

The Observer

Upcoming club meeting:
Friday, July 27, 7:00 pm



Our talk for July:

“LIGO Update: Colliding Neutron Stars and More!”

Speaker:

Tim Thompson



Credit: Hubble, Subaru, Composition & Copyright: R. Gendler

INSIDE THIS ISSUE

Jupiter: 79 moons—so far!
A source for cosmic rays
DAWN, Ceres and more...

OUR MEETING SITE

Wildwood School
11811 Olympic Blvd.
Los Angeles, CA 90064
Free parking:
Garage, SE corner of
Mississippi & Westgate.

PICTURE AT LEFT:

Artists conception of a collision between two neutron stars—detected in gravitational waves by LIGO, and picked up in ‘ordinary’ light by telescopes around the globe.

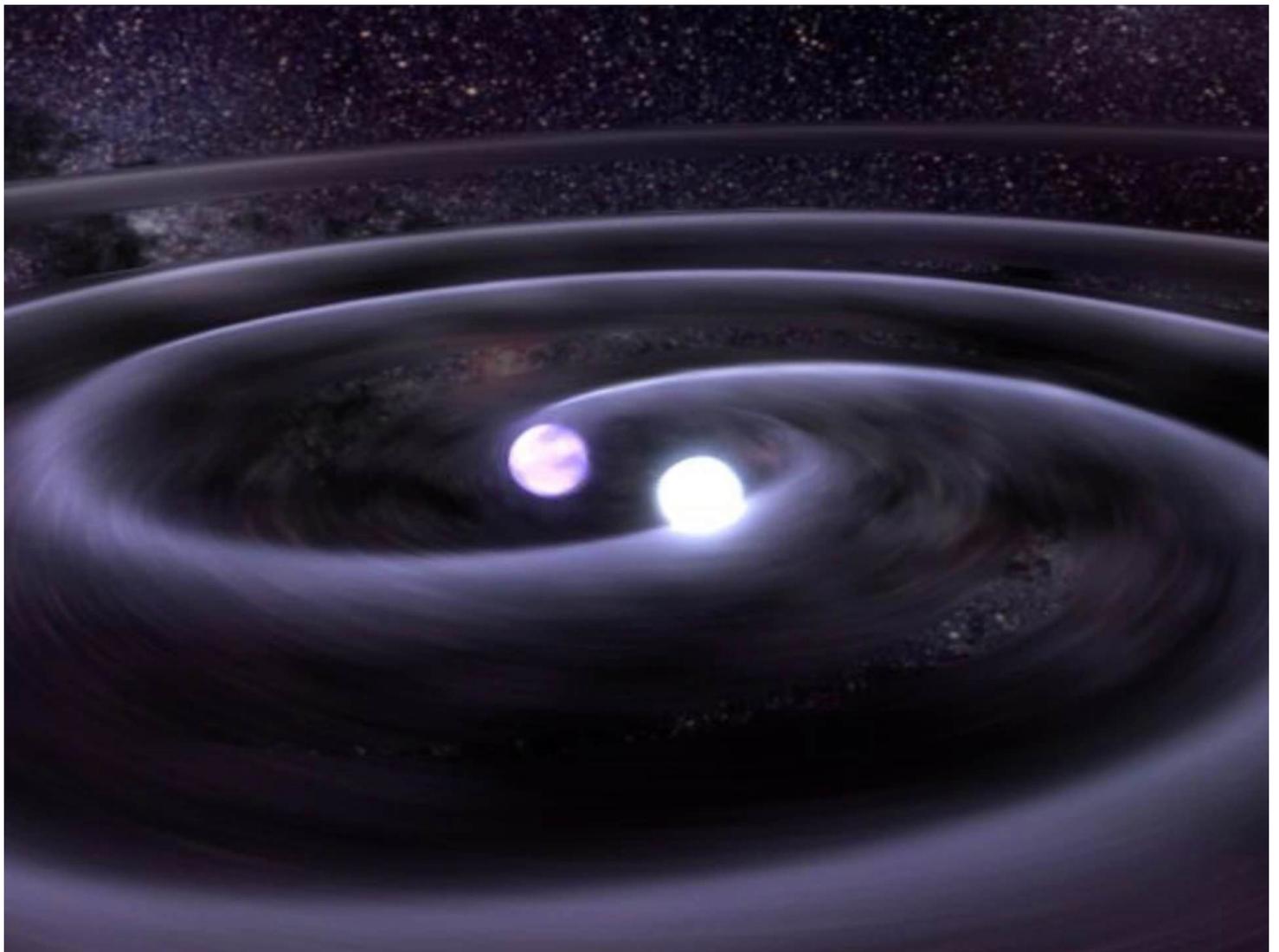


When and where did the elements arise? We know that hydrogen and helium were forged in the first 20 minutes of the expanding Big Bang “fireball”? Others form in supernova explosions, and giant stars. But LIGO has pointed the way to another source: Colliding neutron stars. These exotic, rare events may play a role in nucleosynthesis far beyond what their relative numbers would suggest. Learn more at our July meeting!

July talk: LIGO Update: Colliding Neutron Stars and More!

Tim Thompson, a longtime favorite speaker to our club, will give us an update on LIGO, a subject he introduced in a previous talk. LIGO, the gravitational wave observatory famous for its discovery of colliding black holes, has since found a neutron star collision, which yielded a bonanza of information, as the visual signal was also detected. (You may remember that our club was one of the first groups to hear about this, as we had a Carnegie Observatories speaker just when their Swope Telescope in Chile became the first to see the visual signal.)

