Delmarva Stargazers Meeting Nov. 3 2009

Recorded by Jerry Truitt, Mike was absent I did these the next day by memory which is failing.

President Don Surles brought the meeting to order at 19:00 hours.

Don introduced our guest speaker Dr. Harry Shipman professor of astronomy and physics at UDel.

Also in attendance was a lady with an antique binocular to show us. She was also interested in getting access to our Yahoo group.

Old Business

- Halloween – It was a bust, completely clouded over so no one was able to show anyone the stars that night.
- Orionides – Don, Dave and some others looked but did not see any.
- Out Reach Events:
    - Lyle has an event which goes twp days, first is Nov. 4 during the day and the second is Nov. 17 at night.
    - Don has one Nov. 20th at Ocean City's Frontier Town, several club members are helping with that one.
    - Jerry has the Pittsville MD Library Nov. 21 and may have some help left over from Friday.
    - Jerry also has the Elkton Central Library Dec. 7th.

First presentation Tony Mullin on Stellar magnitudes:

In astronomy, **magnitude** refers to the logarithmic measure of the brightness of an object, measured in a specific wavelength or passband, usually in optical or nearinfrared wavelengths.

• **[edit] Origin and why bright objects are negative magnitude, dim objects positive**

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• It traces to the Greek astronomer Hipparchus (or the Alexandrian astronomer Ptolemy—references vary). He classed stellar objects on how bright they appeared — the brightest were "magnitude 1", the next brightest were "magnitude 2", on down to "magnitude 6", the faintest he could see.

• Thus the scale is roughly 2000 years old.

• Absolute scale based on Vega

• The star Vega is defined to have a magnitude of zero, or at least near. Modern instruments as bolometers and radiometers give Vega a brightness of about 0.03. The brightest star, Sirius, has a magnitude of −1.46. or -1.5.

• Problems

• The human eye is easily fooled, and Hipparchus's scale has had problems. For example, the human eye is more sensitive to yellow/ Red light than to blue, and photographic film more to blue than to yellow/red, giving different values of visual magnitude and photographic magnitude.

• When we use precise instruments to actually measure light from stars, we find a rough multiplicative factor of 2.5 between (closer 2.512, the 5th root of 100), i.e., a

magnitude 2 star is roughly 2.5 times less bright than a magnitude 1 star, and so on, thus the scale is logarithmic, not linear.
• The use of the 5th root of 100 is difficult in computations as it is an irrational number. Furthermore, many people find it counterintuitive that a high magnitude star is dimmer than a low magnitude star.
• The modern world
• Astronomers can now measure differences as small as one-hundredth of a magnitude. Stars between magnitudes 1.5 and 2.5 are called second-magnitude; there are 20 stars brighter than 1.5, which are first-magnitude stars.
• Apparent and absolute magnitude
• Two specific types of magnitudes distinguished by astronomers are:
• **Apparent magnitude**, the apparent brightness of an object. For example, Alpha Centauri has higher apparent magnitude (i.e. lower value) than Betelgeuse, because it is much closer to the Earth.
• **Absolute magnitude**, which measures the luminosity of an object (or reflected light for non-luminous objects like asteroids); it is the object's apparent magnitude as seen from certain location. For stars it is 10 parsecs (32.6 light years). Betelgeuse has much higher absolute magnitude than Alpha Centauri, because it is much more luminous.
• Usually only apparent magnitude is mentioned, because it can be measured directly; absolute magnitude can be derived from apparent magnitude and distance using the distance modulus.
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What this means to star gazers

• If one finds the brightest stars it will help us orient us with the sky. It helps us find constellations. If we know Vega and Arcturus are the two brightest stars we con make sense of our planisphere. We can find Lyra and Bootes from there we can find other constellations.
• Constellations shaper do not stand out to me as much as brightness does. When Don explained to me there are only so many really bright stars and to use them I was able to learn the sky well
• Lining up digital setting circles often requires knowing two or more stars.
• Knowing the brightest stars can help tremendously with star hoping.

Stellar Brightness
(as seen from Earth)

	Common name	Distance in light years	Apparent Mag.	Abslute Mag.	Constellation
	Sun	-	-26.72	4.8	
1	Sirius	8.6	-1.46	1.4	Canis Major
2	Canopus	74	-0.72	-2.5	Car.
3	Rigil	4.3	-0.27	4.4	Cen
4	Arcturus	34	-0.04	0.2	Bootes
5	Vega	25	0.03	0.6	Lyra
6	Cappella	41	0.08	0.4	Auriga
7	Rigel	~1400	0.12	-8.1	Orion
8	Procyon	11.4	0.38	2.6	Canis Minor
9	Achernar	69	0.46	-1.3	Eri.
10	Betelgeuse	~1400	0.50(var.)	-7.2	Orion
12	Acrux	510	0.76	-4.6	Cru.
13	Alitair	16	0.77	2.3	Aquilae
14	Aldebaran	60	0.85(var)	-0.3	Tauris

