nightwatch
Newsletter of the Pomona Valley Amateur Astronomers

... free and friendly exchange of ideas
has brought us close together.
Edward M. Purcell

Volume 30 Number 11 *nightwatch* **November 2010**

Club Events Calendar

November 19, – General Meeting - Gene Serabyn of JPL
"Progress toward directly imaging nearby solar systems."

December 4, – Star Party - Wilderness Park, Claremont
December 8, – Star Party - Oakmont School
December 10, – Holiday Party - Sizzlin' Skillets - 6-9pm
December 16, – Board meeting 6:15PM Sizzling Skillet

January 11, 2011 – Main Branch, Ontario Library, 7 – 9 PM
January 21, 2011, – General Meeting
January 29, 2011, – Star Party at Salton Sea.

February 18, 2011, – General Meeting - Dave Jurasevich

March 18, 2011, – General Meeting - Dave Doody

April 15, 2011, – General Meeting - Christine Pearce of Columbia Memorial Space Center
May 13, 2011, – General Meeting

June 17, 2011, – General Meeting

July 15, 2011, – General Meeting

August 12, 2001, – General Meeting

September 9, 2011, – General Meeting

October 14, 2011, – General Meeting

Christmas Party reminder!

The Christmas Party is Friday December 10 from 6pm to 9pm. Sizzlin Skillet, NE of the corner of Foothill and Euclid, Upland Ca, No advance deposit, order from the menu. Please RSVP to Bill Connelly 714-329-4080.

PVAA Officers and Board

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President ....Position Open ….......
Vice President ..Joe Hillberg...............909/949-3650
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The Division of Planetary Sciences Meeting – 2010

Icy Dwarfs, Hot Giants, and Other Planetary Wonders

Here is a summary of what I saw at this year's meeting of the Division of Planetary Sciences of the American Astronomical Society. The DPS meeting is the largest annual gathering of people who study solar system bodies (both in our solar system and others), and this year it was held close by in Pasadena.

There are many concurrent sessions going on at DPS, and I was only able to attend for a few of the days because of my work schedule. However, I did get to see a number of very interesting talks and posters on a range of subjects. Here is a summary of some of the ones I found most interesting.

Tilting at Rings

Jupiter has a faint ring around it, much harder to see than the one around Saturn. Mark Showalter (SETI Institute) and Joe Burns (Cornell) presented a couple of talks on a wobble in this ring. It seems to be wobbling up and down with a couple of different periods. By looking at how fast this wobble is decaying, they could pinpoint the time when the tilting began. For one of these wobbles, it was July 1994. This is really interesting, because in July of 1994 Jupiter was hit by a bunch of comet fragments called Shoemaker/Levy 9. The authors suggested that dust from the comet hit the rings gave it a slight tilt.

Several other talks discussed small moons buried within the rings. Current work with the Cassini mission is now allowing scientists to study tease out the effects of bodies just a few tens of meters across within the rings themselves.

Living on the Edge

The edge of our solar system is the land of the dwarfs: dwarf planets that is and the rest of the Trans-Neptunian Objects (TNO's). There are thousands of these now known, including dwarf planets like Pluto, Eris, Makemake and Haumea. Some of them come in pairs, and Alex Parker (Victoria) and Wesley Fraser (CalTech) gave talks about their survey of binary TNO's. One of their major conclusions is that there must have been many more of them in past, because many of them would be easily disrupted if they got too close to another TNO.

Other people are looking at the colors of TNO's to get a sense of what their surfaces are made of. Emmanual Lellouche (Meudon) gave a talk about the Herschel infrared space telescope that is being used to study these bodies. It seems that the bigger bodies are brighter as if they are covered with bright ice (instead of the dark tarry material that we often find in the outer solar system). This suggests that there may be something that is covering up or cleaning off the dark material on these worlds.

Asteroids and Comets Galore

The WISE spacecraft is doing a complete survey of the sky in the infrared. While it is mostly focused on things outside of the solar system, they can't help but see lots of things inside our solar system as well. Amanda Maizner (JPL) described how they have made over 4 million observations of small bodies (including many multiple observations of the same bodies) and discovered over 30,000 new asteroids and comets in less than a year of operation. They can also see things farther away, and by the time they finish the second pass across the sky they say they should be able to detect Jupiter-mass bodies as far as a light-year away.

