Santa Monica Amateur Astronomy Club

August, 2016

The Observer

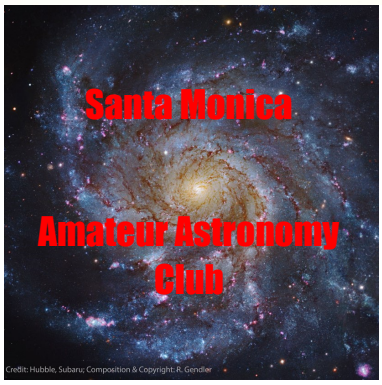
UPCOMING CLUB MEETING:
FRIDAY, AUGUST 12 (7:30 PM)

Speaker: Trina Ray, JPL

Topic: "Cassini at Enceladus"

The Cassini Mission imaged jets, rich in water ice, emerging from beneath the icy surface of Enceladus. How can such a small world be so active? Could there be a habitable environment deep below the ice? This perplexing moon is our topic for August.

Above: Jets emerge from the south polar region of Enceladus. What drives them? What kind of an environment lies at their source? What have we learned about these icy plumes—and how will we answer the many questions they raise?



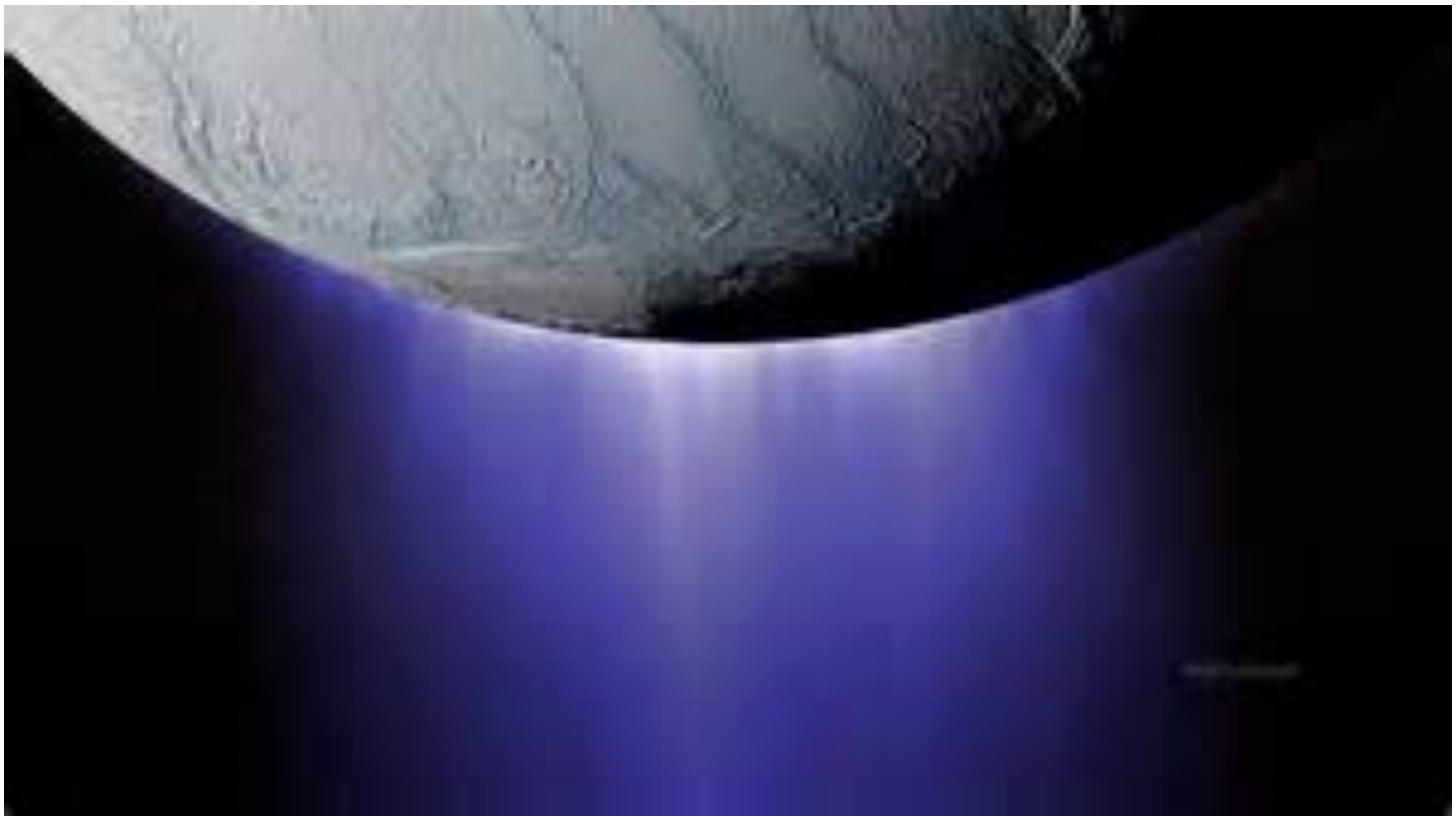
INSIDE THIS ISSUE

OUR MEETING SITE

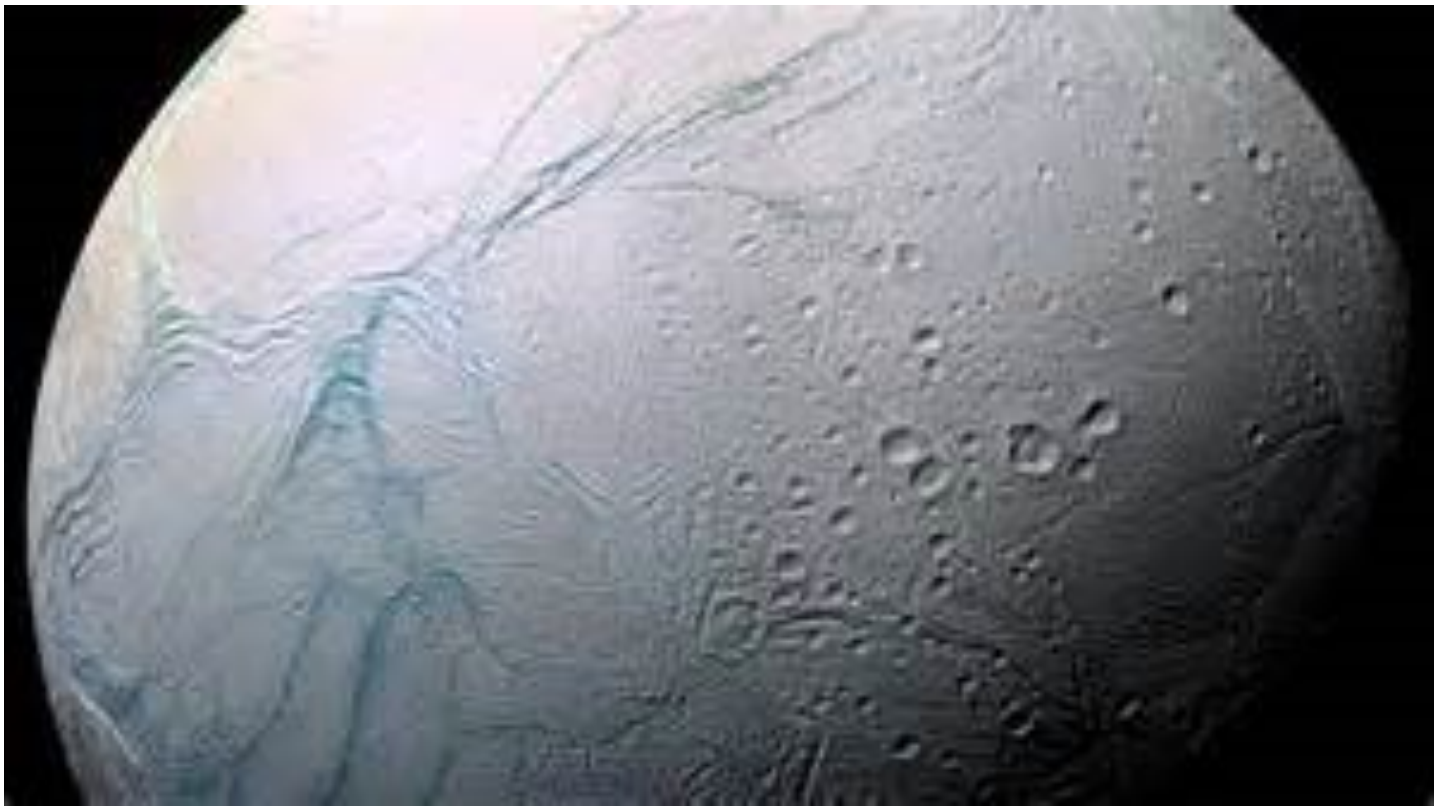
Wildwood School
11811 Olympic Blvd.
Los Angeles, CA
90064

Free parking:

Garage, SE corner of Mississippi & Westgate.