Tim worked on infrared astronomy and planetary atmospherics at JPL, and has played a major role in outreach at Mt. Wilson Observatory, as well as with half a dozen other organizations in Southern California. He has won several awards for his work in bringing astronomy to the public.



July/August Events

→Events may change. Please double-check all events before attending!

Friday, July 27, 2018, 7 pm

Santa Monica Astronomy Club meeting

“LIGO Update: Colliding Neutron Stars and More!”

Wildwood School

Free

See: Samoastronomy.org

Sunday, August 5, 2018, 3 pm and 5 pm performances

Mt. Wilson Observatory, 100” Dome

Concert: The Lyrus Quartet

Works by Haydn, Tanguy, Hertzberg and Johnston

\$50 (fundraiser) See: mtwilson.edu

Thursday, August 9, 2018, 7pm

JPL Von Karman Talk: The Spitzer Infrared Telescope

The von Kármán Auditorium at JPL

4800 Oak Grove Drive, Pasadena, CA

Free

See: jpl.nasa.gov

Friday, August 10, 2018, 7pm

JPL Von Karman Talk: The Spitzer Infrared Telescope

Caltech’s Ramo Auditorium, 1200 E California Blvd. Pasadena, CA*

Free

See: jpl.nasa.gov

**Note the change of venue! The second night talk used to be at PCC.*

From now on, it will be at Caltech’s Ramo Auditorium.

This is on the same quad as Beckman Auditorium—see maps for details.

Sunday/Monday, August 12/13, 2018

Sky event: Perseid Meteor Shower

Peaks in the evening of the 12th, morning of the 13th—and with outstanding, new moon conditions!

Tuesday, August 14, 2018, 10:33 PM

RECON Event: Occultation with Pluto (We are within 200 km of the expected event)

