



AU AstroNews

The Newsletter of the Astronomical Unit

December 2014

Sponsored by the Santa Barbara Museum of Natural History



Martin Meza eyes the conditions at Los Prietos for solar viewing. Photo: T. Totton.

OUR DECEMBER SPEAKER

Our speaker for the December meeting will be Philip Lubin, professor of Physics at UC Santa Barbara whose primary research has been focused on studies of the early universe in the millimeter wavelength bands. His group has designed, developed and fielded more than two dozen ground based and balloon borne missions and helped develop two major cosmology satellites.

This evening, however, Dr. Lubin will talk about his work on DE-STAR. A short summary follows: "Our planet is bombarded daily by about 100 metric tons of asteroid and meteoritic debris which normally burns up harmlessly in the upper atmosphere. Occasionally we are hit by an object large enough to penetrate to low enough altitudes to do significant harm as we saw last year in Russia. Historically such events have played a large role in the evolution and extinction of a number of species. It is inevitable that large-scale destruction will occur again if nothing is done to mitigate it. The consequences of doing nothing are extremely dangerous over long periods of time. Yet even over the span of a human lifetime an event with energy deposition comparable to that of strategic nuclear weapons is not atypical. I will discuss the threat as well as possibilities for using directed energy as a possible means of both a medium and long term mitigation strategy. The same type of system is capable of a number of other uses, beyond including

planetary defense, such as space debris removal, photon driven propulsion allowing relativistic probes and interstellar and intergalactic communications and beacons as well as SETI searches for comparably advanced civilizations. Recent developments in photonics allow such a system whereas even a decade ago it would have been simply science fiction. While a very difficult engineering challenge, no technical miracles need be invoked (except for funding). The generic system is called DE-STAR for Directed Energy Solar Targeting of Asteroids and exPloRation."

OUTREACH SUMMARY

Since the last newsletter, AU outreaches Chatt Aiton, Andy Allen, Peter Angeloff, Angela Bates, Marciano Chan, Adrian Conrad, Krissie Cook, Tim Crawford, Danny Doyle, Joe Doyle, Mike Farris, Ruben Gutierrez, Art Harris, Jürgen Hilmer, Ken Kihlstrom, Chris Larson, Adrian Lopez, Zanna Lucy, Pat & Chuck McPartlin, Janet & Martin Meza, Bonnie & Bruce Murdock, Max Neufeldt, Edgar Ocampo, Maureen O'Rourke, Javier Rivera, David Salvia, Curry Sawyer, Tom Totton, Chris Ulivo, John West, Barry White, Tom Whittemore, Jerry Wilson, Paul Winn, and Linda & Harold Yarbrough showed the night sky to **1783 happy viewers**.

OUTREACH FOR DECEMBER

Here are the AU events scheduled so far for December. Remember, events are subject to change, so to get the latest information on schedules, or directions, just contact Chuck at 964 - 8201 or macpuzl@west.net

WEDNESDAY, DECEMBER 3, SETUP 5 PM

Telescopes for Science Night at Adams Elementary School, at 2701 Las Positas Road in Santa Barbara. We set up on their playground, with access through their main parking lot, next to the auditorium. Pizza from 5 to 6, for those so inclined.

FRIDAY, DECEMBER 5, 7 PM

Monthly AU meeting in Farrand Hall at SBMNH. Elections and a talk by Phil Lubin about his work on the DE-STAR program.

SATURDAY, DECEMBER 6, SETUP 5 PM

Telescopes for Bacara Resort and Spa. We set up on their Miró Lawn.

THURSDAY, DECEMBER 11, GATHER AT 6 PM

Annual AU Holiday Party at Mulligan's, at the Municipal Golf Course, 3500 McCaw Avenue.

SATURDAY, DECEMBER 13, 5 PM

AU planning meeting, in the classroom next to Javier's office.

SATURDAY, DECEMBER 13, 7 PM

Monthly Public Star Party at SBMNH. Bring a scope and have fun showing goodies in the sky outside Palmer Observatory, or just show up and enjoy looking at them. Maybe we'll see some Geminid meteors.

TUESDAY, DECEMBER 16, SETUP 6 PM

Telescopes and slide show for Santa Barbara Junior High School. We set up behind Marjorie Luke Theater on the campus, and get in via the gate on the East Ortega and North Quarantina intersection.

FRIDAY, DECEMBER 19, 7 PM

Monthly Public Telescope Night at Westmont College, at the observatory, next to the baseball field.

SUNDAY, DECEMBER 21, 3:03 AM – Winter!

TUESDAY, DECEMBER 23, SETUP 7 PM

Telescope Tuesday at Camino Real Marketplace in Goleta. We set up in the plaza next to the theater, under the Christmas tree.

SATURDAY, DECEMBER 27, SETUP 5 PM

Telescopes for Bacara Resort and Spa. We set up on their Miró Lawn.

From the Workshop

Tim Crawford

In 1851, Leon Foucault demonstrated an experiment that, surprisingly, no great minds before that time had considered. He proved the Earth rotates on its axis. It sounds so simple to us - so taken for

granted. No one today should be amazed by this, right? Yet the brilliant trio of Copernicus, Galileo, and Newton never proved that the Earth spins!

