SkyWAAtch

Coat Hanger Asterism

Rick Bria took this picture of the Coat Hanger asterism. It is a 2-1/2 minute exposure taken at the Mary Aloysia Hardey Observatory on September 15, 2011. Rick used a 76mm TeleVue Refractor with a field flattener, and a Canon T1i(a) modified camera. He assembled the image in Maxim DL5 and processed it in Photoshop CS5.

Notes Rick: The Coat hanger asterism is not a star cluster or constellation, but a random group of stars that form a 'picture'. The stars that form the Coat Hanger are about 400 light years away. It can be found with binoculars high in the west this time of year in the constellation Vulpecula (the Fox). The Big Dipper is another good example of an asterism. The Big Dipper is not a constellation. It is a small part of the constellation Ursa Major (the Great Bear). There are 88 official constellations, asterisms are not officially recognized but have names that 'caught on' due to their interesting shapes. Just off to the right of the Coat Hanger is a small faint patch of stars. It is a true star cluster cataloged as Herschel H14-6 (NGC 6802). H14-6 is thousands of light years distant and contains hundreds of stars.

Events for November 2011

WAA Lectures

"The World's First Telescopes to Focus Hard X-rays in Space -- Built in Westchester."
Friday November 4th, 7:30pm
Miller Lecture Hall, Pace University
Pleasantville, NY

Our presenter will be X-ray astronomer Dr. Jason Koglin. He is a Research Scientist at the Columbia Astrophysics Laboratory where he investigates a variety of astrophysical phenomena through the development of instrumentation for balloon-born and satellite missions. Dr. Koglin will discuss the development of NASA's NuSTAR telescope, scheduled to launch in February 2012. Free and open to the public. Directions and Map.

Upcoming Lectures
Miller Lecture Hall, Pace University
Pleasantville, NY

On December 2nd, science writer Dava Sobel will be our speaker. Her numerous books are described on her homepage: http://www.davasobel.com/index.php. Our January presenter will be Andy Poniros, who will speak on "The Icy Moons of Saturn."

Starway to Heaven

Saturday November 19th, 6:30pm
Meadow Picnic Area, Ward Pound Ridge Reservation, Cross River

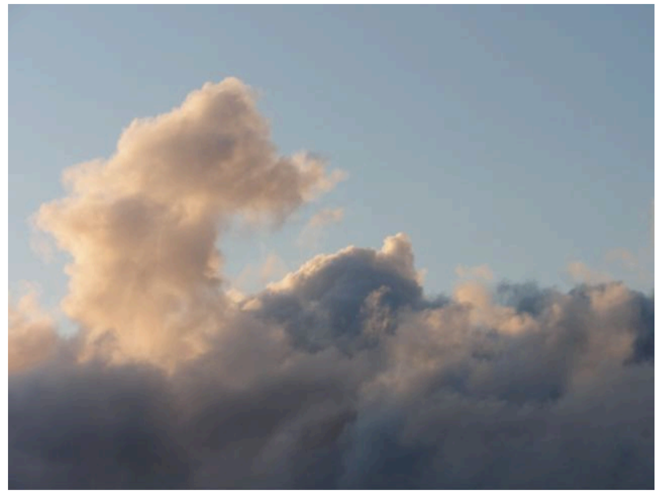
This is our scheduled Starway to Heaven observing date for November, weather permitting. Free and open to the public. The scheduled rain/cloud date is November 26th. Participants and guests should read our General Observing Guidelines and Directions.

New Members. . .

Alex Cohen - Tarrytown

Renewing Members. . .

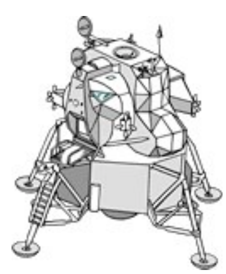
Sharon and Steven Gould - White Plains
Frank Jones - New Rochelle
Olivier Prache - Pleasantville
MaryPat Hughes - Briarcliff Manor



Horsehead Cloud Nebula

Lori Wood took this photo of a cloud formation over Cape Cod Bay. She used a Sony Cyber-Shot digital camera. The formation bears an uncanny resemblance to the Horsehead nebula in Orion.

