ASTROTENT

November 2009

NYAA Meeting October 20, 2009

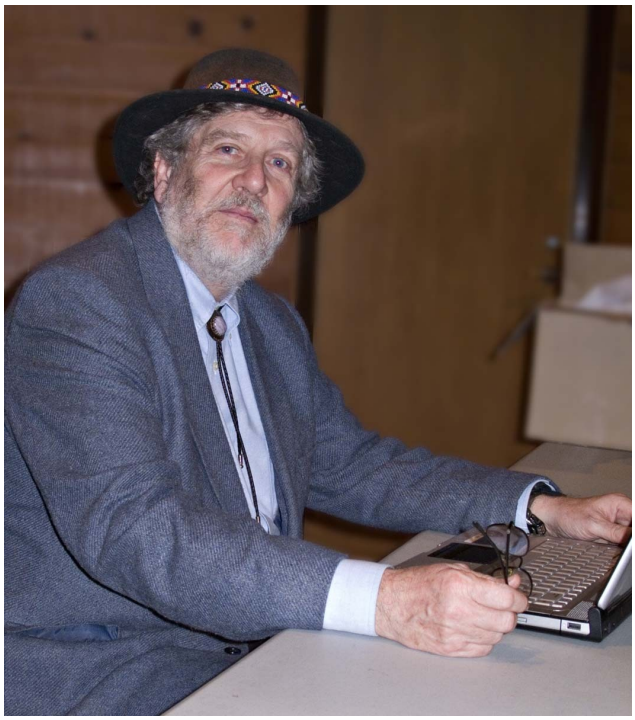
Andreas opened the meeting by showing a time lapse sequence of photos of the conjunction between Mercury, Saturn and Venus taken on several consecutive (or not so consecutive, as dictated by the weather) mornings. To achieve a more balanced exposure as the morning sky brightened, Andreas set his camera to Aperture Priority and allowed the camera to choose the appropriate shutter speed. The speeds ranged from several seconds at the beginning to "instantaneous" at the end of the sequence.

Image by Andreas Gada

Malcolm Park provided a brief recap of the Starfest wrap-up meeting, held at Norm and Ingrid's. John Merchant presented an irreverent slide show of the meeting highlights. Planning for Starfest 2010 gets underway on November 24th at a meeting at Rick and Cathy's. Bring your ideas for next year's theme.

Image by Bill O'Brien

Bill O'Brien showed a few astro images – M33, Crab Nebula, Horsehead nebula and M42. All images were obtained with a TV102 on a Celestron CGE mount using a SBIG ST2000XCM camera. The Orion Nebula image was taken using AO-8 adaptive optics. It is a stack of 5 x 10 minute, 10 x 15 seconds and 20 x 5 second exposures.



Patrick McDonald

The evening's featured speaker was Patrick McDonald. Patrick spoke about the Citizen Sky Project. This is a project to obtain magnitude estimates of the variable star ε Aurigae. This star undergoes a significant dimming approximately every 27 years, dropping from its normal 3.0 magnitude to about 3.8 over a time span of several months. The star's variability was discovered in 1821 and confirmed in 1847. The light curves obtained over the next 4 eclipses showed very strange behaviour. The time of minimum and degree of central brightening was increasing, while the overall length of eclipse was decreasing. The current thinking is that the parent F-type star is orbited by a binary system which is surrounded by a toroid of dust. The binary system comprises of two B-type stars in a tight orbit, separated from the primary by 27 AU. The dust toroid blocks some of the primary's light as the binary pair passes into our line of sight. Obtaining a good light curve may yield information about the extent of the toroid as well as the size of the central opening. There have been noticeable changes in the past two eclipses. High quality data from this eclipse could show how the dust disk is evolving. The dust disk temperature is estimated to be about 500 Kelvin and the mass of the disk plus companion stars is about 14 solar masses. There is a tantalizing possibility that the centre of the toroid is being swept clear by a planetary body.

Epsilon Aurigae is located near "The Kids" in Auriga and is normally brighter than either of those two stars. Currently epsilon is at magnitude 3.4 and dimming. If you would like to participate in the Citizen Sky Project you can find more information at www.citizensky.org. Follow the links from there to take a 10-star tutorial to help you learn about making magnitude estimates on variable stars. If you are interested in photometry, you can find more information at www.hposoft.com.

Maureen

Lance

Malcolm

NYAA Meeting November 3, 2009

Dave and John

The November meeting was well-attended, with the usual suspects in attendance. Bruce brought along his son James and we also had first-time visitor Kiron.

Glenn reminded members that Sky and Telescopes should now be renewed on-line. You can contact Glenn about Astronomy magazine subscriptions.

Malcolm stepped in for the absent Maureen to give a report on sky events for the next month or so. The highlight is the Leonid meteor shower on November 17/18. The peak is predicted to occur around midnight on November 17th as the Earth passes through a debris stream of parent comet 55P/Tuttle. This is the stream that produced the1466 Leonid "rainstorm". Leo rises at about the time of the predicted peak and is high in the eastern sky by about 3 AM. Mars, shining at magnitude 0.3, will make for a pretty vista. The absent Moon will give us a truly dark sky – as long as you're away from city lights!

Cathy gave us a "heads-up" on the Geminid shower, on December 12th. The radiant rises in the early evening and remains visible through the whole night. The Moon, a couple of days before New, rises around 5AM and will not interfere.

