conversations With Eminent Women in Science - March 1, 2008 In celebration of National Women's History month, there will be a Periodic Roundtable Book Discussion of Elga Wasserman's book The Door in the Dream: Conversations With Eminent Women in Science on March 1, 2008 from 10:30 a.m. - Noon. The book discussion will be facilitated by Linda Hall Library Reference Librarian Jenny Bruenger and Rebecca Power, Science Reference Librarian at UMKC's Miller Nichols Library. This event is free and open to the public. Reservations are not required, but seating may be limited. To ensure your seat, please R.S.V.P. by emailing Jenny Bruenger or calling (816) 926-8725. At the Water's Edge: Fish with Fingers, Whales with Legs, and How Life Came Ashore but Then Went Back to the Sea - April 7, 2008 April's Periodic Roundtable Book Discussion will feature Carl Zimmer's book At the

Water's Edge on April 7, 2008 from 6 p.m. - 7:30 p.m. The book discussion will be facilitated by Linda Hall Library Reference Librarian, Christine Taft. This event is free and open to the public. Reservations are not required, but seating may be limited. To ensure your seat, please R.S.V.P. by emailing Christine Taft or calling (816) 926-8778. Hope is the Thing with Feathers: A Personal Chronicle of Vanished Birds - May 5, 2008 At the height of Spring migration, May's Periodic Roundtable Book Discussion will feature Christopher Cokinos' book Hope is the Thing with Feathers on May 5, 2008 from 6 p.m. - 7:30 p.m. The book discussion will be facilitated by Linda Hall Library's Head of Marketing and Reference Librarian, Eric Ward. This event is free and open to the public. Reservations are not required, but seating may be limited. To ensure your seat, please R.S.V.P. by emailing Eric Ward or calling (816) 926-8753. Beyond Oil: The View from Hubbert's Peak - June 9, 2008 June's Periodic Roundtable Book Discussion will feature Kenneth Deffeyes's book Beyond Oil on June 9, 2008 from 6 p.m. - 7:30 p.m. The book discussion will be facilitated by Linda Hall Library's Head of Reference, Scott Curtis. Calling upon his background as a petroleum industry geologist and university professor, Ken Deffeyes argues that we have just passed "peak oil" and are headed for diminishing returns. He pragmatically addresses how we can extract more oil from the earth, the economic costs involved in these extraction methods, and the energy alternatives available beyond oil. This event is free and open to the public. Reservations are not required, but seating may be limited. To ensure your seat, please R.S.V.P. by emailing Scott Curtis or calling (816) 926-8739. 2008 One Book Program featuring The Selfish Gene Mark your calendars for the first One Book Program of 2008 at Linda Hall Library! On Tuesday, February 5, 2008, from 6 p.m. - 8 p.m., staff will lead a community discussion of Richard Dawkins' The Selfish Gene. What if, instead of explaining evolution by the survival of desirable individuals, we view evolution as a competition between genes for supremacy? Does this make understanding evolution easier? Although The Selfish Gene was published in 1976, the book has never been out of print and has gained status as one of the rare popular books on science that exerts influence over both scientific and popular thought. For more information, please call Jenny Bruenger at (816) 926-8725 or email at bruengej@lindahall.org This e-mail address is being protected from spam bots, you need JavaScript enabled to view it.

The Linda Hall Radio Club

The Linda Hall Library Amateur Radio Club (LHL ARC) was formed to provide an environment where new amateur radio operators, or hams, can learn about the theory and practical application of radio one-on-one mentoring by experienced hams, or Elmers. Each new ham is paired with an Elmer, and the new ham works on a project of his/her own choosing, with direction and guidance from the Elmer. The new hams document their projects and present technical reports for the club membership. In addition to project reporting, meetings can include discussions of the theory behind questions on the radio licensing exam, small demonstrations of electrical or electronic concepts, and opportunities to learn more about recommended operating technique. The LHL ARC does not seek to replace or duplicate the activities offered by other local amateur radio clubs, like preparations for emergency services, contesting, or license test preparation. LHL ARC members are encouraged to be involved with their local radio club as well. While there are no membership dues, participation in the LHL ARC requires a sincere commitment to complete radio projects and to become involved in the local ham radio community. For the year 2008, membership is by invitation only. If you are interested in receiving an invitation to the LHL ARC, please contact Scott Curtis at curtiss@lindahall.org This e-mail address is being protected from spam bots, you need JavaScript enabled to view it . Meetings will be held the third Saturday of each month, except December, from 10:00-12:00 in the Classroom