WANTED Co-editor: Individual to help edit the WAA newsletter. Initial responsibilities to be proof-reading, but eventually seeking someone to co-edit newsletter. Knowledge of Apple Pages would be helpful. Contact: Newsletter.



Westchester Amateur Astronomers, Inc., a 501(c)(3) organization, is open to people of all ages with the desire to learn more about astronomy. The Mailing address is: P.O. Box 44, Valhalla, New York 10595. Phone: 1-877-456-5778. Observing at Ward Pound Ridge Reservation, Routes 35 and 121 South, Cross River. Annual membership is $25 per family, and includes discounts on *Sky & Telescope* and *Astronomy* magazine subscriptions. Officers: President: Doug Baum; Senior Vice President: Larry Faltz; Vice President Public Relations: David Parmet; Vice President Educational Programs: Pat Mahon; Treasurer: Rob Baker; Secretary/Vice President Membership: Paul Alimena; Vice President Field Events: Bob Kelly; Newsletter: Tom Boustead.

Articles and Photos

Hold On to Your Hat, Universe
by Larry Faltz

The last few weeks brought two news items of interest to those of us who are helplessly fascinated by the problem of understanding how the universe is made.

Accelerating Expansion

The Nobel Prize committee announced on October 4th that the prize for physics was awarded, not unexpectedly, "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae". Half the prize went to physicist Saul Perlmutter, who heads the Supernova Cosmology Project based at the Lawrence Berkeley National Laboratory at the University of California, and the other half was divided between astronomers Brian Schmidt (Australia National University) and Adam Reiss (Space Telescope Science Institute) from the High-Z Supernova Search Team, based at the Harvard-Smithsonian Center for Astrophysics. Observing Type Ia supernovae in distant galaxies (42 by SCP, 16 by High-Z, as reported in their initial papers), the two groups announced in early 1998 that the rate of expansion of the universe, previously thought to be decreasing, was in fact increasing. The race for right of discovery is detailed in a wonderful book, *The 4% Universe* by Richard Panek (2011). This book is highly recommended to anyone who has even a passing interest in cosmology or astronomical research. In addition to a clear and erudite explanation of the science, Panek gives a real flavor for the competition between the two groups, the impact of unexpected results on the scientists' thinking and whether every player in the drama was wholly honorable under the pressure of being first. Panek provides a detailed analysis of the timing and content of the groups' original announcements, at research conferences in 1997-1998, which were sufficiently couched, for fear of prematurity or error, to make it unclear to this day who actually won the race.

Hubble's proof in 1929 that the universe was expanding caused Einstein to regret his inclusion of the "cosmological constant" Λ (lambda) in the field equation of general relativity

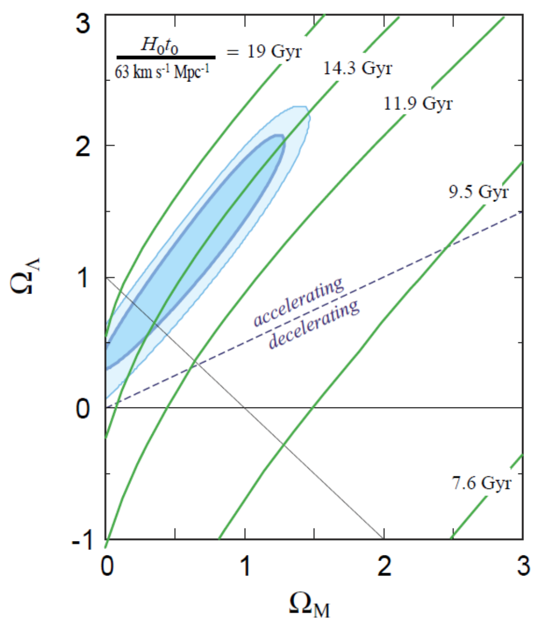
$$R_{\mu\nu} - \tfrac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

where $R_{\mu\nu}$ is the Ricci tensor (relating to the dynamics of the curvature of spacetime), R the scalar tensor (the absolute amount of curvature), $g_{\mu\nu}$ the metric tensor (relating to the gravitational field), $T_{\mu\nu}$ the stress-energy tensor (density and flux of energy and momentum in spacetime, and therefore the source of the gravitational field), G the Newtonian gravitational constant and c the speed of light. Don't ask me to explain the details further: my tensor calculus was primitive at best and now lost in the distant past.