EXAMPLES OF TYPICAL MAGNITUDES
• MOON -12.7
• VENUS at its brightest -4.4

• Typical naked eye limit in towns 4.5
• Typical naked eye limit in country 5.8
• Naked eye limit with acute vision 7
• 10 x 50 binocular limit 11
• Proxima Centauri (nearest star) 11.01
• 4.5 in telescope limit 13
• 8 in telescope limit 14
• Giant telescope limit 30+

Next presentation was on Binoculars by Don Surles:

- **Binoculars**
- For Astronomy
- For Other Uses
- **Binoculars**
- _ Types
- _ Roof prism
- _ Porro Prism
- _ Construction
- _ B&L (American)
- _ Zeiss
- _ Glass for prisms
- _ BAK4, BK7
- _ Glass for lenses (primary & eyepieces)
- _ Good glass is better…not sure how to define
- _ Look for Zeiss, B&L, Nikon, Swarovski, Leica
- _ Coatings
- _ Multi-coatings are absolutely necessary
- _ All Surfaces Should be Multi-Coated!!!!
- _
- _
- **Binoculars**
- _ Care
- _Hard-sided case is necessary
- _ Keep them dry when not in use
- _Do not touch optics with oily skin
- _Clean infrequently
- _Do not drop
- **Binoculars**
- _ Handholding (hard with anything better than 7x50)
- _ Tripods
- _ Parallelogram mounts
- _ Other mounts
- **Binoculars**
- _ Bino scopes
- _ Bino viewers
- **Binoculars**
- _ Focused Image
- _ In the Center
- _ At the Edge
- _ Contrast
- _Faint fuzzies at night against the night sky

- _ Wildlife detail in shadows
- _ Light transmission
- _ Determined by
- _ Glass refractivity index
- _ Coating(s)
- _ Individual vs Center Focus
- _ Individual => better quality
- **Binoculars**
- _ For astronomy
- _ Bigger is better - at least a 7X50
- _ Porro prisms are the better buy
- _Hi-quality glass & coatings are better
- _Mounts for > 10X50 are necessary
- _ For birding and other uses
- _Hi-quality is more important than aperture
- _Contrast comes with multi-coatings
- _Roof prisms are smaller and preferred

Next was the Constellation Cetus again by Don Surles:

Cetus - the Sea Monster

And the fishy part of the sky

Cetus - the Neighborhood

_ Found in the Fall southern skies
_ Close "watery" relatives are:
_ Fornax
_ Sculptor
_ Aquarius
_ Pisces
_ Eridanus
_ From our viewing point, light pollution hinders our appreciation of the watery constellations
_ Cetus is far from the Milky Way galactic plane
_ Found in the "empty window" of Fall
_ Many galaxies shine in absence of Milky Way dust

Cetus - Mythology

_ Take a look at the story of how Perseus slew Medusa, the mother of Pegasus, and rescued Andromeda, the daughter of Cepheus and Cassiopeia, from the sea monster Cetus…
_ See Grace Hamilton's and Bullfinch's mythology works
_ Cetus has also been identified as the Biblically famous whale who swallowed Jonah

Cetus - some facts to remember

_ Mira - first variable star to be recognized as a variable…
_ In 1596 by Dutch astronomer David Fabricus
_ David thought it was a nova…
_ Period is 331 days
_ Mag ranges from 2.5 to 9.3 (see prev chart for uh-oh…)
_ Max diameter is > 400 million miles, ie > 400X our sun
_ Mira changes size and color (temperature)

_ Also has a companion - blue subdwarf with 2x Mira's mass…< 1 arcsec sep; seen when Mira is @ minimum

Cetus - some facts to remember

_ Found in the "empty fall window" to the southeast of the Milky Way
_ Therefore there are several galaxies available
_ Brightest is M77 @ mag 8.8
_M77 is a Seyfert Galaxy
_ Seyfert => a galaxy with an active nucleus that is brighter than normal
_ Cetus has 1 fine planetary - NGC 246 @ mag 8.0
_Need an OIII filter and 8-10" scope to see it

M77

_ Right Ascension 02 : 42.7 (h:m)
Declination -00 : 01 (deg:m)
Distance 60000 (kly)
Visual Brightness 8.9 (mag)
Apparent Dimension 7x6 (arc min)
_ Discovered 1780 by Pierre Méchain.
_ Messier 77 (M77, NGC 1068) is a conspicuous spiral galaxy situated in constellation Cetus. With its bright Active Galactic Nucleus (AGN), it is the prototype of an active galaxy, and a famous group of these objects called "SeyfertGalaxies," after their discoverer

NGC 246

M253

_ Discovered by Caroline Herschel in 1783.
_ NGC 253 is the brightest member of the Sculptor group of galaxies, which is grouped around the South galactic pole (therefore, also sometimes named "South Polar Group").
_ The Sculptor group is perhaps the nearest to our Local Group of galaxies. NGC 253 is also one of the brightest galaxies beyond the Local Group.
_ The RASC Observer's Handbook gives the common name *Silver Coin Galaxy* for NGC 253; it is also referred to as the *Sculptor Galaxy*.