Possible Areas of Interest

- Digital Operations
- Antenna Building and testing
- DX / Contest Operation
- Construction Practices
- Computer / Radio Interfacing
- QRP (low power operation)
- Antenna software modelling
- Satellite Operation
- Station Layout and Organisation
- Data Logging

Meeting Agendas

2007

November 17, 2007 Agenda

2008

January 12, 2008 Agenda

Technical Reports

Computer Radio Interface - Report by Harold E. Myers

Demonstrations and Activities

Siggraph 2008 Conference Los Angeles, CA, Los Angeles Convention Center Monday 11th Aug to Friday 15th of August.

Last Updated (Friday, 08 February 2008)

56 MEETING NOTES, 2/8/2008

Written by Jim Emery Friday, 08 February 2008 A couple of topics from our November meeting were, (1) the application of topological sorting to displaying a triangulated surface correctly, and (2) Voronoi Diagrams.

In the case of topological sorting, I may put the software into a useful form and make it available.

Voronoi diagrams are named after Georgy Fedoseevich Voronoi. The wikipedia article gives historical information about them. Given a set of points, A voronoi diagram defined by a set of points consists of polygons whose edges lie on lines that bisect each pair of points. The polygon corresponding to each point p is the area of points surrounding the point p, each point in the area being closer to p than to any other of the original set of points.

The Delaunay triangulation is the dual in the sense of Graph Theory (see the book by Harary "Graph Theory p114). So corresponding to every node of the voronoi diagram is a triangle of the Delaunay triangulation. There are many applications in computational geometry. Surfaces may be triangulated for display. The diagrams are related to certain definitions in crystallography. A link to a nice visualization, via a Java applet, on the Internet is <http://www.cs.cornell.edu/info/people/chew/delaunay.html> Steve Brooks has used Voronoi techniques in various geometry problems and in his aerial photography work.

56.1 Submitting News

Written by Jim Emery Tuesday, 13 November 2007 First go to the site <http://stem2.org>. When you enter the site, you can read news. But to submit news you must login. To login, scroll down and find the login area on the left side of the screen. Type your user name and your password. Now the

password tends to be a little hard to remember because it usually contains both lower and upper case characters. You can store your password in some information file on your desktop, and then copy and paste.

After one is logged in, a new menu appears on the left side of the screen. Scroll down to see the button "Submit News." Select this button. An area opens where one can type in the content. The first thing to do is to give the news a title. Select from the drop down menu labeled Select Category, which is near the top. The only thing available is "Latest News." Not selecting a category causes Joomla to complain. Type the news content. However, sometimes while saving content, Joomla logs out. What has been typed is apparently lost. So I recommend typing the content using notepad, and then copying and pasting. The reason this logout occurs is probably that the page context in the web browser has been lost. Joomla then thinks that you have left.

After completing the news, scroll down until the "Save" icon is seen. This is a floppy disk image. Click it. Your content should be saved and a message will say, "Thanks for your submission. Your submission will now be reviewed" Your content has been saved, but it has not yet been published. To mark your submission as "Published" you need to login as administrator. Scroll down until you will find a button called "Administrator." Click that button. A control panel will be displayed. Select "Content Items Manager." You will see a list of files. Put a check mark in the box to the left of the file that you have just created. Then click the "Published" button at the top of the screen. Your document is now published and can be viewed by others. You can also select "Edit" from this "Content Items Manager" to make changes to your document.

Click the Logout button at the top right of the page to leave the Administrator

Last Updated (Tuesday, 13 November 2007)

56.2 Books Linda Hall

Books Linda Hall Written by Jim Emery Tuesday, 13 November 2007 Scott Curtis of Linda Hall Library has created an interesting list of books that might make good gifts. These books are also available at Linda Hall Library. Scott discussed these books at the Book-a-Night meeting at Linda Hall Library on Monday Nov 5th. Here is a link to the list

<http://stem2.org/je/lindahallbooklistnov07.pdf>

Last Updated (Tuesday, 13 November 2007)

56.3 BBC Science Programs

BBC Science Programs Written by Jim Emery Tuesday, 09 October 2007

Listen to Science Discussions

BBC - Radio 4 In Our Time - Science Archive <http://www.bbc.co.uk/radio4/history/inourtime/>
Melvyn Bragg and guests investigate the history of ideas. Thursday 9.00-9.45am, repeated 9.30pm.

Antimatter - where has it all gone?