The plumes (above) of Saturn's moon, Enceladus, emerge from the South Polar region's "Tiger Stripes" (below). Four of these troughs are active along their central regions, with one currently "shut down". What does this tell us about the source of the plumes? Does water correlate with life on a world so different from the earth? How can such a small, cold world be geothermally active? These, and many more questions, await us, out in the perplexing environs of Saturn... Trina Ray (JPL) will tell us more!



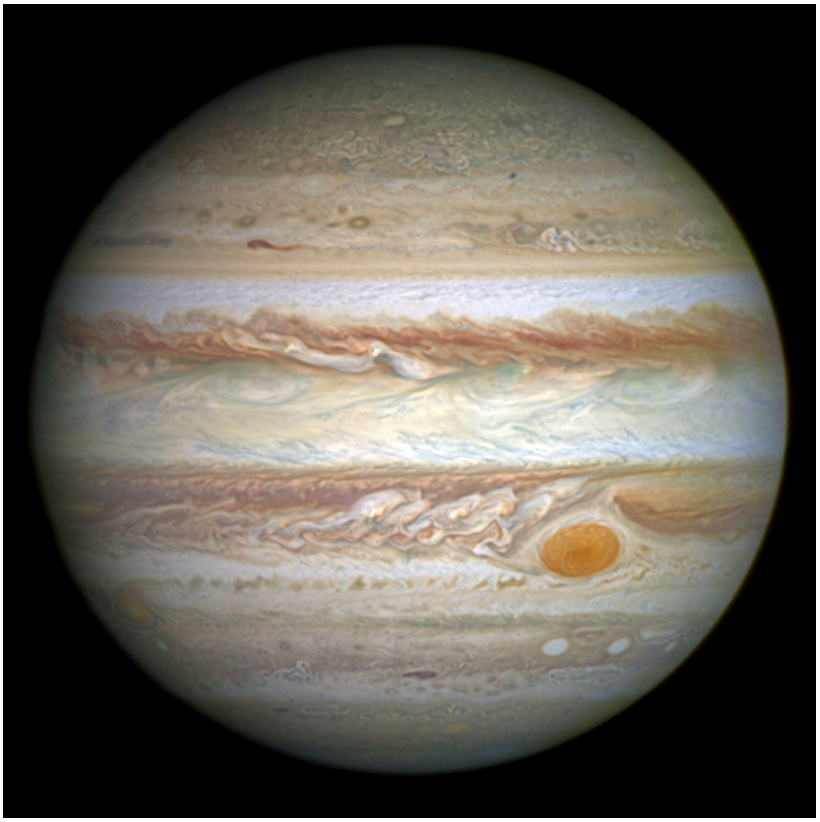
Jupiter: Gas Giant?

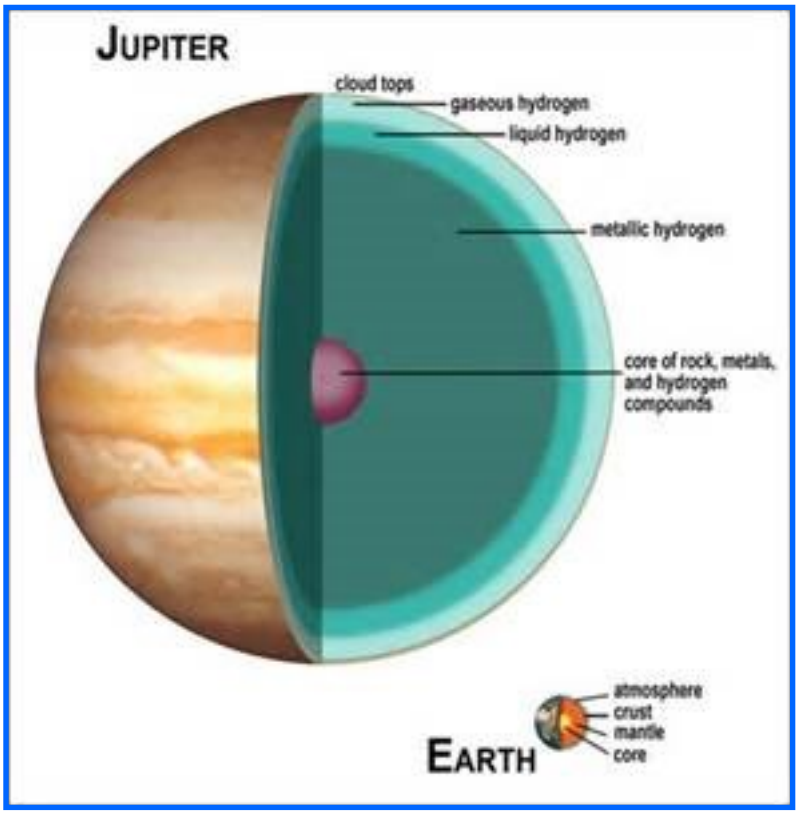
What *Is* Jupiter?

