

STEM Society Meeting, April 10, 2012

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1 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. The start time is 6PM. 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:

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

Direct to the documents list:

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

Direct to the archive file:

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

2 The April Meeting Announcement

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 Montesana: 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.

3 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).

4 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 spectroscopy would be to look at 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 fluorescent light excites the white fluorescent material and produces white light, and not the gas spectrum. It is not at all clear that this crude spectroscopy 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 camera 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 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.

6 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.