The Permian-Triassic Boundary - when 95

Gravitational Waves - a new window on the universe

Symmetry - the pattern at the heart of our physical world

Anaesthetics - from ether frolics to pain-free surgery

Microbiology - the story of the invisible masters of the universe

The History of Optics - from telescopes to microscopes, a new way of seeing the world

Archimedes - the Greek mathematician and his Eureka moments

Mars - the search for life on the Red Planet

Indian Maths - laying the foundations for modern numerals and zero as a number

The Speed of Light - a cosmic speed limit?

The Poincare Conjecture - how a 19th century mathematician changed how we think about the shape of the universe

The Needham Question - did China lay the foundations of modern science?

Alexander von Humboldt - the remarkable career of the Prussian naturalist

Galaxies - extra-galactic nebulae, black holes, stars and dark matter

Carbon - the basis of life

The Heart - its anatomical and cultural history

Mathematics and Music - the science behind sound and composition

Astronomy and Empire - the link between colonial expansion and scientific discovery

The Search for Immunisation - and the battle against smallpox

The Royal Society - the first club for experimental science

Negative numbers - how they spread across civilizations
 Human Evolution - from early hominids to Homo sapiens
 Prime Numbers - the building blocks of mathematics
 Artificial Intelligence - the quest for a machine that can think
 The Graviton - the quest for the theoretical gravity particle
 Asteroids - celestial bodies from the beginning of time
 The Rise of the Mammals - life in a cold climate
 Magnetism - an attractive history
 The KT Boundary - did the dinosaurs burn out or fade away?
 Renaissance Maths - the birth of modern mathematics?
 Perception and the Senses - how do we see what we see?
 Dark Energy - the unknown force breaking the universe apart
 Alchemy - seeking the perfection of all things
 The Cambrian Explosion - the big bang of evolutionary history
 The Second Law of Thermodynamics - the most important thing you will
 ever know
 Carl Gustav Jung - Discovering the Self
 Higgs Boson - the search for the God particle
 Electricker - the origins of electricity
 The Origins of Life - how it all began
 Pi - the number that doesn't add up
 Planets - the astronomy of the 21st century
 Zero - everything about nothing
 Hysteria - the normal state of human beings?
 Theories of Everything - still the holy grail of physics?
 Dreams - is there a science of dreams?
 Rutherford - the father of nuclear physics
 Cryptography - secret history of ciphers and codes
 Lamarck and Natural Selection - the Lamarckian Heresy
 Ageing the Earth - a journey in geological time.
 Infinity - a brief history.
 James Clerk Maxwell - great 19th century physicist
 Nature - from Homer to Darwin
 Vulcanology - significance of volcanoes.
 The Lunar Society - scientific ferment 200 years ago.
 Memory - and the brain
 Supernovas - the life cycle of stars

Meteorology - why does it still fascinate us?
Chance and Design in Evolution - Design in Nature
Disease - the fight against diseases and plagues
The Calendar - a history of the Calendar
Psychoanalysis - do people crave dictatorship?
The scientist in history - missionary or monster?
History of drugs - their role in medicine and the arts
Schrodinger's Cat - Quantum Mechanics
Chaos Theory - ws the universe chaotic or orderly?
ET - new life within our solar system
Anatomy - 2000 years of anatomical study
Last Updated (Tuesday, 09 October 2007)

56.4 Submitting Content Using An External Website

Written by Jim Emery Monday, 08 October 2007 Although it is probably better to enter your content directly into the stem2 site using Joomla, there is an alternative.

Rather than type your news content directly into Joomla, it is possible to simply put a couple of sentences into Joomla, and a link to your personal website, where the actual content resides. Thus one could put in the following sentence, which contains a link to an external website. This link is to a document that contains more links to local kansas City area libraries. The link is

<http://www.geocities.com/jdemery1/libraries.htm>

Also if you have a paper or document you want to reference, you can put a similar link to your document, which might be a pdf file readable by acrobat reader. You can also store such a document on the stem2 website. This requires ftp access, which you may or may not have.

If you do not have a personal website, there are free websites. One is geocities, which is now owned by yahoo. You may need to have a yahoo mail account, I am not sure. Your user name and password are the same as for yahoo email. After you have setup this free website, you can upload your html file or pdf file easily using the file manager: <http://www.yahoo.geocities/filemanager> Click the upload button on the right side of the screen. An area opens where you can type in file names, or browse on your computer for file names. To create html you can use an html editors. Microsoft Word will save documents

as html. If you have Acrobat distiller, almost any application will print to distiller, creating a pdf.