The Juno probe has arrived at Jupiter. Now in a great, looping orbit, Juno is heading back for a close approach on August 27—we await the first real data, and even sharper images than the ones pictured here.

But, what *is* Jupiter? We often call Jupiter, Saturn, Uranus and Neptune "Gas Giants". Sometimes, Uranus and Neptune are also called "Ocean Worlds."

Are these really gas giants? If Jupiter is a Gas Giant, can we pass right through its center? You probably already know the answer to that—but the next page spells it out a bit.



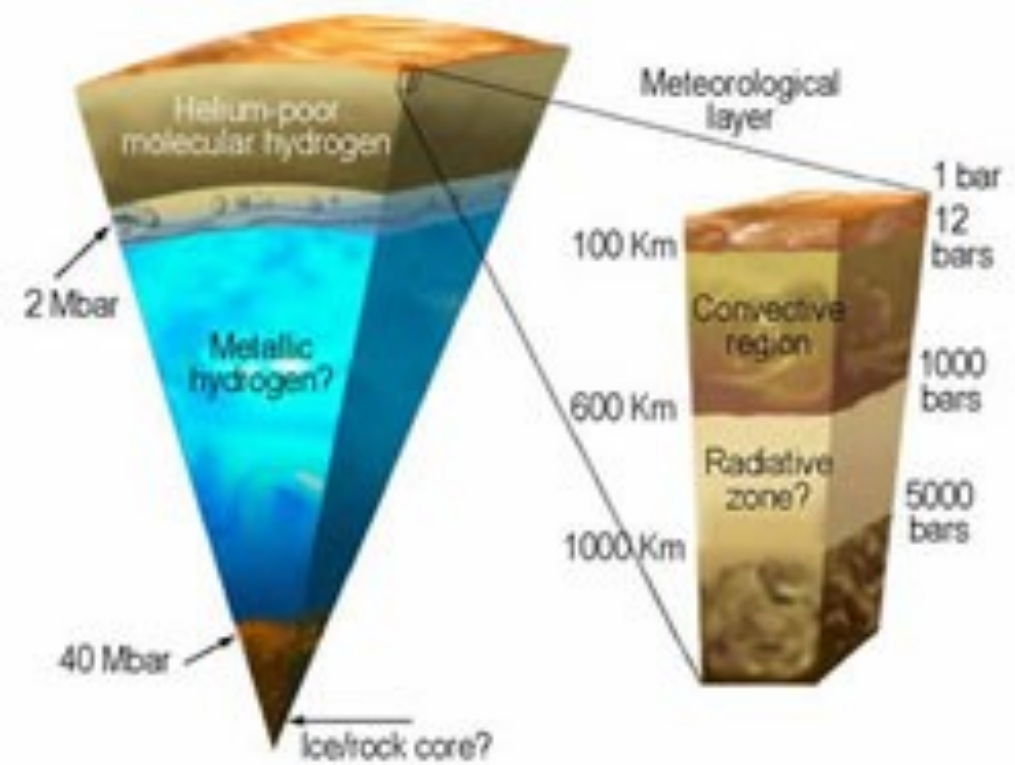


A DROP IN THE BUCKET?

Pictured (left) is a model of Jupiter's inner structure.

A thin **atmosphere**, mostly hydrogen and helium, surrounds a layer of **liquid molecular hydrogen**. Beneath this is a vast region of **liquid metallic hydrogen**. At the center, there may well be a large **molten silicate core**.