Andreas showed a time lapse move of a mostly clouded-out Moon-Jupiter conjunction. He took several thousand images over a three hour period and assembled the best into a movie. His intent was to show the relative motion of the Moon with respect to Jupiter. The near constant cloud cover prevented that, but he did make a composite using three images which showed the same thing in one frame. As one meeting attendee observed, he could have saved 5% of his camera life by taking only those three frames.

Ivan Semeniuk

The evening's featured speaker was Ivan Semeniuk. Ivan is the journalist-in-residence at the Dunlap Institute of the University of Toronto. Prior to beginning his presentation Ivan remarked that the Mars opposition of 2010 will be the first since 2001 that a spacecraft is not en route to the red planet – the Phoenix lander (with the Canadian lidar) in 2007, the Mars Reconnaissance Observer in 2005 and a pair of over-achieving rovers in 2003.

Ivan presented an episode of a show called Cosmic Vistas which he produced for Oasis TV. In these shows Ivan creates a narrative around high-definition images from Hubble or other spacecraft. This particular episode showcased the moons of Jupiter and Saturn. The first part dealt with the differences between Jupiter's Galilean moons. Io is the most geologically active body in the solar system as a result of tidal

heating from the gravitational forces exerted by Jupiter and the other three large moons. Callisto's ancient cratered surface was contrasted with the younger and reworked surfaces of Ganymede and Europa. Both these moons show evidence of a liquid water layer under the surface. Ganymede's water may be buried several hundred kilometres deep, but Europa may have a global ocean only a few kilometres beneath its icy surface. There is some warranted speculation that Europa's underworld may be a cauldron for alien lifeforms.

The second part of the episode concentrated on Saturn's smog-shrouded moon Titan. The Voyager spacecraft gave the first glimpse of the only moon in the solar system with a significant atmosphere. Detailed images did not come until the arrival of the Cassini spacecraft and the Huygens lander. Cassini's radar imager penetrated the clouds to show a landscape dotted with methane lakes. The Huygens lander beamed back pictures of landforms seemingly shaped by flowing liquid. The lander survived impact to send a photo of the actual surface, showing rounded pebbles strewn across the landscape. At the conditions on Titan's surface, ordinary water ice is as hard as rock and the water analogue is liquid methane.

Ivan gave a brief recap of his trip to Palo Alto to witness the impact of the LCROSS satellite and rocket stage into a permanently shadowed crater in the Moon's polar region. The impact was less than spectacular, but the “human stories” more than made up for it as NASA officials tried to put a brave face forward when the expected debris plume failed to live up to expectations. The plume kicked up by the rocket stage impact would have had to rise at least a kilometre to be seen by LCROSS. The moon's gravity and geometry of the ejecta likely limited the vertical rise of the debris.

The big things such as exoplanet discoveries and the search for dark matter get a fair amount of exposure in the public press, but Ivan wanted to take a look at a couple of lesser-known areas in the second part of his presentation. The first is the contention that the Universe is a hologram.

One of the mathematical discoveries regarding black holes is that the information in a black hole is proportional not to its volume, but to the area of its event horizon. If you make the not-so-outrageous contention that we are inside the event horizon of the Universe, considered as a black hole, then all the information in the universe is proportional to the surface area of this event horizon. Now make the leap that matter and energy are just forms of information, then a description of the event horizon is equivalent to a description of the entire universe. That is, the 3-D universe is described by its 2-D surface, in the same way that a 2-D hologram reconstructs a 3-D image.

In a photographic hologram the reconstructed image is somewhat grainy. There is an analogue in the reconstructed 3-D universe: it has graininess on a quantum scale. Theoretical predictions show that this graininess should manifest itself as “noise” on a gravitational wave. It turns out that there is a gravity wave detector in Germany, the GEO 600, which is just the right size to detect this noise. And as it turns out, they have noise in their data! So is this just instrument noise? Or is it a tell-tale signal that we are living in a hologram? The universe may not be as deep as we think it is.

Ivan also spoke about another area of research: the existence of a force between dark matter particles. Ordinary matter can shed energy in the form of heat and light, but dark matter is thought to already be in its lowest energy state. Data from the WMAP satellite, which measures the cosmic microwave background at very fine scales, show an overall signal excess, or haze. The FERMI gamma ray satellite also shows an excess of high energy electrons toward the galactic core, where dark matter is thought to be more abundant. One explanation is that these dark matter particles are their own anti-particles, so will self-annihilate if two collide. The decay products include high energy electrons and

this, through various processes, end up providing the excess signal seen by both WMAP and FERMI, one in the microwave regime and the other at gamma ray energies. Researchers are not all jumping on the bandwagon, but neither are they rejecting the hypothesis out of hand.

If dark matter particles can in fact interact, this raises the possibility that there is a force, called the dark force, which mediates the interaction. This in turn indicates that there is a mechanism whereby dark matter can shed energy and so may be able to coalesce into macroscopic objects, in the same way that interstellar gas and dust form into stars. And this leads to the thought that the early universe may have had a population of dark matter stars.

Aside from the FERMI and WMAP data, there is also some evidence of interaction between dark matter and ordinary matter in the form of a sinusoidal oscillation in the data from DAMA, a DArk MAtter detector located in Italy. If dark matter pervades the galaxy then the solar system is moving through this material. As the Earth orbits the Sun, its speed relative to the dark matter will change. So if, and it's a big if, dark matter interacts with ordinary matter then the degree of interaction will cycle on an annual basis. The data from DAMA show just such annual change. Is this change evidence of dark matter interaction?

You can get Ivan's blog and download his podcasts at www.theuniverseinmind.com or pick him up through the Sky and Telescope website www.skyandtelescope.com.

Scenes from a Wrap-up

by John Merchant