Last Updated (Wednesday, 31 October 2007)

56.5 About Barycentric Coordinates

About Barycentric Coordinates Written by Jim Emery Monday, 08 October 2007 There is a section in the document called "Graphics and Geometry" on Barycentric Coordinates. This document is viewed with Acrobat Reader. Note that once opened in Acrobat reader, the file can be saved to your computer. PDF documents can also be read from the "Documents in Acrobat PDF Form" button. To access the

graphics file click <http://stem2.org/je/graphics.pdf>

56.6 Postscript Images and Topological Sorting

Written by Jim Emery Saturday, 06 October 2007 Polyhedra have appeared in many of my problems. Many such polyhedra are convex and closed. Drawing these is no problem because the surface polygons are usually oriented and so define an outward normal to the surface. To draw such polyhedra one only need draw the forward facing polygons as determined by the normal. This is easily done in Postscript. One projects the polygons onto a two dimensional picture plane using either orthogonal projection or perspective projection. Then the edges are drawn as straight lines enclosing each polygon. Then the polygon is filled with gray according to the inner product of the polygon normal with a vector from the viewpoint.

When a surface is not convex and not closed, then this method will not work. Postscript draws and fills each polygon as it is encountered, overwriting previous polygons. Thus perhaps hiding viewable areas. I have thought about sorting the polygons so that the image is correct. This can often be done, but can not be done in general. For B can be in front of A, and C in front of B, and D in front of C. Then the drawing order should be $A_i B_i C_i D_i$. However, because we are in 3 dimensions, it is possible for A to be in front of D. So D should be drawn after A, and yet D should be drawn before A. So the method will not work in this case. But in most cases it will work because there is no cycle. So the "in back of" order will work usually. So recently, I decided to construct an algorithm. The first task is to compute an order for pairs of

triangles. So we compute $A \leq B$ if the projections of A and B intersect and A is behind B . We assume that A and B meet only at edges. We use barycentric coordinates to compute this order. There are many cases. But we get what is called a partial ordering, meaning that some pairs are ordered others are not. We can represent this implied partial order with a digraph. That is a directed graph or network. This consists of nodes and directed edges. In order to draw the complete image we need an order for all of the polygons. That is we need a total order that does not violate our digraph. Such total order is not unique. Producing such an order is called a topological sort. To a mathematician, such use of the term topological is not appropriate. He would use the word "graph", rather than the word "topology." In order for this topological sort to work the digraph must be acyclic, that is it must not contain any directed cycles. An algorithm can be designed to discover these directed cycles and so announce failure. Unfortunately, a topological sort is of order n squared. Such algorithms are not in general practical. So if there were 100 triangles then the time to compute the algorithm would be of order 100 squared or 10000, which can be done. However, surfaces with millions of triangles are common. The time for this algorithm would be of order 10 to the 12th. This is not practical. However, I think the algorithm is useful for small polyhedra, say of fewer than 10000 triangles. I have created programs to do this algorithm. So that is what I have been doing lately. Incidentally, one might ask how computers draw surfaces so quickly if an algorithm to draw them is n squared. Surfaces are represented as triangular polygons. A z-buffer method is usually used. The things that are sorted are pixels rather than triangles. The z-buffer maintains only a color or shade for each pixel. As a pixel in a triangle is computed, it overwrites the pixel in the z-buffer when it is in front of the currently stored pixel. So pairs of pixels do not have to be compared. It is the pair comparison that leads to the n squared order of the triangle sort above. The z-buffer technique avoids this. The z-buffer technique is fuzzy and not exact, because the image is pixilated. However, with a screen of high pixel resolution, the eye says, "really great!"

Barycentric coordinates occur in the concept of the simplex, and in the related simplicial complex. The boundary of an n dimensional simplicial complex, is an $n-1$ dimensional simplex. The orientation of the simplices, results in an algebraic structure. If a topological space is "triangulated" to represent it as a simplicial complex, then the resulting algebraic structure (homology) characterizes some topological properties of the original space.

This is one of the techniques of algebraic topology. For more information on barycentric coordinates, see relevant sections in the file graphics.pdf, which has the title "Computer Graphics and Geometry."