The Λ term was needed because Einstein believed that the universe was static. The implication of the field equation is that since matter attracts itself (as Newton showed), the universe would have to collapse. But the universe is here, right? So a counterbalancing repulsive force was needed to make everything stable. Λ supplied that force: it is the "energy of the vacuum", a repulsive "anti-gravity" at every point in space. When Hubble's results became known, Einstein famously said that the cosmological constant was "the biggest blunder of my life" (he must have forgotten by then about his dreadful first marriage). Λ would no longer be needed (that is, its value could be set to zero) because the Big Bang provides the force necessary for expansion. Observational cosmology then turned to the "matter density" problem: will the gravitational force of all the mass in the universe, which must inevitably slow down the expansion, be enough to completely overcome the outward push from the Big Bang and result in a "Big Crunch"? Or, is the amount of mass insufficient, resulting in an ever-slowing but never zero expansion? Inflationary cosmology suggests that the amount of matter is very close to the "critical density", which is about 10^{-30} grams/cubic centimeter. Determining the rate of slowing was the goal of both research teams.

Type Ia supernovae are "standard candles" with known luminosities, so correlation of their brightness with galactic distance based on redshift (reflecting their age relative to our present epoch) could permit the "deceleration parameter" and therefore the matter density to be determined (this technique was originally suggested by Baade in 1938). But each team's results showed the opposite: there was an *acceleration* parameter, in other words, a positive Λ. This is the now-famous "dark energy".

Both groups' papers are on the web. They are, as expected, extremely complicated and intended for professional astronomers and cosmologists. But one figure from Perlmutter's paper gives some idea of the result.



This graph correlates the mass density Ω_M and cosmological constant energy density Ω_Λ plotted against values for the age of the universe estimated from the value of the Hubble constant at the time the paper was published (before WMAP established the age as 13.75 ± 0.13 billion years and the Hubble constant to be around 70 km sec^{-1} Mpc^{-1}). The data, in the blue ovals, require Ω_Λ to be greater than 0, which forces expansion to accelerate. Correction of the age and Hubble constant to current values doesn't change the results.

The experimental results suggest a value for Ω_Λ of ~0.7. But if the source of vacuum energy is the spontaneous creation and annihilation of matter-antimatter particles, as predicted by quantum mechanics, the value ought to be somewhere around 10^{120}. That's 120 *orders of magnitude* larger, an as yet unexplainable difference. A number of recent books, including Panek's, explore this problem (some also address the logical conundrums posed by cosmic inflation, the period of exponential expansion that is thought to have occurred around 10^{-35} seconds after the Big Bang). Some of the speculation is truly wild, like the idea of the "multiverse", where there's a separate universe for every possible value of Λ.

Tachyonic Neutrinos

On September 22nd, physicists from the OPERA experiment (Oscillation Project with Emulsion-tRacking Apparatus) at the Gran Sasso National Laboratory in Italy announced the detection of superluminal neutrinos. They were able to time the flight of neutrinos coming from CERN in Geneva, some 730 kilometers away. The team claims to have measured the distance between the emitter and their detector to an accuracy of 20 cm, and they can time events down to 10 nanoseconds. Although originally designed to detect the transformation of muon neutrinos into tau neutrinos, as predicted by the Standard Model (see below), in 2 years the experiment detected 16,000 neutrinos that arrived 60 nanoseconds faster than expected if they were traveling at the speed of light, with significance better than 6 standard deviations. This is a remarkable and unprecedented result if true. Einstein's special theory of relativity makes *c*, the speed of light, the limiting velocity for any particle, with or without mass. How could a particle go faster?

The first possibility, and the most likely (but least interesting) is that the experiment is simply wrong, and that there is a systematic error in the equipment, data or analysis. The main objection is based on the prediction of general relativity that clocks slow down as gravity increases (this effect is taken into account in the GPS system). Since CERN is slightly closer to the center of the earth than Gran Sasso, there is a slight difference in the rate of time measured by the clocks at each site, and perhaps there was inadequate correction for this effect. Another suggestion has been that there are fluctuations in the neutrino beam that were not accounted for properly. Nevertheless, in the few weeks since the result was announced, more than 30 papers have appeared trying to explain the effect as real.

