



# AU AstroNews

## The Newsletter of the Astronomical Unit

November 2014

Sponsored by the Santa Barbara Museum of Natural History



*The Moon in silhouette at Westmont. Photo: Tim Crawford.*

### OUR NOVEMBER SPEAKER

Our speaker for the November meeting will be Laura Faye Tenenbaum, Communication Specialist for NASA JPL. The title of her presentation will be: "Earth Right Now: NASA's Big Missions to Our Home Planet" A short summary of her talk follows.

“Of all the planets NASA has explored, none yet have matched the dynamic complexity of our own Earth. Earth teems with life and liquid water; massive storms rage over land and oceans; environments range from deserts to tropical forests to the icy poles. And amid all of that, seven billion people carve out a daily life. And our planet is changing. Through the gradual build-up of more greenhouse gases in the atmosphere, Earth is warming. As Earth warms, ocean waters expand and ice melts to make sea levels rise. The cycle of rainfall and evaporation accelerates, leading to more severe droughts and more severe bouts of rainfall. Heat waves become more frequent and more intense.

Since the agency's inception in 1958, NASA has established itself as a world leader in Earth science and climate studies. NASA continues to explore this changing world so that societies can meet the challenges of the future.

With the launch of five Earth-observing missions in 2014 – more Earth-focused launches in a single year in more than a decade – NASA will be able to deliver even more crucial data to scientists trying to understand our changing planet.”

### OUTREACH SUMMARY

Since the last newsletter, AU outreaches Peter Angeloff, Angela Bates, Adrian Conrad, Tim Crawford, Ruben Gutierrez, Art Harris, Jürgen Hilmer, Sean Kelly, Ken Kihlstrom, Chris Larson, Adrian Lopez, Zanna Lucy, Pat & Chuck McPartlin, Janet & Martin Meza, Bonnie & Bruce Murdock, Max Neufeldt, Edgar Ocampo, Bob Richard, Javier Rivera, Mike Sommermann, Colin Taylor, Stephen Taylor, Tom Totton, Dick Tracey, John West, Tom Whittimore, Jerry Wilson, and Linda & Harold Yarbrough showed the night sky to 1466 astro-tourists.

### OUTREACH FOR NOVEMBER

Here are the AU events scheduled so far for November. 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](mailto:macpuzl@west.net)

*We have two school events on the night of November 6, so we'll need some extra volunteers. Please let Chuck know if you can come help out.*

### SATURDAY, NOVEMBER 1, SETUP 6 PM

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

**MONDAY, NOVEMBER 3, SETUP 5:30 PM**

Telescopes for Science Night at Coastline Christian Academy, on Cathedral Oaks at the NE side of the intersection with Fairview.

**TUESDAY, NOVEMBER 4, SETUP 7 PM**

Telescopes for an astronomy night at Midland School, at 5100 Figueroa Mountain Road, past Los Olivos in the Santa Ynez Valley. Dark skies!

**THURSDAY, NOVEMBER 6, SETUP 6 PM**

Telescopes for an Astronomy Night at Peabody Charter School, at 3018 Calle Noguera in Santa Barbara. We set up on their blacktop, with entry at the SW corner of the campus.

**THURSDAY, NOVEMBER 6, SETUP 6 PM**

Telescopes for a Science Night at Foothill School, 711 Ribera Drive in Goleta. We set up on their blacktop, with entry at the NW corner of the campus.

**FRIDAY, NOVEMBER 7, 7 PM**

Monthly meeting in Farrand Hall at SBMNH. Short planetarium show, followed by a talk on "Earth Right Now: NASA's Big Missions to Our Home Planet" by Laura Tenenbaum of NASA/JPL.

**SATURDAY, NOVEMBER 8, 5 PM**

AU Planning Meeting in the classroom outside Javier's office at SBMNH. Come help plan your club's activities.

**SATURDAY, NOVEMBER 8, 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.

**MONDAY, NOVEMBER 10, SETUP 7 PM**

Telescopes for Santa Cruz Dormitory at UCSB. Contact Chuck if you can come, so he can arrange for parking permits.

**FRIDAY, NOVEMBER 14, SETUP 6 PM**

Telescopes for an Astronomy Night at Goleta Public Library, 500 North Fairview Avenue in Goleta. Scopes will be in the back parking lot of the Christian Science place next door.

**FRIDAY, NOVEMBER 21, SETUP 6:30 PM**

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

**TUESDAY, NOVEMBER 25, SETUP 7 PM**

Telescope Tuesday at the Camino Real Marketplace in Goleta. We set up in the plaza by the theater.