Last Updated (Saturday, 06 October 2007)

57 MEETING NOTES, August 2007

57.1 Electroformed Stents, Rick Hines

August 2007 Meeting (Electroformed Stents) Written by Steve Brooks Tuesday, 21 August 2007 Richard Hines from ESI (Electroformed Stents Inc) <http://www.estent.com/> presented his company's research in for electroformed stents, cylindrical photolithography and porous electroplated layers for elution of drugs or other biological material.

Richard is a retired Honeywell FMandT associate that worked at FMandT for 29 years before retiring early and taking advantage of research he performed for an electroformed stent. He used his own money and resources to file the patent and start his own company, ESI. Since then Richard has accomplished a lot with several other patents for medical devices for treating Aneurysms, and received the Technology of the year award from the Silicon Prairie Technology Association.

The presentation was inspiring for the STEM2 group and shows what can be accomplished in taking the risk of using science, technology, engineering and mathematics in pursuit of one's dream of owning your own company.

The word "stent" is a word used commonly in medicine. It comes from a proper name. Charles Stent invented a device for use in dentistry for creating structure. So any device implanted in the body that becomes embedded in the body tends to be called a "stent."

Rick has a laboratory near the Kansas University Medical in a building owned by Kansas University at 38th and Cambridge. Cambridge is one block west of Stateline road. His laboratory is in the basement level and is accessible from a parking lot located to the south of the building.

57.2 Thermoacoustic Oscillator, Charlie Mentasana

Written by Charlie Mentasana Friday, 15 June 2007 The attached picture is the thermoacoustic oscillator that I demonstrated a couple of meeting ago. Also, Bob Kessler sent me a web reference to some really interesting new work going on at the University of Utah. You can check it out at: <http://www.sciencedaily.com/releases/2007/06/070603225026.htm>.

58 MEETING NOTES 2/21/07

Written by Jim Emery Saturday, 24 February 2007 STEM squared notes. The meeting of February 21 was held up, levitated so to speak, by buoyant conversation, in the spirit of Archimedes. The Trailside Center, located beside both the Oregon and Santa Fe trails, with walls decorated with beautiful artwork, where 30 feet to the side of the main room, lay a bank vault visible from the main room, the walls again full with art, depicting historical scenes related to the Battle of Westport. The great Italian artist Asterio Pascolini (<http://rendezvousstyle.com/artists/pascolini/pascolini.shtml>), a retired Hallmark man, who is the one who created much of this art work, made an appearance, late, and presented a video on the Smart Board, of the crazy traffic of Florence, with speeding motorcycles, cars, buses, bicycles, and runners, avoiding fatal collisions by an eyelash. This all recorded viewed from some elevated position. When a recognizable scene from Florence appeared, these world travelers, commented, and spun anecdotes about when they were in Florence and when they viewed these places. This meeting was not quite as heavily attended as our last meeting, apparently many people, being hung over from the previous nights Mardi Gras (Tuesday Fat) celebration. Present in approximate order of appearance, were Bob Kessler, Bob Williams, Maurice Smith, Charley Mentasana, Scot Yerganian, Jim Emery, Leon Dixon, and Steve Brooks. None were wearing strings of Mardi Gras Beads. Several did not make the meeting because they were out of town, or had guests to entertain. Mark Pressly was the most out of town, being in New Zealand, working on some big deal. Again at this meeting, Amir Bagatelle did not appear, but no one seemed to give it much significance. Toward the middle of the meeting, Descartes made a spiritual appearance. Maurice talked to him about the fact that they both had spent time in the Boy Scouts. Maurice asked