With all of this junk in our solar system, some folks are wondering what to do if one of these things is heading our way. Catherine Plesko (Los Alamos National Lab) described simulations of what would happen if you set of a nuclear explosion near an asteroid. Most asteroids seem to be "rubble piles" that are very loosely held together, so what happens in such an explosion is that the pieces break apart quickly then re-accrete under gravity in just about a day. So it's hard to destroy one of these things, but you may still be able to give them a nudge.

Mars Methane

My favorite poster was done by Kevin Zahnle (NASA Ames). There has been a lot of fuss in the press recently about the detection of methane in the atmosphere of Mars and what this may mean for life there. Kevin took a look at these observations and argued that they may not be seeing Martian methane at all. He points out that they are very weak signals of a single spectral line (the light signature of an element or compound), and that they could be confused with similar lines in our own atmosphere. He also made a number of suggestions on what to do to be more confident of the observations.

Titan – Weirdest world in the Solar System

What else can you say about a moon that has a hazy nitrogen-methane atmosphere, lakes of methane and ethane, hydrocarbon rain and dunes made out of frozen tar. Oh yes, and it all happens at -180 C. The Cassini spacecraft has flown past Titan many times in the last few years, so we are starting to be able to map out its surface and understand it's atmospheric processes.

Lauren Wye (Stanford) ,Jason Soderblum (Cornell) and Jason Barnes (Idaho) all gave talks about the waves in the hydrocarbon lakes at Titan's north pole. From the way light glints off of the liquid and the way it reflects a radar beam, the largest average wave size they are seeing is 0.5 mm (thinner than the thickness of dime). The surf is definitely not up.

All of the known lakes on Titan are near the poles. Jeff Moore (NASA Ames) thinks he's seeing evidence of dry lakes and seas around the equator, no actual liquid there. If the equator has dried up then there may be no more evaporation of methane into the atmosphere. Since methane turns into more complex organics due to the action of sunlight, it's possible that Titan is drying up. On the other hand, Caitlin Griffith and Juan Lora (Arizona) think they have found some small lakes left, possibly fed by underground seeps, and Carl Mitchell (JPL) thinks that some there may be ice-volcanoes that can still spew methane into the atmosphere.

How Does It Work?

*A*t least one visitor has asked why NASA uses the "slingshot" of one planet to reach another. I suspect the answer is too complicated for a 20 second sound bite, so NASA doesn't try to explain.

If a space ship wants to go past a planet, it has a hard time going in a straight line. Think of the planet in its gravity field like a steel marble sitting on a rubber sheet. Energy is precious, there can only be a limited amount of fuel on board. So the path to be chosen will use the minimum energy. But it also wants the minimum time. What choices are available?

Any path chosen will be a "conic cross section." That means that if you imagine a cone, the path will be an intersection of the cone and a plane. If the plane is at right angles to the cone's axis, the intersection is a circle. If it is off a bit, it will be an ellipse. If it is off some more, it will be a parabola. And if it is parallel to the axis, it will be a hyperbola.

As we approach the planet, we are already in its gravity. We know where we are and where we want to go. The question is which path will require the minimum energy and have the shortest time?

We will likely have to change heading. If we have exceeded the terminal velocity for that planet, we could choose a hyperbola or parabola. That would take us close to the planet and we would accelerate rapidly as we approached and decelerate as we go out the other side. Otherwise we will choose an ellipse. What ellipse and where we enter and exit will be important.

One approach is to calculate the circular orbit which we would have given our speed. Then we would attempt to intersect it nearly on the tangent. If this is a stable orbit and we get below it, our speed will increase. That will cause us to be on an elliptical orbit which eventually goes above the circle.

Conservation of energy and angular momentum will permit us to circle the planet and eventually be as far from the planet as when we entered orbit. We can use some energy whenever we wish to change heading and thereby exit the orbit of that planet.

By choosing an ellipse with a focus at the center of the planet and a near point close to the focus, we will be able to accelerate and decelerate such that the elapsed time is much less than going around the planet on the long circular route. This is what NASA calls the "slingshot."

Keep in mind that the "big guy" on this sheet is the sun and it too has to be considered. To get the best course, the whole surface of the rubber sheet must be defined from the time we start to the time we expect to arrive. Only then can the minimum energy, minimum time path be chosen. Also remember that only the energy is limited. A short time is only a nice thing to have.