Sounds like a lot of liquid! Juno will help us do a reality check on all these models—but there's no way to make a giant sphere of gas out of these layers.



Standard pressure at sea level on earth is 1 atmosphere (1.01265 bars, so they're pretty close).

For every 10 meters (33 feet) you descend in the ocean, you add one atmosphere.

At the bottom of the Challenger Deep, nearly 36,000 feet down, the pressure is about 1,100 atmospheres, or 16,100 pounds per square inch.

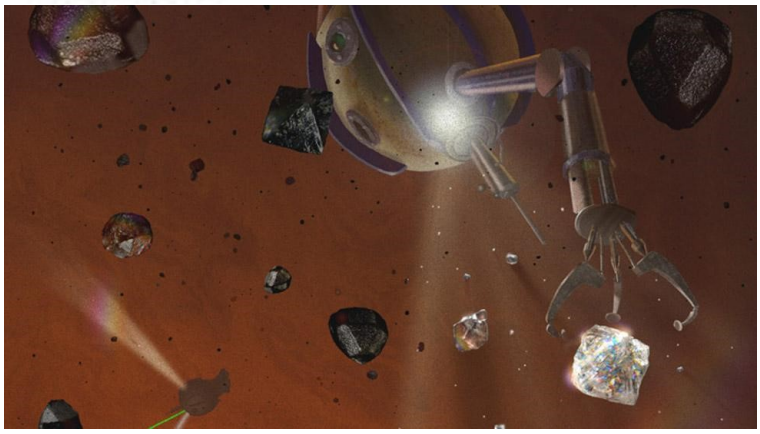
That's like the pressure of an elephant balancing on a postage stamp, or a person holding up 50 jumbo jets!

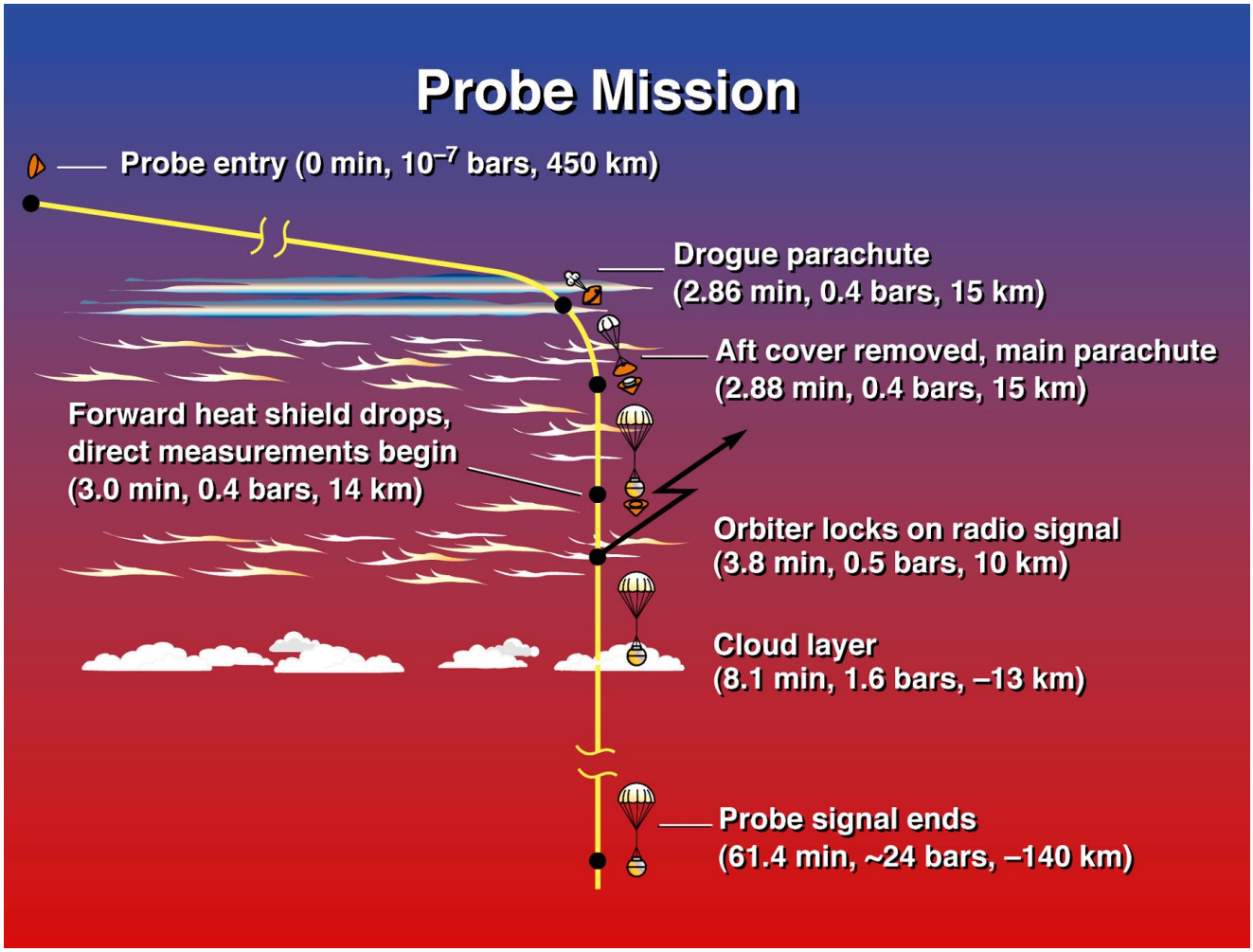
The central pressure on Jupiter? Around *50 million bars*! Temperatures may reach *65,000°F*, just at the top of the core. The hydrogen layers actually glow white hot.