Descartes, What were your thoughts, when you were tying a sheepshank. Descartes answered, I think knot, and then disappeared. Charley Montesana gave a demonstration of his experimental Sondhaus tube. This is, a closed metal tube, with electrical heating bands, and a glass partial barrier. In this device the heating bands heat the air and cause a pressure, which because of the barrier, produce a rather sharp pressure gradient. Charley worked on this in graduate school. Charley threw the switch, and squirted a little water into the end of the tube as stimulation. It gave out a long sustained moan, the heat energy being converted into audio energy. Charley gave an explanation, and drew some diagrams on the Smart Board. This generated much comment about feedback, energy conversion, pressures in organ pipes, and an interesting tutorial by Maurice Smith on the construction and properties of organ pipes. To organize, is to literally lay out your pipes on the floor in order. There is some current research, on an environmentally friendly energy-converting device based on the Sondhaus tube, sponsored by Ben and Jerry ice cream Company. Lord Rayleigh first discussed the Sondhaus tube in the nineteenth century. If audio energy created by crowd applause could be used to power a Sondhaus refrigerator, then perhaps theaters would not only be entertaining, but also very cool. Charley has a contract to work with Scot Yerganian on one of Scots piezo electric devices at Honeywell. Maurice talked about his pending trip to Antarctica and a global warming experiment. With the permission of the ships captain, which has been granted, he will suspend a temperature-measuring device from a line into the water and so will chart the sea temperature, on the way to Antarctica. Garmin is willing to contribute an accurate GPS device to determine the location of the measurements. Maurice asks us for suggestions on how to compensate for depth and how to improve accuracy. Maurice also showed some interesting maps of Antarctica, and showed us the granite cubit that he has had made. Steve Brooks has a forearm, where the distance from elbow to fingertips matched the cubit. Most of us fell short. This cubit has hieroglyphics carved and colored by Kansas City sculptor Anita Shikles, her web site is <http://www.shiklesfineartcreations.com/>. A future project is to carve an accurate copy of the Rosetta stone from a digital image of a rubbing made by the Napoleon expedition to Egypt. The Napoleon scientific expedition to Egypt is the subject of a current display at the Linda Hall library. I did not get to my presentation on Relativity theory. Bob Kessler had a presentation on some books, one book was the C.P. Snow book, *The Two Cultures*,

which Bob believes is quite relevant to current Kansas City politics. There are some free 2D CAD programs that may be downloaded. One is called free2Design and is being used extensively by the Chinese. The website for free2Design uses Joomla, like our website. Another one is from Unigraphics, called Solid Edge 2d Drafting. These companies want to sell their 3d packages. We talked some, about our web site. For those interested in word origins, there are copies of the old NPR programs made by the poet John Ciardi at the National Public Radio WEB site.

<http://www.npr.org/templates/story/story.php?storyId=4986368>

Perhaps I should put these notes in our stem2 wiki. Then readers could access our site

<http://www.stem2.org/>

to make additions, or correct the lies.

A Sondhaus Reference:

Author: Alex Cargill

Published: October 1988

Page(s): 15

Article Type: Physics in Action

Full text (PDF, 2,364K)

Article Summary Thermoacoustic phenomena, involving the generation of sound by fluctuating heat addition have been studied for over two centuries. They are most familiar in the form of such laboratory devices as the Sondhaus tube and the Rijke tube and in the destructive instabilities that can occur in combustion systems. Now, Albert Migliori and Greg Swift at the Los Alamos National Laboratory in New Mexico have put these phenomena to practical use in a novel thermoacoustic engine (Appl. Phys. Lett. 1988 53 355).

Last Updated (Sunday, 11 March 2007)

58.1 Maglev Trains, Ambrose Wolf

Ambrose Wolf gave a talk on the technology of magnetic levitation trains and proposed a project to promote such a system in the United States. A route from Kansas City to St Louis, and a route from Kansas City to Minneapolis would be a natural development.

Transrapid is a German high-speed monorail train using magnetic levitation. Based on a patent from 1934, planning of the Transrapid system started in 1969. The test facility for the system in Emsland, Germany was completed

in 1987. In 1991 the technical readiness for application was approved by the Deutsche Bundesbahn in cooperation with renowned universities.[citations needed]

In 2004, the first commercial implementation was completed. The Shanghai Maglev Train connects the rapid transit network 30.5 km (19.0 mi) to the Shanghai Pudong International Airport. The Transrapid system has not yet been deployed on a long-distance intercity line.

The system is developed and marketed by Transrapid International, a joint venture of Siemens AG and ThyssenKrupp AG. Critical voices, such as Sir Rod Eddington [1] refer to recent developments of railway and other competing technologies and draw parallels between Transrapid and previous high technology hypes without broad market impact outside niche applications.

See also: Technology in the Magnetic levitation train article. The synchronous longstator linear motor of the Transrapid maglev system is used both for propulsion and braking. It functions like a rotating electric motor whose stator is cut open and stretched lengthways along the underside of the guideway. Inside the motor windings, alternating current generates a magnetic traveling field which moves the vehicle without contact. The support magnets in the vehicle function as the excitation portion (rotor). The respective magnetic traveling field works in only one direction, and therefore makes moving train collisions less likely; if there were several trains on the track section, they would travel in the same direction.

