

# The High Desert Observer

The Bulletin of the Astronomical Society of Las Cruces

May, 2007

## President's Message

The Society will be facing some new challenges this year. The Wirefly X-Prize Expo, which has been held at the Las Cruces Airport, will be held this year at Holloman Air Force Base. This will mean a little longer trip for those of us who will be working X-Prize Expo, but they are also combining it with an air show, so it should be an interesting event. We have only gotten initial information, but the planning needs to start soon. If you would be interested in running the ASLC X-Prize Expo exhibit this year, please let me know as soon as possible. We hope everybody in the Society will provide as much support as they can for this major event in our astronomy outreach calendar.



*2007 X-Prize Events*

*from the Wirefly X-Prize Website*

*<http://space.xprize.org/x-prize-cup/>*

We are still working on our first contact with NMSU Astronomy Department to determine if there is an opportunity for us to use their Meade 16-inch LX-200 telescope. Unfortunately the meeting we planned to have in March never occurred. We will continue working on this project and hopefully we can begin to discuss where we would have the observatory and what instrumentation will be included. Stay tuned to help plan how we should go forward with this project.

Quite a number of members will be attending the Texas Star Party this year. The results of their observations as well as their research into the Coronado Solar Telescope will be reported at an upcoming meeting, followed by a decision to purchase the telescope. This telescope will be used for astronomy outreach and will replace the telescope that our friend Richard Jones will be taking with him when he moves to Colorado. We look forward to any input our membership may have on this proposed purchase.

Finally, with the school year winding down there will be fewer school-related astronomy outreach events. I would like to thank everybody who has participated in these outreach programs and hope more of you will participate in the next school year's events. Clear Skies! Bert

## Variable Stars Part 3: Cepheid Variables and Distance Scale

By Bill Stein

When we discussed the types of variable stars, we found that astronomers classify stellar brightness variations as either intrinsic or extrinsic. For intrinsic variables, we learned that variability is caused by physical changes internal to the star (e.g., radial or non-radial vibrations or pulsations; eruptions in the star). We will discuss the pulsations in more detail for the variable, Delta Cephei (Del Cep). Next, we will see how the Del Cep class of variables plays a critical role in the cosmological distance scale.

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## Next Meeting

The next meeting will be held on May 25 (fourth Friday of the month), 2007, at the usual place and time (DABCC, room 77, 7:30pm). The program for this month will consist of reports from the Texas Star Party.

The Imagers Group (Contact: Rich Richins) will meet prior to the monthly meeting at 7pm. The "Astro Tidbits" Group (contact: Nils Allen) will meet again in June prior to the monthly meeting. Anyone is welcome to attend these special interest groups.

Other events planned for April include:

Dark Sky Observing at the Upham dark sky site, Saturday, May 19, dusk

ASLC MoonGaze, International Delights Cafe, Saturday, May 26, dusk

Please see the ASLC website for further information (<http://www.aslc-nm.org>)

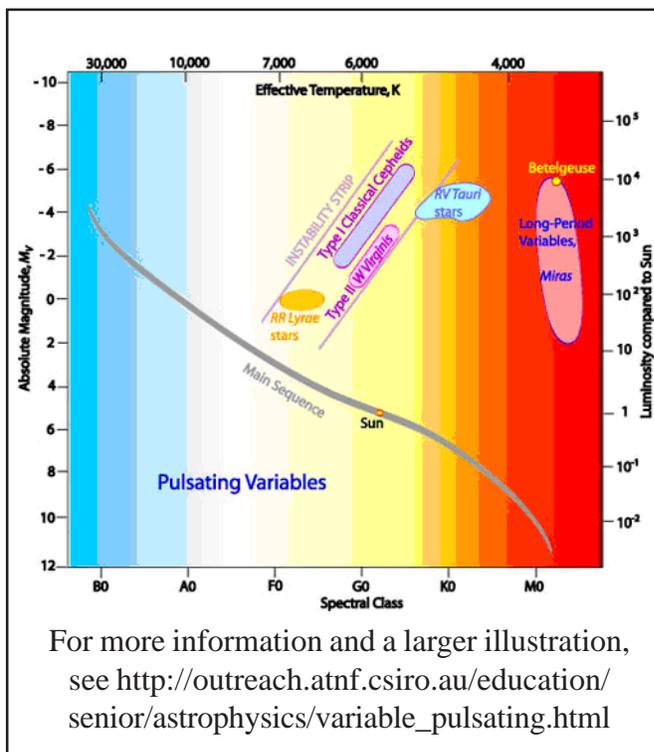
### Variable Stars Part 3: Cepheid Variables, continued from page 1

Delta Cephei is the prototype of the Cepheid variables. It is the closest star of this type to the solar system and is the fourth brightest star in the constellation Cepheus. The English astronomer, John Goodricke, discovered its variability in 1784. It was actually the second Del Cep star discovered, Eta Aquilae being the first one; Polaris also is a Cepheid. Del Cep varies from magnitude 3.6 to 4.3 and its spectral type varies from F5 to G3. It is a yellow supergiant as are all Del Cep variables. Its period is 5.36634 days; rise to maximum is quicker than the decline to minimum. Astronomers hypothesize that the Del Cep class of variables form with masses of 3-30 times the mass of the Sun and evolve on the Main Sequence as B-class stars fueled by nuclear fusion of hydrogen to helium. When they deplete the hydrogen in their core, they evolve off the main sequence. At this stage, Del Cep variables move into the instability region where they are in the later stages of nuclear burning and exhibit brightness pulsations (see adjacent figure).