Wildwood School

Sunday, August 26, 2018, 2:30 pm

Collection of Meteorites from Antarctic Ice Fields

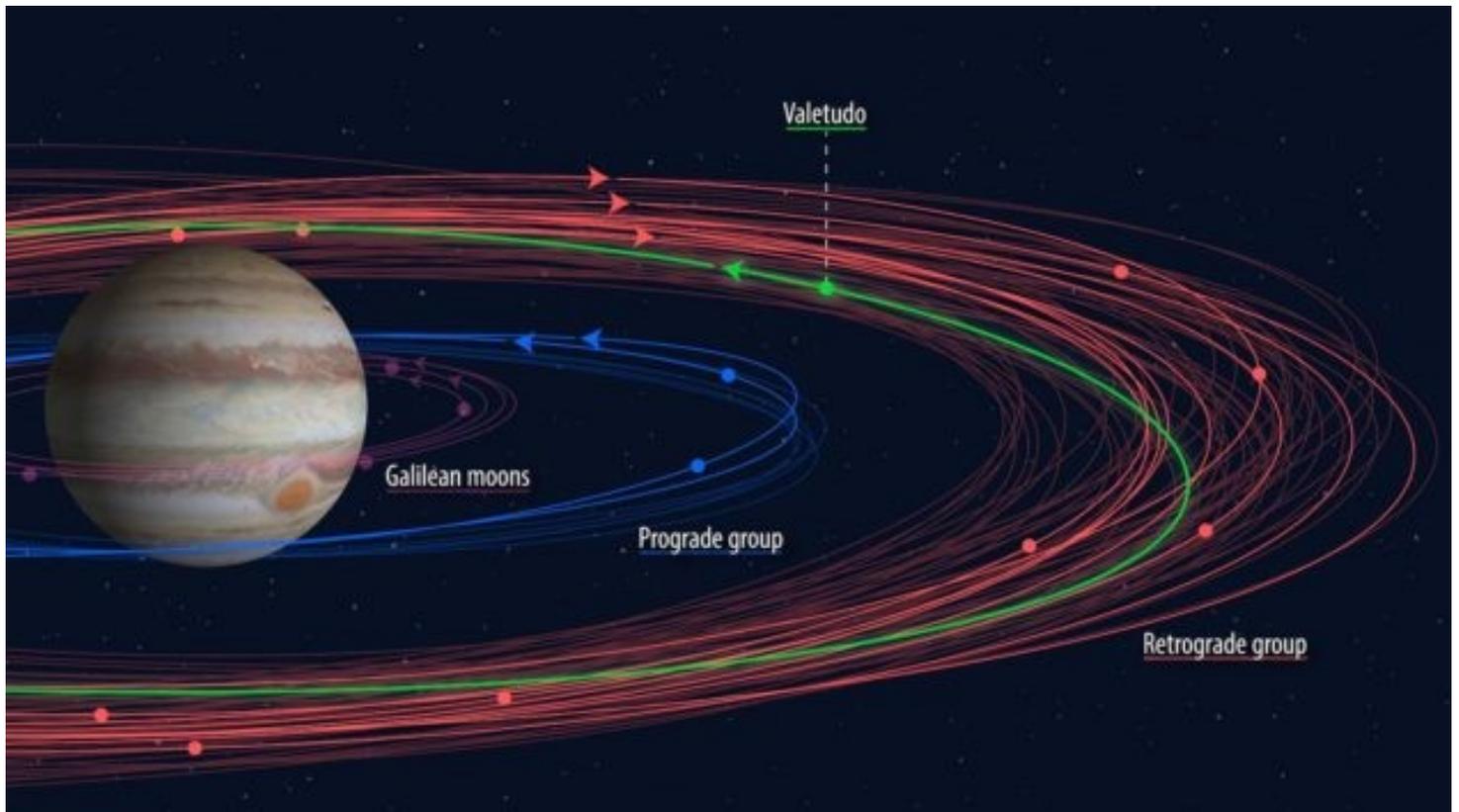
UCLA—Geology 3656 (near Meteorite Gallery)

Free (but \$6 to \$12 for parking on campus)

See: [UCLA Meteorite Gallery](#)

Jupiter: 79 Moons—For Now!

(But, what's a moon?)



Ten new moons have been discovered orbiting Jupiter—including two announced earlier. This brings the total to 79, for now. The moons were found using a ground-based telescope, the Magellan—Baade 6.5 meter reflector, from Carnegie Observatories' Las Campanas site in Chile (as well as the 4.0 meter Blanco Telescope at Cerro Tololo).