The superspeed maglev system has no wheels, axles, transmissions, or pantographs. It does not roll, it hovers. Electronic systems guarantee that the clearance remains constant (nominally 10 mm). The Transrapid requires less power to hover than is used by its air conditioning equipment. The levitation system and all on board electronics are supplied by the power recovered from harmonic oscillations of magnetic field of the tracks linear stator (those oscillations being parasitic cannot be used for propulsion) at speeds above 80 km/h, while at lower speeds power is obtained through physical connections to the track. In case of power failure of the tracks propulsion system, the Transrapid car can use on-board backup batteries to power the levitation system.

This information comes from a wikipedia article on magnetic levitation trains.

For more see:

<http://stem2.org/je/transrapid.pdf>

58.2 Forums Are Working

Written by Steve Brooks Thursday, 04 January 2007 I have replaced the Forums from phpBB to Fireboard which is better integrated with Joomla. So, the Forums are working good now. They understand the user login without patching Joomla or phpBB.

The Forums are now mostly working. There seems to be a problem with the style sheet on the front page.

The Forums are currently broken. I tried upgrading to the latest phpBB and this broke the Joomla php bridge component. I will have to restore the back up version.

Sorry for the inconvenience.

Last Updated (Sunday, 19 August 2007)

58.3 LaTeX

LaTeX Written by Jim Emery Wednesday, 22 November 2006 Latex commands can be used on this website. For example:

Mathematical things: $\pi, i, e, -1$ can all be combined in a single formula:

$$e^{\pi i} = -1.$$

For a tutorial on LaTeX, access the document called, "Getting Started With LaTeX"

Click the following link :

<http://stem2.org/je/GSWLaTeX.pdf>

Last Updated (Friday, 21 March 2008)

58.4 TeX Formulas

Written by Jim Emery Wednesday, 22 November 2006

$$\pi = \frac{\prod_{n=1}^{\infty} (1 + \frac{1}{4n^2-1})}{\sum_{n=1}^{\infty} \frac{1}{4n^2-1}}.$$

$$f(x) = \int_{-\infty}^x e^{-t^2} dt.$$

$$e^{\pi i} = -1.$$

Last Updated (Wednesday, 29 November 2006

58.5 Book Review: Female Brain

Book Review Written by Bob Kessler Wednesday, 22 November 2006 The Female Brain by Louann Brizendine About This Book Synopses and Reviews Read an Excerpt Comment on this title and you could win free books! More Books by Louann Brizendine ISBN: 0767920090 All Product Details

Available at: Beaverton, Burnside, Quimby Warehouse, Technical Synopses and Reviews Publisher Comments:

It's not as if we all start out with the same brain structure. They are different by nature. Think about this. What if the communication center is bigger in one brain than the other? What if the emotional memory center is bigger in one brain than the other? What if one brain develops a greater ability to read cues in people than another? In this case, you would have a person whose reality dictated that communication, connection, emotional sensitivity, and responsiveness were the primary values. This person would prize these qualities above all others and be baffled by another person with a brain that didn't grasp the importance of these qualities. In essence, you would have someone with a female brain. from Chapter 1, "What Makes Us Women" Every brain begins as a female brain. It only becomes male eight weeks after conception, when excess testosterone shrinks the communications center, reduces the hearing cortex, and makes the part of the brain that processes sex twice as large.

Louann Brizendine, M.D. is a pioneering neuropsychiatrist who brings together the latest findings to show how the unique structure of the female brain determines how women think, what they value, how they communicate, and who they'll love. Brizendine reveals the neurological explanations behind why

A woman uses about 20,000 words per day while a man uses about 7,000 A woman remembers fights that a man insists never happened A teen girl is so obsessed with her looks and talking on the phone Thoughts about sex enter a woman's brain once every couple of days but enter a man's brain about once every minute A woman knows what people are feeling, while a man can't spot an emotion unless somebody cries or threatens bodily harm A

woman over 50 is more likely to initiate divorce than a man Women will come away from this book knowing that they have a lean, mean communicating machine. Men will develop a serious case of brain envy.