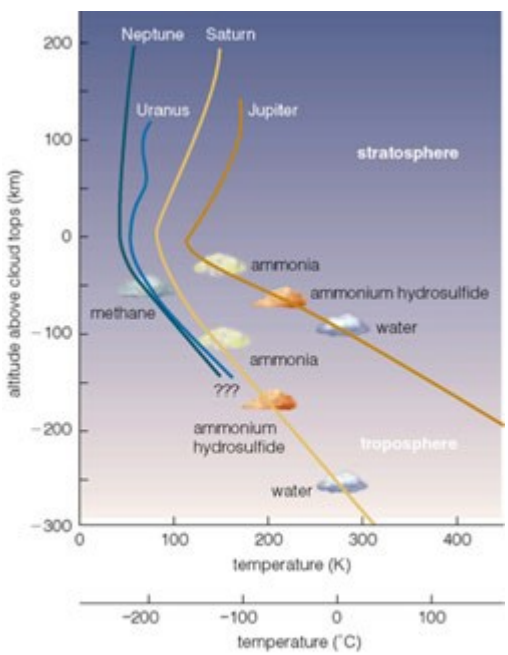
Not exactly an easy place to just float through!

Oh, and don't forget the diamonds! Many of our club members heard all about this exciting topic.

Pictured (right): A rather challenging mining operation!







Above: Altitudes, from cloud tops (so a bit different from standard figures, calibrated to 1 bar). Models vary somewhat, as does the atmosphere from place to place—hence, Juno!

THE GALILEO ATMOSPHERIC PROBE: A ROUGH RIDER!

The Galileo Atmospheric Probe did drop in to Jupiter's atmosphere, finding conditions a little bit different from predictions—but it seems to have dropped into a particularly 'dry, warm' spot. The basics of the atmosphere:

+450 km, 10-7 bars: Galileo Probe enters so fast it endures 28,000°F temperatures and 230 g's, vaporizing over 176 lbs. of its heat shield!

+14 km, 0.7 bar: Ammonia ice crystal cloud layer

0 km, 1.0 bars: Clearer region. Still brightly lit and freezing.