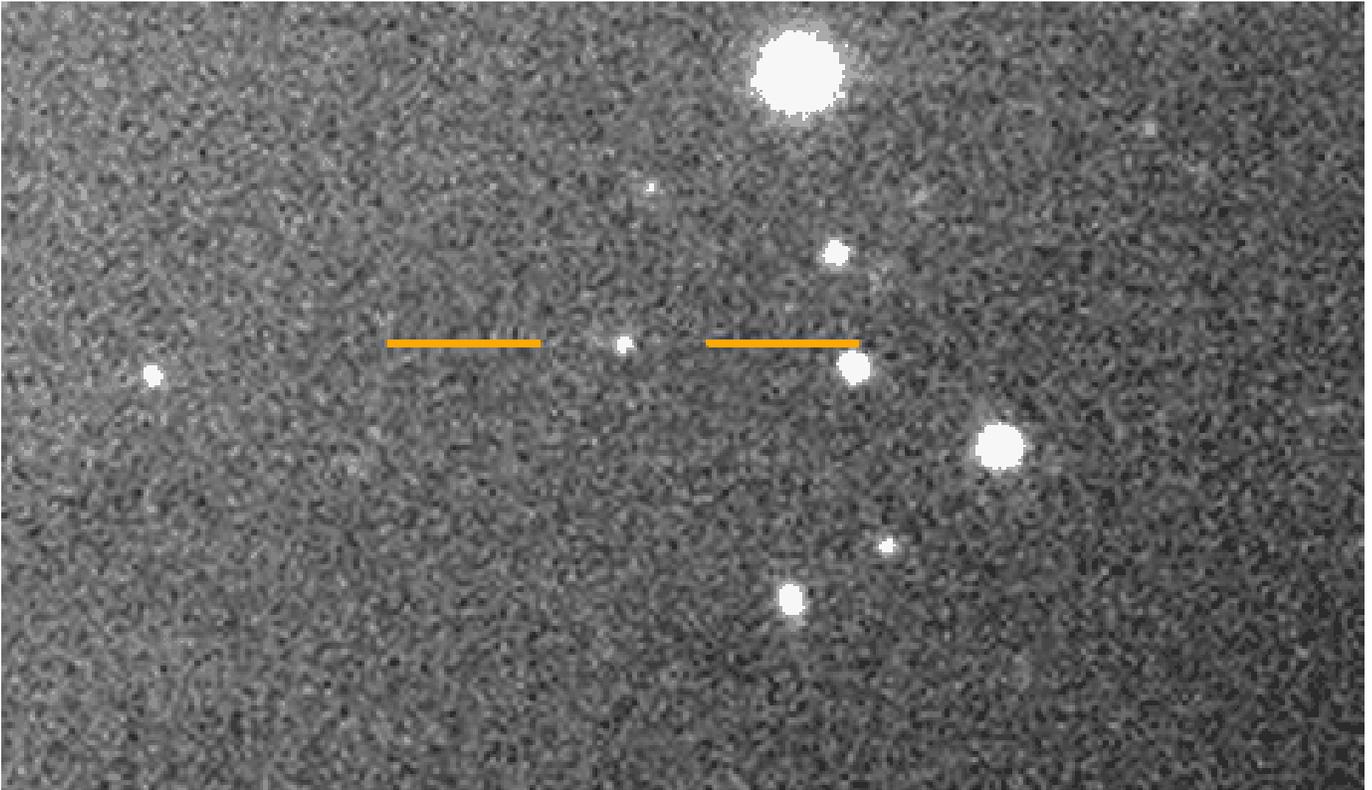
The satellites range from half a mile to two miles in diameter, and orbit Jupiter in periods from 252 to 723 days, at anywhere from 11 million to 23 million kilometers distance. Most were in the range of about 23rd magnitude—around 10,000 times dimmer than Pluto.