Review: "This comprehensive new look at the hormonal roller coaster that rules women's lives down to the cellular level, 'a user's guide to new research about the female brain and the neurobehavioral systems that make us women,' offers a trove of information, as well as some stunning insights. Though referenced like a work of research, Brizedine's writing style is fully accessible. Brizendine provides a fascinating look at the life cycle of the female brain from birth ('baby girls will connect emotionally in ways that baby boys don't') to birthing ('Motherhood changes you because it literally alters a woman's brain-structurally, functionally, and in many ways, irreversibly') to menopause (when 'the female brain is nowhere near ready to retire') and beyond. At the same time, Brizedine is not above reviewing the basics: 'We may think we're a lot more sophisticated than Fred or Wilma Flintstone, but our basic mental outlook and equipment are the same.' While this book will be of interest to anyone who wonders why men and women are so different, it will be particularly useful for women and parents of girls." Publishers Weekly (Copyright Reed Business Information, Inc.) Review: "Finally, a satisfying answer to Freud's question, 'What does a woman want?' Louann Brizendine has done a great favor for every man who wants to understand the puzzling women in his life. A breezy and enlightening guide to women and a must-read for men." Daniel Goleman, author of Social Intelligence Review: "Sassy, witty, reassuring, and great fun. All women and the men who love them should read this book." Christiane Northrup, M.D., author of The Wisdom of Menopause Review: "An eye-opening account of the biological foundations of human behavior. Destined to become a classic in the field of gender studies." Marilyn Yalom, author of A History of the Breast Review: "The author's greatest gift to her readers is the way she takes us through the stages of a woman's life to show the influence of hormone levels on every decision. It's not just a matter of biology...but also of how biology affects perception and our ability to function." Los Angeles Times Review: "Brizendine brazenly promotes politically incorrect concepts." St. Petersburg Times Book News Annotation: In response to an observed need for information on the female mind, Brizendine (neuropsychiatry, U. of California, San Francisco) established the first clinic in the US to study women's brain structure, function and mood. This volume combines two decades of Brizendine's neu-

robiological research, real-life stories from her clinical practice, and all the latest information from the scientific community to provide a comprehensive look at the unique mechanics of the female brain. Annotation 2006 Book News, Inc., Portland, OR (booknews.com) Synopsis: Every brain begins as a female brain. It only becomes male eight weeks after conception, when excess testosterone shrinks the communications center, reduces the hearing cortex, and makes the part of the brain that processes sex twice as large.

Louann Brizendine, M.D. is a pioneering neuropsychiatrist who brings together the latest findings to show how the unique structure of the female brain determines how women think, what they value, how they communicate, and whom theyll love. Brizendine reveals the neurological explanations behind why

58.6 Physics Constants

Written by Jim Emery Tuesday, 14 November 2006

Picture

Click Here For Physics Constants:

<http://physics.nist.gov/cuu/Constants/index.html>

$$f(x) = \int_{-\infty}^x e^{-t^2} dt$$

Last Updated (Sunday, 19 August 2007)

58.7 Pictures of Sundials etc.

Pictures Written by Jim Emery Friday, 10 November 2006 There are some pictures loaded at this address.

<http://stem2.org/je/pictures.htm>

Last Updated (Friday, 10 November 2006)

58.8 Documents

Downloads Written by Jim Emery Thursday, 09 November 2006 Documents

<http://stem2.org/je/documents.htm>

Sundial Pictures: <http://stem2.org/je/pictures.htm>

Last Updated (Friday, 16 May 2008)

58.9 Web site

Written by Jim Emery Wednesday, 08 November 2006 My WEB site was <http://www.planetkc.com/jemery1/> but now is <http://www.geocities.com/jdemery1/>

The Equation of Time Javascript program is there, as well as some PDFs.

Jim Emery

Last Updated (Thursday, 09 November 2006)

59 MEETING NOTES, 11/6/2006

Nov 6 Meeting Highlights Written by Steve Brooks Monday, 06 November 2006 We had eight attendees. It was a good meeting

Those attending: Steve Prewitt, Jim Emery, Bob Kessler, Bob Williams, Leon Dixon, Ambrose Wolf, Noel Christensen, Steve Brooks,

Last Updated (Thursday, 16 November 2006)

59.1 Trialside Center

Written by Bob Kessler Thursday, 26 October 2006 The Trailside Center at 9901 Holmes is a Kansas City, Missouri owned facility that is presently being leased by The Historical Society of New Santa Fe. The lease arrangement encourages the use by non-profit organizations involved with the community. The Center School District is one of those organizations that has supported and used the facility, as well as the Blue River Watershed Association, for STEM related purposes.

Last Updated (Sunday, 12 November 2006)

59.2 Welcome to STEM2

Welcome to STEM2 Written by Web Master Saturday, 12 June 2004 STEM2 is a community that promotes Science, Technology, Engineering, and Mathematics.

STEM2 Objective: Promotes Science, Technology, Engineering, and Mathematics Community Organization: Champions: Jim Emery and Bob Kessler. This site and the STEM2 group are still being formed. Come back to this site and see how we progress.

Last Updated (Sunday, 19 August 2007)