One suggestion is something called "the standard model extension", or SME. The Standard Model of particle theory describes the interactions between fundamental particles and forces (the electromagnetic, strong and weak forces) but has the critical defect of not incorporating gravity. SME, initially proposed by Don Colladay and Alan Kostelecký in 1997, incorporates aspects of gravity and allows for "background fields" in the fabric of space that could give it a "preferred direction". If those fields interact with neutrinos but not photons, the neutrinos might be accelerated, yielding the experimental result.

To me, this looks like an analog of the late, lamented ether, but coming up with a neutrino Michelson-Morley experiment would take some doing, since detecting interference between neutrino beams seems impossible with today's technology. SME is far from being accepted. The Standard Model itself, with its many arbitrary parameters and lack of gravity, is generally agreed to be only a structure for making predictions, close to but not exactly the actual description of nature. This is one of the major reasons there is so much interest in string theory.

Another thought is that neutrinos might be capable of moving through one of the additional dimensions of spacetime that exist in a universe structured according to string theory, and somehow this gives them a spacial short-cut. String theory requires 6 or 7 additional spatial dimensions that are "compactified" at the Planck scale (10^{-33} cm) at every point in space. Don't try to visualize it yourself; read Brian Green's excellent *The Fabric of the Cosmos* (2004) or Shing-Tung Yau's *The Shape of Inner Space* (2010). The idea that some subatomic particles can interact with additional dimensions is one of the possible sources of dark matter (along with WIMPs and MACHOs). It has been proposed that gravitons, theoretical carriers of the gravitational force, leak from an adjacent dimension to ours and create gravitational dark-matter effects. Why couldn't a similar mechanism work for neutrinos?

But I had another theory, one that I fancied might be original (stimulating pleasurable fantasies of myself in white tie and tails chatting with the King of Sweden) until I found a 1998 paper by Steven Weinstein of the Perimeter Institute for Theoretical Physics in Canada. What if there are multiple time dimensions? Then, perhaps, certain particles can "move" (a better term might be "exist") among them, and when timed by clocks in "our" time dimension might appear to be moving faster than light. If true, this would really rock the world of theoretical physics. One wonders, for example, if such a theory could be invoked to explain the non-locality of quantum entanglement, which Einstein, Podolsky and Rosen termed "spooky action at a distance" in their famous 1935 paper.

The idea of multiple time dimensions doesn't seem to have had much traction in the world of theoretical physics, but it's out there, and perhaps one day its time (or multiple times) will come.

"2012 Sky Events"
by Bob Kelly

Heads UP! for 2012: Planning your astronomical year (and perhaps your vacation location) for 2012.

Venus steals the show in every possible way this year.
Mars finally comes to opposition in March.
Saturn's rings opening wider.
Jupiter starts and ends the year in the evening sky.
No solar or lunar eclipses this year for our area.

March 3: Mars at opposition (rises at sundown, overhead around midnight). Well placed in the sky for us, but not a close opposition. Mag -1.2, diameter 13.9". Watch summer come to Mars' northern hemisphere as the bright northern polar cap and associated clouds decrease late in 2011 and early 2012.

March 14: Venus and Jupiter, approaching each other in the evening sky since October 2011, are at their closest. The two brightest planets 3 degrees apart, 25 degrees up in a dark sky in the evening will be the outstanding astronomical event for the general public in 2012*.

March 27: Crescent Moon near Pleiades.

March 27: Venus at greatest elongation - 46^0 east of the Sun, 25" wide and half-lit. With Mercury 18^0 east of the Sun on March 5th, and Jupiter nearby, it's a good month for daytime observation since they will be following the Sun across the sky.

April 15: Saturn at opposition. Mag 0.2, diameter 19.1".

April 21-22: Lyrid Meteor Shower: New moon will provide favorable viewing.

May 20: Annual solar eclipse path starts in China and Japan and ends at Grand Canyon just before sunset. Not visible from Westchester.