Discoverer Scott Sheppard (and team—together, responsible for finding 51 of Jupiter's 79 moons!) has been searching for "Planet 9" which has been stirring objects around in the Outer Solar System (assuming it exists). Jupiter just happened to be moving into the "Planet 9 search area", so Sheppard took advantage of that opportunity to do a double-search. Planet 9 didn't show up—but look what did!

Two of the moons orbit in the direction Jupiter spins (prograde), matching the motion of an inner group of moons thought to be fragments of a larger moon that shattered.

Nine moons move in the opposite direction (retrograde). Jupiter's *retrograde* moons cluster in three groups of 15 to 20 objects, named for members Ananke (discovered in 1951), Carme (1938), and Pasiphae (1908), the first two of these discovered by Seth Nicholson, of Mt. Wilson. Most likely, each of these "families" represent fragments of larger precursors also shattered by collisions early in Jupiter's history.

Then, there's the one moon for which a name has already been proposed: Valetudo, a great-granddaughter of the Roman god Jupiter, and goddess of hygiene and health. This moves in a highly inclined, prograde direction among the retrograde moons—like someone going the wrong way in traffic. Sheppard thinks it may be the last surviving fragment of the object that destroyed the inner three moons...



Above: Discovery image of Valetudo

So, What's a Moon, Anyway?

Oh, oh—not again! People are starting to argue about what constitutes a “moon”. (Guess the Pluto debate got a few of them going!)

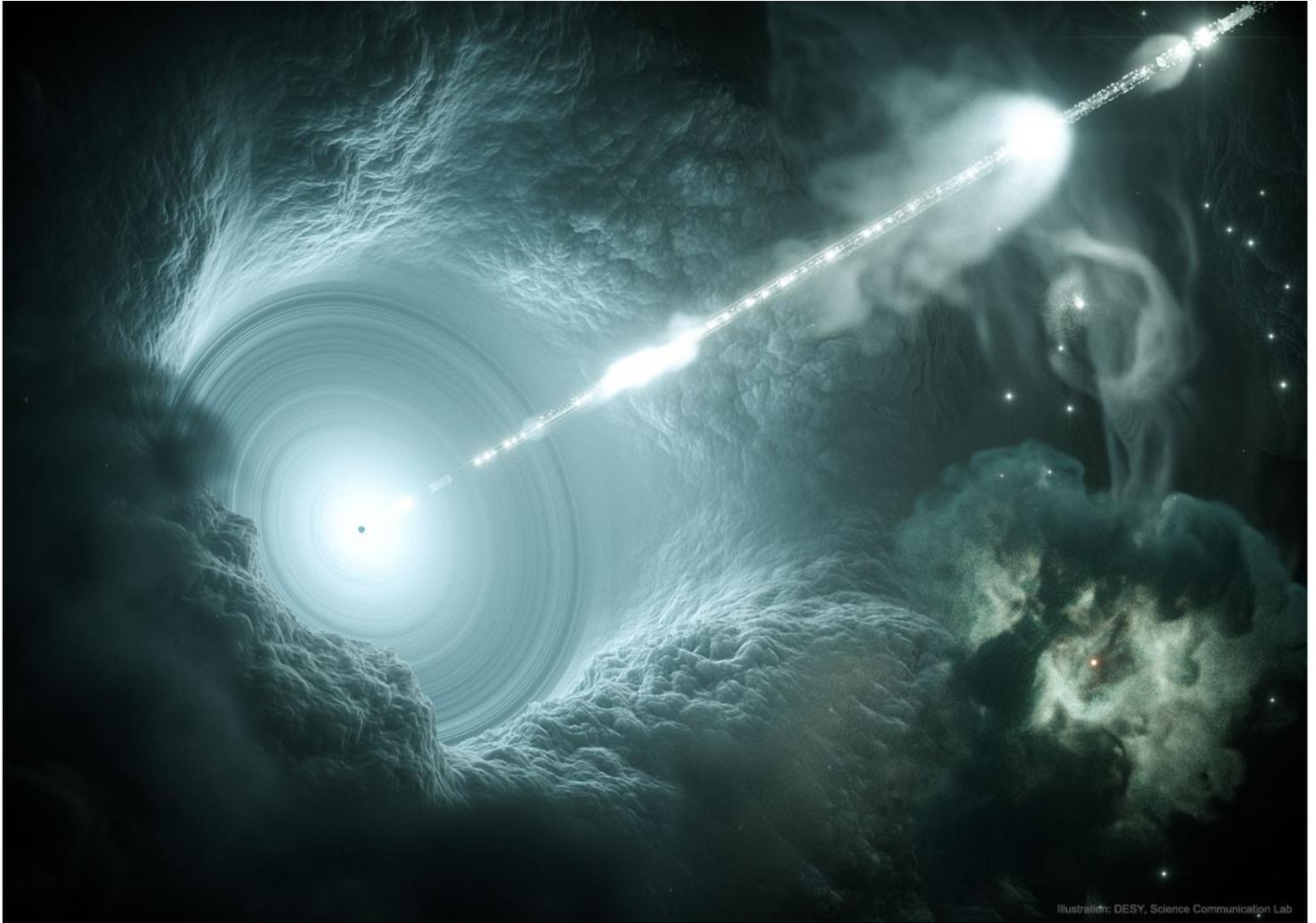
“Mostly I think, who cares,” said Michael E. Brown of Caltech, whose discovery of Eris touched off the infamous Pluto vote.

