nightwatch

Newsletter of the Pomona Valley Amateur Astronomers

Volume 33 Number 2 *nightwatch* February 2013

President's Message

I love asteroids and comets. Not just because they are interesting objects to watch, either moving in their courses against the background stars, or flashing through the atmosphere as meteors, but because they remind us of the true nature of things. The ancients thought of the earth as here and the heavens as out there. We've known scientifically that that is not the case since Galileo at least, but it is still very easy to slip into the habit of thinking of "space" as a place, vaguely "out there", above our earthly concerns, and not as, well, all of the places, including Earth.

But then a comet zips by, or we have a near-miss with an asteroid, or see a brilliant meteor, and we are reminded that we are in the universe, part of it, and it is not done with us.

Humanity got two such reminders recently. We had known for a while that asteroid 2012 DA14 would pass very close to the Earth, and on February 15 it did so, zipping by just 17,000 miles above the surface of the Earth, closer than satellites in geosynchronous orbit.

Apparently by complete coincidence, just 15 hours earlier on the same day, a 10,000 kg asteroid entered the atmosphere over Russia and exploded with a force of 500 kilotons. The blast registered as a Richter scale 2.7 seismic event in Russia, and the shock wave was detected as far away as Antarctica. In Russia it damaged approximately 100,000 buildings, mostly in the city of Chelyabinsk, where the roof of a zinc factory collapsed and hundreds of people were hospitalized for injuries resulting from broken glass.

Although it is very tempting to think that the two asteroid events must be related, the two had very different orbits and trajectories, and their arrival on the same day was an amazing coincidence, but still just a coincidence.

I had my own close encounter with a meteor just a couple of days later. On the evening of Sunday, February 17, I was camping at the Salton Sea with my son, London. He had gone to bed and I had already packed up the telescope after tracking down a few Messier objects and double stars. It was about 11:20 and I was just looking out over the sea for a few minutes, relaxing and letting my mind wander. Suddenly the ground started to flash with light, and I looked up in time to see a brilliant meteor break up into several visibly flaming chunks and gradually fade out.

Now, on one hand, chances are almost nil that any given person will ever have any encounter with an asteroid or comet that goes beyond the purely visible. And yet, as Timothy Ferris pointed out in his book Seeing in the Dark, there is no roof over our heads, and the history of life has been rewritten more than once by impacts from deep space. The recent Russian meteor event was the largest such blast since Tunguska in 1908, which suggests that we can expect something on that scale about once a century on average. But it's the "on average" that should give us pause; the next one could arrive tomorrow. And then there are the 1000-year asteroids and 10,000-year asteroids to worry about, by analogy with 1000-year and 10,000-year floods. I am quite certain that humankind will have an asteroid detection and deflection program in the future. The only question is, will we get it up and running out of foresight, or because we literally get some sense knocked into us?

Our speaker this month is Tim Thompson, retired from JPL, and he'll take us a bit farther out with his presentation, "The Hubble Deep Fields." I hope to see you there!

Matt Wedel

Astrophysics: Neutron Stars

In this series we will look at some of the current thinking in astrophysics. Keep in mind that any new ideas must be tested and that takes decades. In science a theory can never be proven, it can only be falsified. Experiments are still being conducted in General Relativity and so far none have falsified the original theory therefore it is considered reliable. Most of what will be covered in this series has not been tested that much but does seem to be holding up fairly well.

For the first topic I thought it might be interesting to look at the aftermath of a supernova. Two possibilities can result; one is a black hole and the other is a neutron star. Neither can be observed directly but about forty years ago it was postulated that X-rays from accretion could be used to distinguish between the two. When particles fall onto a neutron star surface, X-rays are emitted but when they enter a black hole nothing is emitted. X-rays may also result from collisions within the accretion disk so the energy of the X-rays becomes the distinctive observation. Forty years is long enough to consider this distinction probably reliable. Orbiting X-ray telescopes seem to confirm this theory.

The Pauli Exclusion Principle states that no two fermions can occupy the same energy state and electrons are fermions. If a large number of electrons are pressed together the result is a plasma which is called an electron degenerate gas. This plasma then exerts a force outwardly against the compression.

In the same way that nuclear fusion keeps a star from collapsing, an electron degenerate gas prevents a neutron star from collapsing. But if the mass is great enough, gravity can overcome the outward pressure and the mass collapses into a black hole.

In 1930 an American-Indian astrophysicist, Chandrasekhar, calculated the maximum outward pressure that such a gas can generate. His conclusion was three solar masses. If the remnant of a supernova exceeds this limit, it will form a black hole.

When a supernova occurs nearly half can be thrown into space at escape velocity and will form the nebulas we enjoy. So some significant mass is not going to collapse back in. The limit is about five solar masses for the original star if it is going to produce a neutron star.

White dwarf doubles give us a good model of one way a neutron star can be created. The white dwarf may continue to accrete mass from its companion. Today's telescopes can confirm that the mass times the volume of a white dwarf remains constant as the mass grows. The dwarf is sustained by nuclear fusion at its center until the mass exceeds the outward force caused by fusion. At that point it collapses and a supernova is born. The implosion causes an explosion. Mass is thrown radially in all directions. Some will escape to form a nebula while some will, during the next few weeks, fall back in. If that is less than three solar masses, a neutron star is born.

The companion star is likely to be kicked into a new orbit as a result of the supernova. The neutron star only retains a portion of the mass of the former white dwarf, so the companion star will have a new orbit regardless. In that new orbit the companion star may or may not continue to feed the neutron star. If it does, an accretion disk will likely form around the neutron star and it will gradually grow. If the neutron star exceeds three solar masses, it will collapse into a black hole.