June 4: Partial Lunar Eclipse: Only the Penumbral portions are visible here. Better further west.

June 6: Transit of Venus. The not-to-be-missed event for astronomers in 2012. Visible here late afternoon (time of greatest chance of clouds from afternoon convection). Overhead in Hawaii. Next transits of Venus are in 2117 and 2125.

August 12-13: Perseid Meteor Shower. Moon will rise about 1 am, 30% illuminated, giving some interference.

August 24: Neptune at Opposition. Mag 7.8, diameter 2.5".

September 29: Uranus at Opposition. Mag 5.7, diameter 3.6".

November 13: Total Solar Eclipse – northeastern Australia at sunrise and across Pacific Ocean.

November 16-18: Leonid Meteor Shower, 1-3 day old moon will not interfere.

November 27: Venus and Saturn 1 degree apart in the morning sky.

November 28: Penumbral Lunar Eclipse. Visible only to our west.

December 3: Jupiter at Opposition. Mag -2.8, diameter 48.4".

December 12-14: Geminid Meteor Shower. New moon will not interfere.

Mayan thirteen b'ak'tun ends on December 21 2012. WAA will continue its lectures and star parties in 2013 if the world is not destroyed.

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Days with astronomically-enhanced high tides due to alignment of the Moon, Earth and Sun near times when Moon is closest to Earth for the month:
April 6: Full Moon 21 hours before perigee.
May 5: Full Moon less than one hour after perigee and closest lunar perigee for 2012.
October 15: New Moon 13 hours before perigee.
December 13: New Moon 9 hours after perigee.

Next total solar eclipses for the eastern US: August 21, 2017 in South Carolina and April 8, 2024 in western New York. Next partial eclipse visible from Westchester on November 3, 2013, maximum at sunrise. Then October 23, 2014, starting at sunset.
Next total lunar eclipse visible from the eastern US is April 15, 2014.

*As always, stay alert for transient phenomena such as comets, supernovae or near-Earth asteroid passes.
Data from various sources, particularly NASA's SKYCAL, where you can make your own calendar.

Thanks to Larry Faltz, who added some of his favorite events to the list!

Almanac

For November 2011 by Bob Kelly

Nov 2 Nov 10 Nov 19 Nov 25

November is a "sweeps" month for determining which TV shows dominate their time periods. This November, Jupiter dominates the evening sky in Prime Time. Maxing out at magnitude minus 2.9 and 49 arc seconds wide, its cloud bands show details in moderate-sized telescopes and four moons look like distinct worlds of their own, detectable even in steadily held binoculars. The moons are hardest to find, closest to Jupiter on the 7th. Our Moon passes by on the 8th and 9th to show who really is the brightest light in the night. The pairing is a photo opportunity for any camera, maybe even a smart phone!

Venus blazes low in the western sky and points the way to Mercury though mid month. If you look low in the southwest, right after sunset, Venus at magnitude minus 3.8 but only 11 arc seconds wide continues its climb into the twilight sky. Venus is brighter than Jupiter, but its position in the murk near the horizon dims its brilliance. Mercury (mag minus 0.3, 6 arc seconds) flies in formation two degrees below Venus through the 15th, visible in binoculars at first and without optical aid by the end of the second week of the month.

Mercury gets 22.7 degrees away following the Sun in the sky, with Venus 24 degrees out, for advanced observers who can carefully pick the inner planets out of the daytime sky. Their small sizes will make it even harder than usual to pick out details. Mercury comes to the end of his gravitational leash and, seemingly exhausted, falls back out of the evening sky after mid-month.

This month, you can see both Venus and Jupiter on opposite sides of the sky right after dark. Venus will make up for its slow progress into the evening sky by making a spectacular approach to Jupiter over the next five months.