“We should develop categories,” said Dr. S. Alan Stern, Principle Investigator of NASA’s New Horizons Mission to Pluto. “Best would be organically, not by arbitrary votes. People already use ‘moonlet’ for the little guys.”

Others think we need not worry, yet. There is still a very clear distinction between the moons, whose orbits we can track, and ring particles, whose individual motions we cannot detect. If we were able to track objects the size of a house or car in Saturn’s rings, for example, the number of moons would jump into the millions!

Earth, fortunately only has one—or maybe two! There have been natural objects found in temporary orbits about our planet. Either way, we’re not likely to compete with Jupiter, now at 79—and counting.

Probable Source Found For Mysterious Ultra-High Energy Cosmic Rays!



Above: Artist's impression of a "blazar"—a quasar seen pole-on. These are powered by supermassive black holes in the centers of distant galaxies. If the quasar has a polar jet of super-high energy particles heading right toward us, it can look like a variable star—although with strange properties. The prototype was the star BL Lacerta, which turned out not to be a star at all, but one of these cosmically distant objects.

Ice Cube, the giant neutrino detector rooted in the ice at the South Pole, has enough data to suggest that at least one such object is a verified source of high-energy cosmic rays: The gamma ray blazar [TXS 0506+056](#). It may even put out more energy in neutrinos than in gamma rays.

It has always been difficult to track ultra-high energy cosmic particles to their sources, as they twist and turn in the magnetic fields of our galaxy (and maybe others), concealing their original heading. Neutrinos, however, are almost impervious to such forces, and move so close to the speed of light that gravitational deflection is also minimal. We can now track enough cosmic neutrinos (as opposed to the lower energy solar neutrinos) back to their source to get a probable fix—and the candidate is a worthy one.