Ken Crowder

PVAA Officers and Board

Officers

President ….....	Mathew Wedel	909-767-9851
Vice President ..	Joe Hillberg	909/949-3650
Secretary	Howard Maculsay	909/624-1667
Treasurer	Gary Thompson	909/935-5509
VP Facilities	Jeff Felton	909 622-6726

Board

Lee Collins (2014)	626/852-9442
Ron Hoekwater (2014).........................	909/391-1943
Jim Bridgewater (2014)........................	909/599-7123
Karl Rijkse (2014)	909 428-1884

Directors

Membership / Publicity.........	Gary Thompson	909/935-5509
Outreach	Jeff Schroeder	818/298-3965
Programs	Ron Hoekwater	909/391-1943
Nightwatch	John Stover …...........	909/988-9747

Club Events Calendar

March 1 - General Meeting - Tim Thompson - "The Hubble Deep Fields"
March 9 - Star Party – Cottonwood Springs, Joshua Tree
March 14 - Board Meeting, 6:15
March 16, 2013, Sat., 1- 4pm, Claremont, Library Children's Festival
March 22 - General Meeting

April 6 - Star Party – Mesquite Springs, Death Valley
April 12, 2013 Mt. Wilson tour
April 18 - Board Meeting, 6:15
April 26 - General Meeting

May 9 - Board Meeting, 6:15
May 14 – Ontario Library Main Branch 7 – 9 PM
May 17 – General Meeting
May 22-27 - RTMC

June 8 - Star Party – White Mountain
June 13 - Board Meeting, 6:15
June 21 - General Meeting

What's Up? - Seven Super Starry Sisters

You've probably guessed this about the most famous star cluster in the history of our heavens, the Pleiades in Taurus. A 3,600 year old German bronze called the Nebra Sky Disk shows seven stars believed to be the Pleiades (M45). This is the oldest known depiction of any asterism. They are celebrated in every mythology. Tales about the Pleiades almost always see them as innocents gathered together in self defense. In many cases they're young sisters or birds or both. Australian tribes see them as girls protecting themselves against being raped by the Man in the Moon. American Indians have girls fighting off giant bears. In Japan their name Subaru means "united". This later became a car company that uses the stars as its logo. References to the Pleiades in literature from Homer to the Bible to Shakespeare to Poe to Tolkien are too numerous to mention. It's the only cluster whose brightest stars have names.

The group name of Pleiades comes from a Greek myth seeing them as daughters of Atlas and Pleione. The seven virgin sisters are Alcyone, Electra, Maia, Merope, Taygeta, Celaeno, and Sterope. That last one has a companion named Asterope by astronomers giving us a total of ten names. About 400 light years away they range from 2nd to 6th magnitude. The cluster has a thousand stars but only the brightest six are commonly visible with unaided eyesight. Why then are they Seven? Interestingly many cultures have a tale of a missing Pleiad The Greeks tell of Merope leaving to marry Sisyphus the famous workaholic who rolls a rock up a hill every day only to have it roll back down again. But the star Merope isn't a variable whereas the dimmer mother star Pleione varies unpredictably. Pleione rotates about 100 times faster than our Sun. This gives it a weird flattened appearance. Through the years it has ejected expanding gaseous shells that hide the star then eventually disperse. Also mother Pleione is so close to father Atlas that they can blur into one star without an optical aid. But is it the star that mythically comes and goes?

The cluster also has a nebulosity commonly seen in long exposure photographs. It resembles the thin wind ripped streaming of high cirrus clouds. The thickest nebulosity surrounds Merope and Maia. It might be the remnant of an original Orion Nebula form that gave birth to this young cluster of stars. This foggy nebulosity might also cause a variation in brightness, but the myth of a missing Pleiad remains mysterious.

Most stars in the Pleiades are very hot and blue white. Alcyone at 2nd magnitude is the brightest and is 1000 times more luminous than our sun. Brown dwarfs also exist but no ancient red giants.

An older and closer star cluster than the Pleiades is the Hyades just to the south. At 150 light years they're our closest open star cluster. They form the V shaped "horns" of Taurus the bull and are mythic half sisters of the Pleiades. The Hyades are five water nymphs with Greek names, but the names aren't given to the stars in the cluster. Probably this is because the older cluster has expanded into a loose structure which is less visually dramatic. There are few tribal myths about their clustering but their V shape as a bull's horns is considered bullish by almost all cultures. Both open star clusters have a highly expanding proper motion.

In the middle of the Hyades is the "bull's eye" star Aldebaran. Actually it's in front of the cluster at 68 light years. Aldebaran means "follower" in Arabic since in rising it follows the famous Pleiades. It's the 13th brightest star in our sky, and a red-yellow giant so large that if our sun were a tennis ball it would be the size of a tennis court.

Another super star object in bully Taurus is M1, the first fuzzy to be recorded by Charles Messier in 1758. This odd looking supernova remnant is what inspired Messier to begin his star catalogue of deep sky objects. In 1840 pioneer telescope builder the Earl of Rosse saw it as having a crabby shape and named it Crab Nebula. The history of its origin are revealed in the ancient records of Chinese and Arab observers. In 1054 A.D. it was "guest star" that brightened to -7 magnitude then slowly faded away into a dim but expanding gas cloud. Now having exhausted its supply of nuclear energy the originally massive star has collapsed to form a rotating pulsar. Radio telescope "signals" in the 1960's at first suggested the presence of an alien civilization trying to communicate in regular pulses. But now these pulses are known to come from small rotating neutron stars whose emissions are focused into narrow beams like powerful lighthouses. The Crab Nebula (M1) is known to contain a prime example of a pulsar or pulsating star. So it is that horny Taurus sports many super stars.

Lee Collins