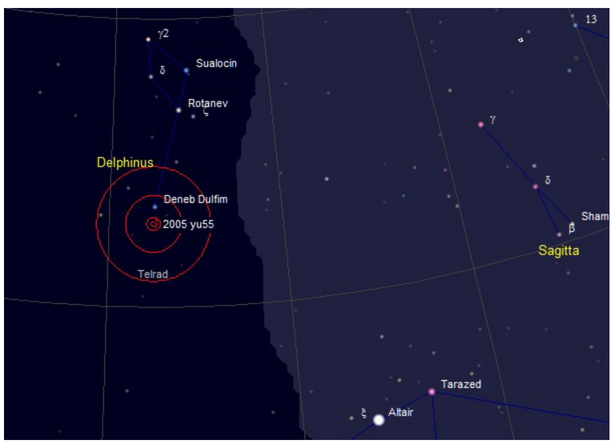
Mars brightens up to magnitude +0.7 well up in the southeast before dawn. At only 7 arc seconds wide, Mars is still small in a telescope, but the north polar cap and the clouds around it are visible as a white dot contrasting with the rest of the tiny ruddy disk. Without a telescope, we can compare Mars' color with the nearby mag +1.4 star, Regulus, at the front paw of Leo.

With rings open to 14 degrees from edgewise, Saturn would be great to see, but the morning twilight's first gleaming makes it hard. As the month goes on, Saturn, at mag +0.7 and 16 arcseconds gets up earlier to make the rings easier to see in a telescope. The shadows of the rings on the planet aren't visible from Earth, but check out the photos from the Cassini probe showing the bands of shadows on Saturn.

Uranus, at mag 5.8 and 3.6 arc seconds, and Neptune, at 7.9 and 2.3, are well placed for evening viewing after dark.

Comet Garradd is a mag 6ish fuzzball in binoculars in the evening sky a ways down from the keystone of Hercules. In a wide-field telescope, a short tail is noticeable. We'll have the pleasure of Garradd's company in our skies through mid-March.

Nov. 8, the Earth-Moon system gets a visitor, only ¼ mile wide, passing inside the orbit of the Moon, but with no chance of hitting the Earth. Romantically named 2005 YU55, it's small in the sense of the solar system, but would be a really bad day for people if it ran into Earth, at least around the 2 to 4 mile-wide crater. You can find out how bad at http://impact.ese.ic.ac.uk/ImpactEffects/ . But folks with dark skies and a 3 inch or larger telescope may be able to catch our fly-by-night visitor sliding across our sky. This is an event where our part of the world has a good view (for once). If you can spy this 11 ½ magnitude rock, it will move the width of Jupiter in 7 seconds, or the width of the Moon in about 4 minutes, making it a little easier to see. About 6:45 EST, I hope to stake out this elusive rock by watching the pointed end of the five star constellation Delphinus, which will be one of the brightest stars near the projected path of this very dark rock.



A more conventional and observable asteroid, number 15 Eunomia, reaches mag 7.9, its brightest for the year, in Perseus.

The Leonid meteor shower peaks on the morning of the 18th; check it out while looking at Mars, but bright moonlight will make them hard to see.

The Moon makes its monthly rounds: past Jupiter on the 9th, Mars on the 18th, and Saturn on the 22nd. A very thin moon is hard to see to the right of Venus on the 26th. The Moon makes the ultimate house call with a partial eclipse of the Sun on the 25th for viewers of the midnight sun in Antarctica and nearby parts of South Africa and New Zealand.

During the darker, moonless times of the month, the starry background has its subtile charms. The Andromeda Galaxy is overhead in the evening sky. Just imagine a time-lapse movie of the next couple of billion years as Andromeda approaches our Milky Way. Not something to worry about for a very long time.

The "W" or "M", depending on your point of view, of Cassiopeia, is the home of many star clusters. Just pull up a reclining chair or picnic bench, grab the binoculars, and a slow scan through the W will show lots of sparkles. If you want turn-by-turn directions, my favorite book for this is Turn Left at Orion, which devotes six pages to diagrams of open clusters around the big W. The clusters' details are enhanced using a telescope at the lowest powers and widest views.

Sightings of the International Space Station this month occur in the evening sky through the 9th and in the morning sky from the 15th onward.

Daylight time ends on Sunday morning, the 6th, moving sunrise from 7:31am EDT on the 5th to 6:32am EST, making it harder to show fellow commuters the morning planets and the waning Moon on the way to work.

Bob's Heads UP! blog is at:

http://bkellysky.wordpress.com/