Consider Giordano Bruno, who in 1600, was brought before the Inquisition for one of his beliefs. He suggested that the Earth rotates. For this he was tied to an iron spike and burned alive. Within a decade Galileo was brought before the same Inquisition but spared the same end because he renounced similar views. He was ordered to home confinement where he promised never to release his writings. This threat would break him: he later succumbed to the opinions of the Inquisition. I don't know, but maybe hearing of Galileo's confinement made people curious. Maybe they wanted to hear more. To me it seems that more and more people held the belief that the Earth must turn about its axis. Yet no one crafted an experiment to prove it. The same year Galileo died, 1642, another great mind was born on Christmas day - Isaac Newton. Even though he brought many brilliant achievements to mankind's use, Newton also could not solve the elusive proof that the Earth turns.

Leon Foucault's story starts in the basement of his mother's house in Paris in 1851, where he carefully suspended a weighted orb from a wire. The idea was to release this ball without exerting any outside influence on it. It had to swing absolutely free from its pivot overhead. Foucault describes his pendulum experiment of 1851: "The phenomenon develops calmly, but is inevitable, unstoppable. One feels, one sees it born and grow steadily; and it is not in one's power to either hasten it or slow it down. Any person, brought into the presence of this fact, stops for a few moments and remains pensive and silent; and then generally leaves, carrying with him forever a sharper, keener sense of our incessant motion through space."

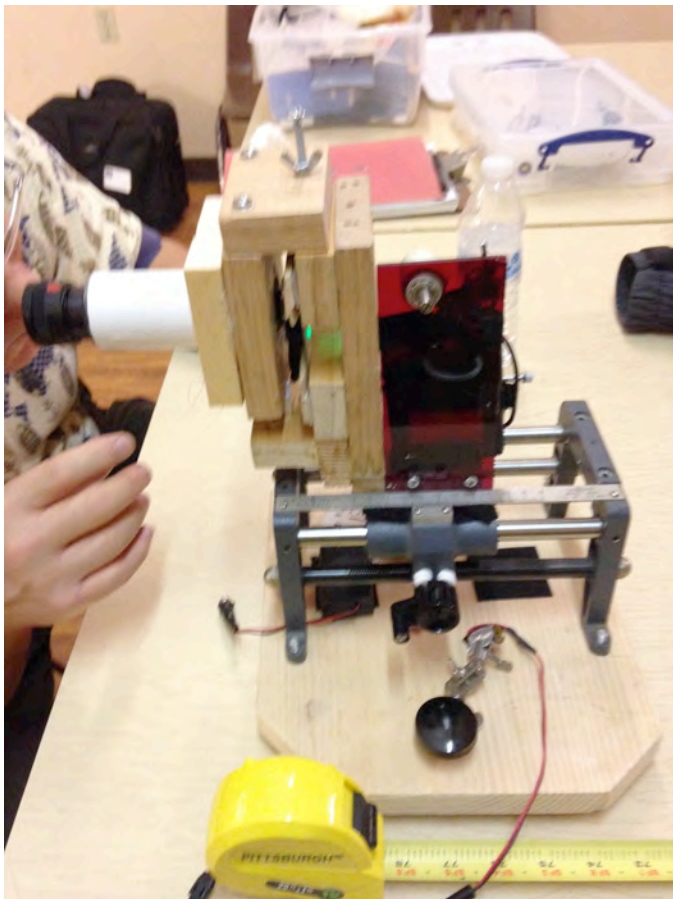
Foucault's pendulum swings on the end of a wire and changes its position over stationary marks under it. The Earth literally turns under the pendulum!

More amazing to me is the proof that this phenomenon also depends on latitude. At the North Pole, his pendulum will make one full turn in a 24 hour period. But at our latitude of 34 degrees, it makes a full turn in over 45 hours. This time, the period, is a function of the sine of the

experimenter's latitude. Mathematically,

$$T = \frac{24\text{Hours}}{\sin(\text{latitude})}$$
 So, if you try the experiment at the equator where the latitude is zero degrees, the period becomes infinite. In essence, the pendulum bob does not move!

Leon Foucault was shunned by the academics of his time since he was not a formally educated man. His brilliance was later recognized and he was brought into academic circles. He had other achievements along with his well-known "pendulum" experiment. One that is particularly dear to me is his knife-edge test – a test we use on our mirrors when we meet at the mirror-making workshop! My most recent article focused on the Ronchi Test – a qualitative test for a mirror on its way to diffraction-limited precision. In my next article I will fill in some of the details of Foucault's Knife-edge Test – a quantitative test that will render a good mirror into an excellent mirror which will yield many fine views of the cosmos!



Mike Chibnik uses Leon Foucault's Knife-edge Test at a mirror-making workshop. Photo: Tim Crawford.

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| AU annual membership rates: Single = \$15 Family = \$25 | | |
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December 2014

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|------------------------------------|--------|---|---------------------------------|---|----------------------------------|---|
| | 1 | 2 | 3 ADAMS ELEMENTARY 5PM | 4 | 5 SBAU MEETING 7PM | 6 BACARA RESORT 5PM |
| 7 | 8 | 9 | 10 | 11 HOLIDAY PARTY 6PM MULLIGAN'S | 12 | 13 SBMNH PLANNING MEETING 5PM STAR PARTY 7PM |
| 14 | 15 | 16 SB JUNIOR HIGH 6PM | 17 | 18 | 19 WESTMONT COLLEGE 7PM | 20 |
| 21 WINTER SOLSTICE 3:03AM | 22 | 23 CAMINO REAL MARKETPLACE 7PM | 24 | 25 | 26 | 27 BACARA RESORT 5PM |
| 28 | 29 | 30 | 31 | | | |

The Astronomical Unit

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