Ken Crowder

The Division of Planetary Sciences Meeting Cont.

Making Solar Systems

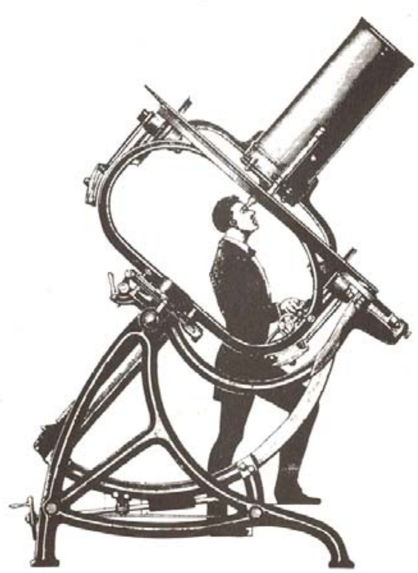
Back when I was researching solar system formation it was easy: we just had one solar system to form. Now we know about hundreds of systems, and most of them look nothing like our own.

The Kepler mission promises to add a tremendous number of new solar systems by watching for the planets passing in front of their stars. This mission is just getting underway, and there were several talks describing how they are searching for planets (and ruling out things that aren't planets). Jack Lissauer (NASA Ames) described one new planetary system that has 2 nearly Saturn-mass planets with orbits lasting 19 and 38 days, and a third much smaller planet (around 6 times bigger than Earth) with an orbit of 1.6 days.

So how do you get giant planets so close to their stars? For about a decade now astronomers have assumed that these planets migrate in from the outer solar system. Sara Rastagar (Northwestern) has done some models of what happens to any terrestrial planets in the way when this happens: the short answer is they get thrown out. This creates a bit of problem, because we do see some terrestrial sized worlds inside the orbits of the hot giant planets.

Jeff Cuzzi (NASA Ames) was also talking about making planets in his Kuiper prize talk (this prize is the highest honor given in planetary science). He was focusing on the problem of getting from dust to large asteroid-sized things, and trying to bridge the gap between the astrophysicists and the meteorite specialists. The problem is as small stuff accretes the surrounding gas makes it spiral in towards the Sun. However, he has found that if there is turbulence in the gas it can make pea-sized grains concentrate into large dense clumps that can avoid this problem and turn into asteroids around 100-150 km in diameter. These would then collide to make larger planets. This meshes nicely with the meteorite data, which shows that many meteorites are made up of large numbers of chondrules

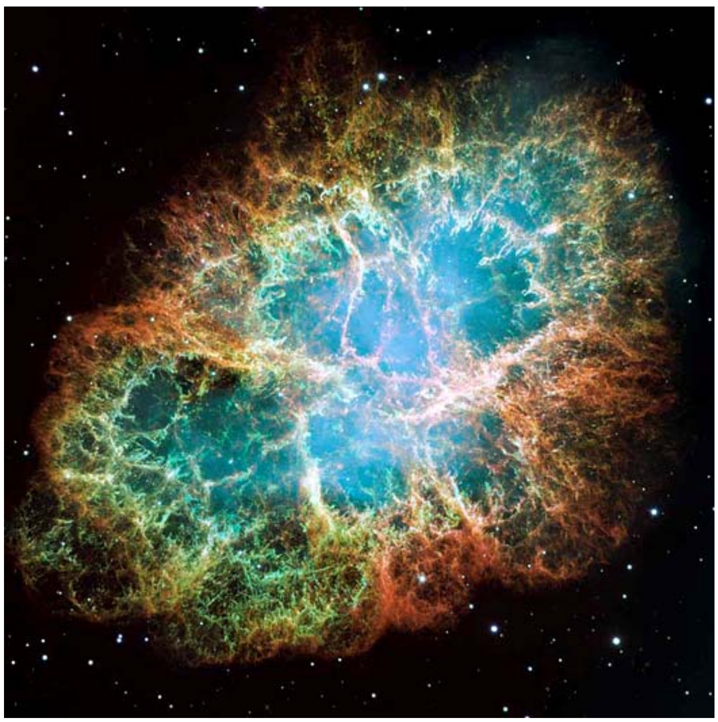
David Kary



What's Up? Little Green Men?

