Physics 106 – Mini-Lab
Distance to the Moon

(See http://www.physics.rutgers.edu/ugrad/106/labs.html for lab write-up guidelines.)

This lab does not require you to go to the MSLC.

Part 1. Go outside on a night when the moon is out, and bring with you a variety of small spherical or cylindrical objects: a dime, a pencil, some chopsticks, a pea, or whatever. Hold these objects up to the moon at arm’s length, and pick the one whose diameter is closest in size to the apparent diameter of the full moon. (It is hard to do this exactly, because your eye can’t focus on both simultaneously, but just do the best you can.)

Go home and measure as best you can the diameter, in fractions of an inch, of the object that was the best fit. Also, measure your arms-length distance (the distance from your eye to your outstretched hand); have a friend with a tape measure or yardstick help you if necessary.

Part 2. Now we need an estimate of the diameter of the moon. On the reverse side of this page you will find a series of photographs of the moon during a lunar eclipse; on one of these I have drawn a circle indicating the size of the shadow, which is also the size of the earth. Measure and determine the ratio of the diameter of the earth to the diameter of the moon.

Now, there are 24 time zones on earth, and each extends for about 1,000 mi, so the circumference of the earth is about 24,000 mi. Put this together with what you obtained above to estimate the diameter of the moon.

Part 3. Estimate the distance to the moon using the ratio formula

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\frac{\text{Distance to the moon (in miles)}}{\text{Diameter of the moon (in miles)}} = \frac{\text{Arms-length distance (in inches)}}{\text{Diameter of small object (in inches)}}
\]

Please explain why this ratio makes sense; draw a sketch in your lab notebook if it helps.

Solve for the distance to the moon.

How long would it take you to go to the moon, driving steadily at 100 mph, if you could drive through space?

Don’t forget to record your measurements, calculations, results, and observations in your notebook.
Total Lunar Eclipse of 2004 Oct 28 (Dunkirk, MD)
AstroPhysics 105mm Refractor + Nikon D100: ISO 400, f/12
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