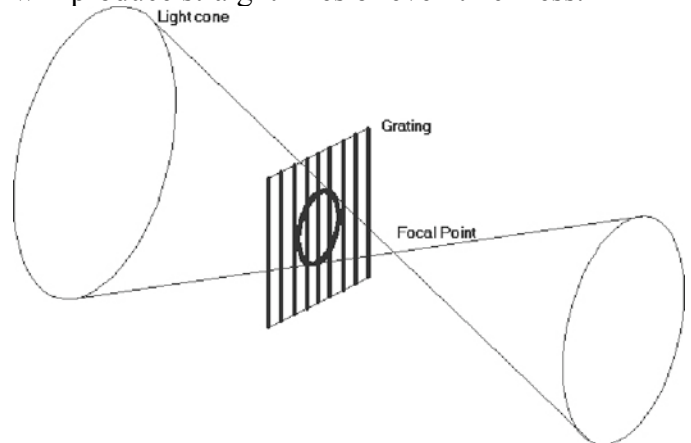
**SATURDAY, NOVEMBER 29, SETUP 6 PM**

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

From the Workshop

*Tim Crawford*

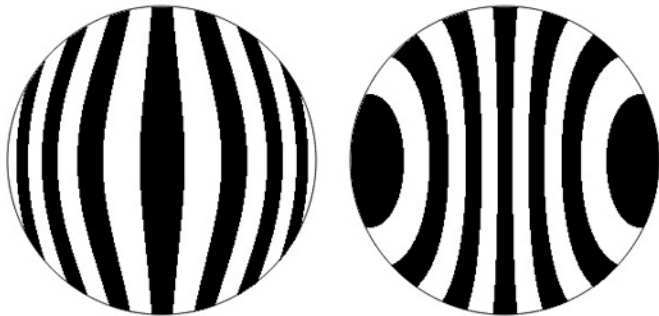
Let's resume with a discussion how to test our mirror. In particular, let's look at the Ronchi test – an inherently qualitative test. On an upright wooden stand we place our polished mirror at a distance  $R$  which is twice the focal length of our mirror. We'll align the mirror center with the light source. To do this we point a red laser through the viewing window (near the light source) to the center of our mirror which sits on our wooden test rack. We adjust the stand so that the returned beam is collimated with the light source. We are ready to test. The Ronchi screen or grating is a glass or acetate substrate with equally-spaced parallel lines. By placing our eye behind the window with the Ronchi screen on the test apparatus we can see silhouetted lines superposed on our mirror. The shapes of the lines tell us the quality of our mirror's surface. A perfectly spherical mirror, for example, will produce straight lines of even thickness.



Pay attention to the image above. It maybe the best and possibly the only thing you need to understand the Ronchi test. Notice the focal point where the light cone converges to a point and then crosses and moves apart again. The closer we are to the center of curvature, the smaller the cone of light and the

fewer lines that are silhouetted onto the mirror through our Ronchi grating. Imagine as we get closer to this focal point and the cone of light narrows to less and thicker lines that are superposed on the mirror's surface. This is exactly what happens in our tests. We can move the stage of our tester towards or away from the mirror on the test stand. At R we may even have one line so large that the whole view is grayed out. When this happens we say that the image is nulled out. But, as we move further away from R more lines appear.

Now, remember that our aim is to figure a mirror to the shape of a paraboloid. This is required since the



light of astronomical objects comes to our mirror from so far away that the beams of light are essentially parallel. If our mirror were shaped as a sphere, the starlight would not come to a common focus. Our mirror must have different radii of curvature to bring this distant (parallel) light to a common focus. This requirement forces a much different pattern on a finished, parabolic mirror. Take a look at the figure above. When the light source is closer to the mirror compared to R we see the figure on the left. On the other hand, if the light source lies on the other side of R, we see the figure to the right. This can be pretty complicated stuff, so there are computer programs which will generate Ronchi diagrams for a variety of focal lengths and focal ratios. They will show the number of lines we choose to show, inside or outside R. If we print out these images and compare them to the silhouettes we see through our tester, we can get very close to our desired paraboloid. This is known as the matching Ronchi test, and it gives a reasonable estimate on a mirror's quality. In some cases, it may qualify as a definitive test, but it is not the only test we use. Ultimately, we would like to have a quantitative test. In our subsequent articles we will discuss one of these tests: the knife-edge or Foucault test. The Foucault Test will become our mirror's definitive test, and we will be able to use

this test to determine the quality of our parabolic mirror to a fraction of a wavelength of light!

Finally, since I love the history of science, I will write an article about Leon Foucault, the inventor of the knife-edge test, who was a genius in his own right. Surprisingly, Foucault was the first to prove that the Earth rotates on its axis by analyzing the motion of a simple pendulum in Paris and South America. Neither Newton or Galileo conceived of this elementary proof of our Earth's rotation.

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**AU AstroNews**, the monthly publication of the **Astronomical Unit (AU)**, is mailed to the AU membership. For publishing consideration for the next month, submit astronomical items by the 20th of the current month!

#### AU annual membership rates:

**Single = \$15 Family = \$25**

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## November 2014

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 BACARA RESORT 6PM
2	3 COASTLINE CHRISTIAN 5:30PM	4 MIDLAND SCHOOL 7PM	5	6 PEABODY 6PM FOOTHILL 6PM	7 SBAU MEETING 7PM	8 SBMNH PLANNING MEETING 5PM STAR PARTY 7PM
9	10 SANTA CRUZ DORM UCSB 7PM	11	12	13	14 GOLETA PUBLIC LIBRARY 6PM	15
16	17	18	19	20	21 WESTMONT COLLEGE 6:30PM	22
23	24	25 CAMINO REAL MARKETPLACE 7PM	26	27	28	29 BACARA RESORT 6PM
30						

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