In 1967 radio telescope astronomers were baffled when exactly regular radio pulses were received from deep space. Was it a signal from "little green men" in some extraterrestrial civilization? After more study, LGM-1 revealed itself to be a new kind of pulsating star, a pulsar. Pulsars turned out to be rapidly spinning neutron stars that emitted beams of magnetically produced radio waves. With each turn a beam flicked out into the universe like a cosmic lighthouse.

Neutron stars are the concentrated central remains of a star that has undergone a supernova explosion. They rotate like the stars of which they are a highly contracted remnant. But because they have collapsed from a much larger size they spin very rapidly. It's the conservation of angular momentum, a rotating star (like a whirling skater drawing in her arms)spins faster as it shrinks. A neutron star has shrunk from a huge star to a size smaller than the Earth. This concentrated ball of energy sends out a pulsating beam through its off-center magnetic poles. Many pulsars have now been discovered, their signal rates vary from a millisecond to seven seconds. Eventually, after 10 million years or more they stop spinning.



In 1974, the pulsar's discover Anthony Hewish became the first astronomer to get the Nobel Prize in physics. Controversy ensued because his assistant Jocelyn Bell, who first noticed the signals, was not included.

The most studied of all pulsars to be discovered is the neutron star at the center of the Crab Nebula. It pulses at an incredible rate of 33 milliseconds. The supernova was first seen by Chinese astronomers in 1054 A.D. when it exploded into a dazzling -7 magnitude. The emperor's astronomers were busy looking for comets, believed to be broom-like "sweepers" of fate.   They reassured the emperor that this "guest star" was no threat to his royal rule. However they made charts of its location before it faded from sight two years later.   Some Arabian observers also noted this brilliant guest, but a Europe deep in the warfare of the Dark Ages didn't seem to notice an object half as bright as the full moon.

Moving forward 704 years to 1758 we find Charles Messier, in a French search for fateful comets. He spotted a "fuzzy flame" that was not a moving comet. So he started a catalogue of non-comets with this supernova remnant as number M1. This catalogue would be his claim to fame.

In 1845, William Parsons, the rich Lord Rosse, built a 72 inch telescope called the Leviathan of Parsonstown. It would be the largest scope until the Mt Wilson's 100 inch Hooker in 1917. In spite of the Lord Rosse being in rainy Ireland, his pioneer observations included first seeing spiral form in the Whirlpool Galaxy (M51) and naming M1 for its crab shell shape. Without knowing what it was, he called it the Crab Nebula.

Eighty years later, Mt. Wilson astronomers reversing the Crab Nebula's expansion rate of 930 miles a second, would fix its origin as the supernova of 1054. No other astronomical object would become so avidly studied by astrophysicists as the Crab Nebula supernova and its neutron star in the constellation of Taurus.

One of the first Mt. Wilson astronomers to encourage the search for neutron stars was the German, Walter Baade. Baade is remembered as a man who turned bad luck into good luck. In 1943 many astronomers were being inducted into military activity but Baade, a German, was excluded. As the remaining astronomer at Mt Wilson he had unlimited access to all the telescopes. He also benefited from a WWII blackout which reduced light pollution. It allowed him to study Cepheid variables in the Andromeda Galaxy. He also found a potential neutron star which he called Baade's star. The constellation of Taurus itself was always a center of interest as it was the location of the Vernal Equinox in ancient times. This was the time of planting and a bull had fertile significance. The bull's "horns" are formed by the V shape of the Hyades open cluster. This nearest of open clusters is crowned by a red giant star, Aldebaran. That means "the follower" of the Pleiades (M45) cluster. The Hyades were mythological half sisters of the young girls represented by the Pleiades. The Hyades, Pleiades, and Taurus are all mentioned in Homer's Iliad. These names are all very old. Epsilon Tauri or Ain (bull's eye) is just north of Aldebaran. An extension of this "horn" leads to Elnath (the butting one). Elnath butts into Auriga (the herdsman) and is often included in that constellation. The Auriga area also features bright open clusters M35, M36, M37, and M38.

So let's observe this cluster-rich area around Taurus. Its a bully time honored center of astronomical interest. Observe until real alien little green men send us a message or arrive on our doorstep.

Lee Collins