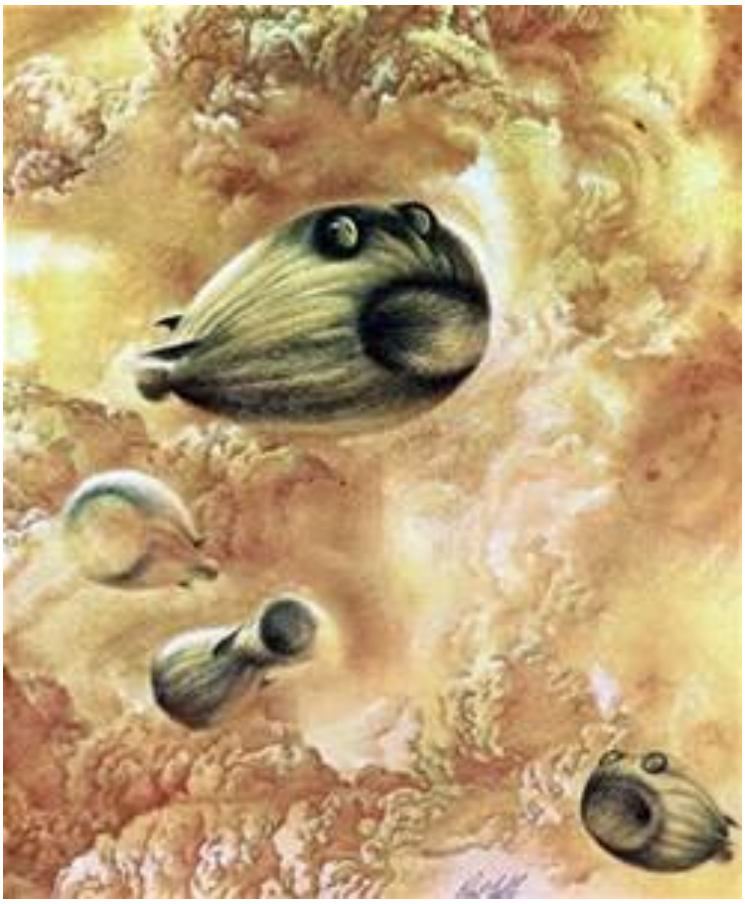
-13 km, 2.0 bars: Ammonium hydrosulfide ice cloud layer. Dark as we fall through the bottom of this layer.

-70km, 5 bars: Water ice cloud layer. Lightning seen here. Liquid drops lower down. Room temperature as we drop below the base of these clouds.

-90 km, 10 bars: Base of the troposphere, usually called the bottom of the atmosphere

-100 km, 12 bars: Hydrogen is now a supercritical fluid, meaning that at these pressures and temperatures, we can no longer call it "gas" or "liquid". The atmosphere smoothly morphs into what would seem like a liquid—and we're only 60 miles down! Jupiter's powerful gravity, 2.53 times that at earth's surface, compresses its atmosphere.

-140 km, 23+ bars: Galileo Probe stops transmitting, after about an hour. The temperature is 307°F, and the pressure is greater than 700 feet of water depth!



BLOWIN' IN THE WIND

After a suggestion by Carl Sagan: Imagine "floaters" and "sinkers" in Jupiter's atmosphere, right about where the temperatures are similar to those in our atmosphere.

Jupiter's atmosphere is convective and unstable in most places, so many people now assume that it would be too difficult for any kind of life to hang on to a habitable layer.

Then again, if you've ever seen salmon hold their place in a rushing Alaskan stream, with almost no apparent difficulty, you might think twice about what living things can achieve.

The atmosphere of Venus also has levels with fairly earthlike conditions, despite the hellish temperatures and pressures at the surface. Tour Venus by balloon, perhaps?

Jupiter's Great Red Spot, a high-pressure "storm" in the atmosphere. Winds exceed 270 mph over a vast area. What makes it red? No one knows. Red phosphorus? Organic compounds? Ammonium hydrosulfide hit by UV rays? It's tough to tell: The chromophores would be mere trace gases in the vast atmosphere. And why is the spot shrinking? It lost about half its E-W length over the last century. Juno will study this, too!

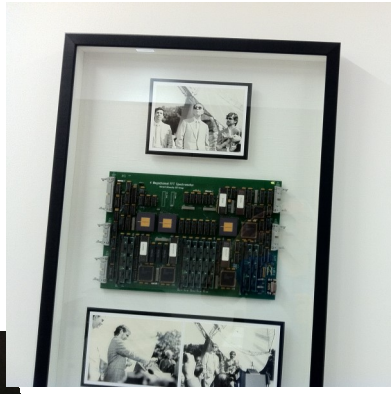
Our Club, On the Town

Left: Our group at Pasadena City College, for a talk by Marc Rayman of the Dawn Mission. Dr. Rayman has spoken to our group, and our host school have been the educational coordinators for Dawn.

Below: An unannounced visit to the Planetary Society—and they were as welcoming and gracious as possible.

The Society has a new headquarters, still in Pasadena, at Los Robles and Green Streets. Our club has been to many Planetary Society events, with many more to come.

The circuit board (seen below) was part of a SETI search called Project META. Steven Spielberg, seen at the Harvard dish, provided funds. The two women (bottom) are with the Planetary Society.