Feature presentation for November:

The Whole Earth Telescope Network

Harry Shipman
University of Delaware and Mt. Cuba Astronomical Observatory
Delmarva Stargazers
http://www.physics.udel.edu/darc

Main Ideas of this talk

• The Whole Earth Telescope and what it can do
• Amateur participation in WET
• XCOV (= Extended Coverage) 25: testing theories of stellar convection, and more

Talk at UD

• Alex Filippenko, one of the top astronomers in the world and an excellent and awardwinning teacher, is giving a talk on Dark Energy and the Accelerating Universe.
• 7 PM, November 7, Clayton Hall, University of Delaware
• Registration helpful but not required: http://www.physics.udel.edu/darc/vernon.html

The Whole Earth Telescope

• A global network of 23 telescopes (latest run), mostly 1-m, a few 2-m
• Management and headquarters moved to the Mt. Cuba Observatory, a public, privately funded observatory associated with the University of Delaware, in 2006
• Several successful runs have been done, papers submitted and/or published

The Whole Earth Telescope – 2006 Participants

Telescopes used in the latest WET run

• 26 telescopes (most ever for the Whole Earth Telescope)
• Many were 1-m or so, but there were some 2-m, one 4-m, and one 10-m
• Sometimes we have obtained time on 10-m telescopes, such as SALT (South Africa Large Telescope) and Gemini

Peak Terskol, located in the Ukraine, operated by the Ukranian and Russian Academies of sciences

South Africa (SAAO 1-m, SALT 10-m)

How Amateurs and students are involved

• Many sites have student participation: e.g., Mt. Cuba, where last week Delaware County Community College helped with observing AE Aqr in a DAMP (Delaware Asteroseismology Mini-Project)
• Amateurs participate at Mt. Cuba, particularly good at acquiring targets but sometimes need to leave before midnight

Amateur participation… more…

• One site, in central Texas, has an 0.6-m telescope and is entirely run by amateurs.
• As with professional observatories, we work with our observers to deal with some of the things that are peculiar to WET (getting the time accurately).

What do we learn from 100,000 pictures?

• For example, convection in the white dwarf star GD 358 (paper published in April 2009 Astrophysical Journal)
• Convection very important energy transport mechanism in stars; most models use 40-year old mixing length theory
• We can test this!

Results and future prospects

• Validate MLT and estimate _ for DBV white dwarfs (done, preliminarily)
• Determine convection zone depth
• Test/calibrate models of convection in various parts of the HR diagram, including overshooting (needs additional stars)
• Identify more modes (what can this tell us?)

What else can WD variables tell us?

Nothing to do with type Ia supernovae, but…

Test the age of the Universe by measuring WD cooling over decades and find planets: two stars done (ZZ Ceti = R 548 and G 117-B15A). These stars have no planets yet; one other star does (Mullaly 2005). Cooling time scales okay. One DBV star in progress (Provencal, Shipman, and Sullivan).

See Mukadam et al. ApJ 594, 961, 2003.

Expected layer masses

• Current Conventional wisdom (CCW) suggests that white dwarfs have a carbonoxygen core, with a thin layer of helium (10^{-2} solar masses) on top and, 80% of the time, a thinner layer of hydrogen (10^{-4} solar masses) on top of the He.
• Units for layer thicknesses in the table on the next page are M(observed)/M (CCW).

White Dwarf Properties from Seismology

Some comments on layer masses:

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• Uncertainty in He layer mass for GD 358 is from two different analyses (Winget et al., ApJ 430, 839; and Metcalfe et al. Ap.J. 545, 974) and should be cleared up by our data.
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• H layer masses vary, in accordance with expectations from observations of cool WD

More observations, maybe relevant to SN Ia

• H layer masses are consistently small, always less than 10^{-4} solar masses. (Does this help H problem? I don't think so.)
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• How important is it to do more He layer masses? Could probably be done but requires more 2m telescopes (likely targets are faint)
Rotation rates:
• Asteroseismology is more sensitive than spectroscopy by factors of about 10, but is roughly consistent with it.
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• If angular momentum per unit mass is conserved during late stellar evolution, we expect P_{rot} ~ 5 min, not the tens of hours that is observed
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Rotation rates (more)
• If SN Ia progenitors are close binaries, much higher rotation than is the case in single stars would be expected
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• Some magnetic WD's rotate EXTREMELY slowly (P_{rot} > 100 yr!)

Magnetic Fields

• Initially discovered by continuum circular polarization measured with an 0.6-m telescope (Kemp 1970) and interpreted by Shipman (1971, ApJ 167, 165). Current work is by Schmidt and Wickramasinghe.
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• Most optical detections are at the level of 10^6 to 10^8 gauss; seismology can go as low as 10^3 gauss
White Dwarf Masses
• While asteroseismology can give very accurate individual masses, spectroscopy provides a much larger N, but is subject to selection effects
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Summary

• Asteroseismology of white dwarfs is a powerful tool, but it's not easy.
• Results for the most recent WET (=Whole Earth Telescope) run. Mt. Cuba Observatory in Delaware manages WET
• Layer masses can only be observationally measured with asteroseismology.
• We can also get magnetic fields, rotation rates, and masses.

Meeting was adjourned at 21:00 hours