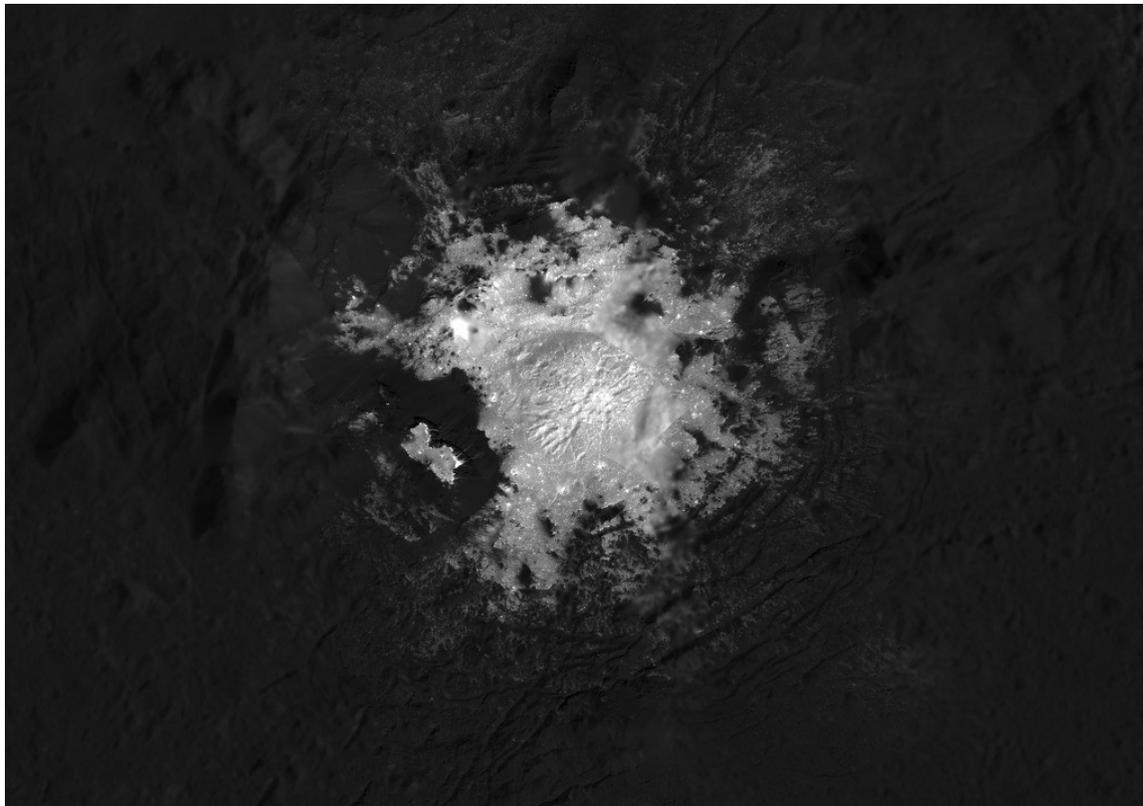
The idea is that the immense magnetic fields in these objects accelerate protons to staggering energies. The protons can collide, producing pions and neutrons, and pions then decay to muons and muon neutrinos. (Time to look at your handy table of subatomic particles!) When muon neutrinos enter the ice, they produce muons again—and these are moving so quickly they emit "Cerenkov" radiation, which can be detected by the sensors beneath the ice.

How energetic were the neutrinos? One was 290TeV (trillion electron volts)—over 40 times the energy in each proton beam at the Large Hadron Collider! Some neutrinos may be coming in at PeV energies—up to 3 quadrillion electron volts. The neutrinos must be moving at practically (but never quite) the speed of light.

If that sounds incredible—well, consider the source!



A COSPAR Result: The Committee on Space Research held its great meeting in Pasadena. At a public talk, Dr. Sara Seager of MIT noted that we have looked for, and should be able to detect, wobbles in transiting planets that would be caused by large nearby moons—like ours. So far: nothing. Large, nearby moons may be rare. And we still haven't seen a Solar System quite like our own. Are we special? Certainly! Are we unique? There *are* billions of stars out there, and a lot of space left to search. Stay tuned!



By DAWN's Latest Light:

Some time in the next few months, the DAWN spacecraft is expected to run out of hydrazine fuel, ending its spectacularly successful mission (and one long-associated with our host school). Meanwhile, from its final, low orbit, it is turning in the most stunning images yet, like the one at left.

Above: Cerealia Facula, one of the bright “eyes” of Ceres. Most of the material is now thought to be sodium carbonate and ammonium chloride from a slushy brine within, brought to the surface through cracks produced by the formation of Occator Crater. Sodium carbonate would even suggest some kind of hydrothermal activity!