Don't forget the Perseid Meteor Shower!

It won't look quite like this, and people used to laugh at images like this one, captured from a 2-hour video—but hardly anyone bats an eye, any more. Mt. Ranier is in the background. It *is* hard to argue with the beauty of the image.

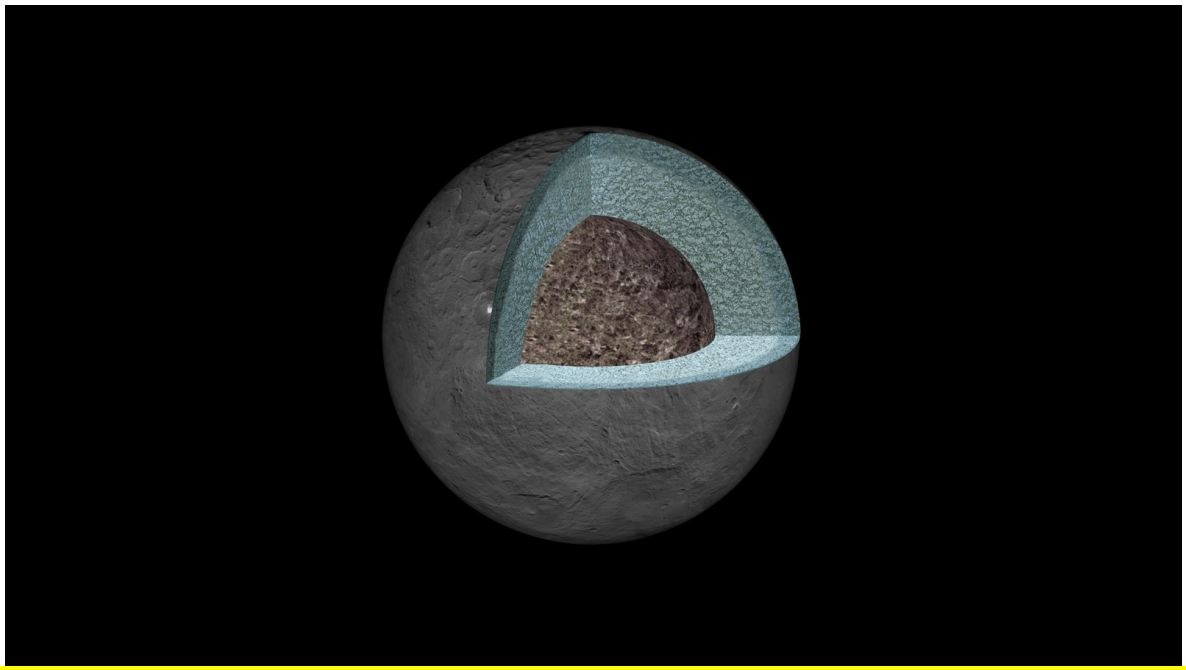
The Perseids peak Thursday night, August 11, into Friday morning, August 12, our meeting day. The moon will be just past 1st quarter, so it won't be up in the morning hours.

Maybe Mt. Ranier wouldn't be a bad spot to watch it, as long as you're back for our meeting...

Left: Aurora with Perseid meteor over Colorado, in 2000.

Your editor once saw an aurora in Canada during the Perseid shower—and the meteor tracks gradually broadened and morphed into "patches" of aurora. A totally unexpected sight—but auroras and meteor do shine at similar altitudes, and both can ionize the atmosphere...

JPL talk on the Rosetta Mission: Thursday, August 11, Von Karman Auditorium, 7pm. See the JPL website for details. (And keep an eye out for bright meteors over Pasadena?)



ANOTHER DAWN MISSION DISCOVERY!

From the JPL website: "We have found that the divisions between different layers are less pronounced inside Ceres than the moon and other planets in our solar system," Park said. "Earth, with its metallic core, semi-fluid mantle and outer crust, has a more clearly defined structure than Ceres," Park said.

Scientists also found that high-elevation areas on Ceres displace mass in the interior. This is analogous to how a boat floats on water: the amount of displaced water depends on the mass of the boat. Similarly, scientists conclude that Ceres' weak mantle can be pushed aside by the mass of mountains and other high topography in the outermost layer as though the high-elevation areas "float" on the material below. This phenomenon has been observed on other planets, including Earth, but this study is the first to confirm it at Ceres."