Cepheid variables are pulsating stars which expand and contract at extremely regular periods. Supergiant stars have small, dense cores and large, low-density envelopes. For Del Cep variables, only the envelope expands and contracts. The radius of a Del Cep can fluctuate by as much as 10 to 20 percent. For Del Cep variables, brightness maxima and, thus, hottest surface temperatures occur when their expansion velocity is greatest. Astronomers can determine the radial (line of sight direction from Earth to star) velocity of Del Cep stellar surfaces by examining the wavelength shift of the spectral lines caused by the Doppler

## This Month's Observer

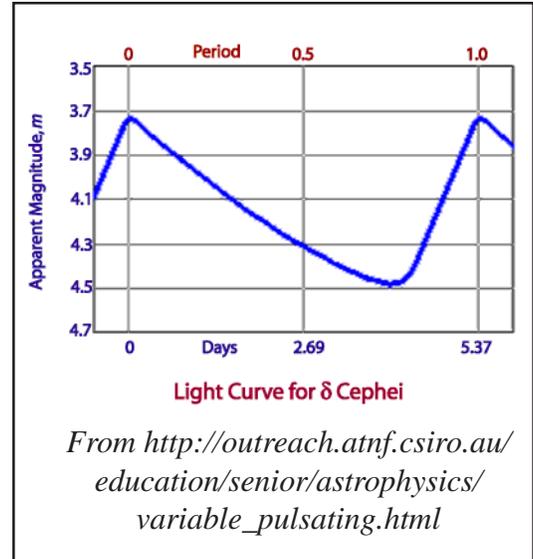
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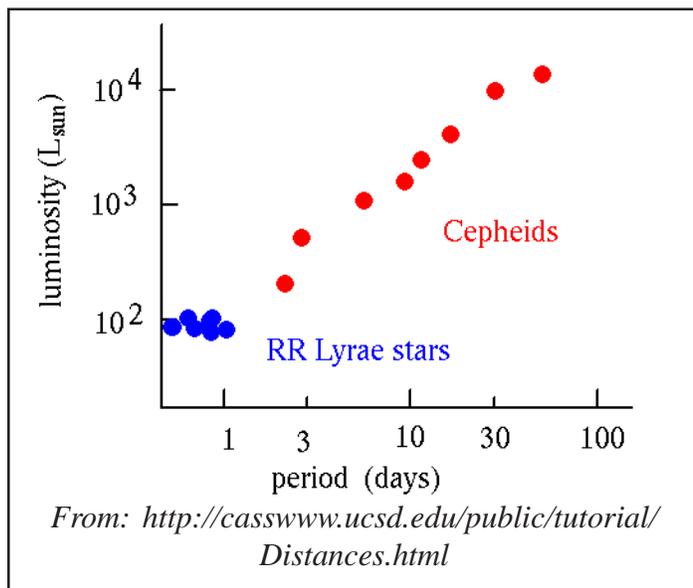
## Variable Stars Part 3: Cepheid Variables, continued from page 2

Effect. Maximum brightness occurs shortly after the outer layers of the star are compressed to their minimal radius. Conversely, Del Cep minima in brightness and temperature occur when the stellar surfaces are undergoing contraction.

What do astronomers attribute the physical cause of Del Cep pulsations and brightness variations? When stars are on the main sequence, there is a balance between the pressures working to contract and expand the star. There is just one pressure working to contract the star: self gravitation. There are two components that will make the star expand: gas pressure and radiation pressure. For the Sun, these pressures balance due to stable hydrogen nuclear fusion in its core and we say the star is in hydrostatic equilibrium. However, for Del Cep variables, they are undergoing changes in nuclear burning and there are temperature fluctuations. Consequently, the star is no longer in hydrostatic equilibrium. As the envelope temperature cools, the Cepheid contracts and the atmosphere becomes opaque (escaping photons are blocked, thus the brightness decreases) since certain particles start to condense out in the atmosphere. The atmosphere traps photons (radiation) inside, heating the envelope and increasing its pressure and temperature (similar to the Earth's greenhouse effect). The high pressure gas expands, making the atmosphere transparent, and the star brightens. Photons escape, the gases in the envelope cool, and the pressure drops. As the pressure drops, gravity compresses the Cepheid envelope and the brightness variation cycle starts again.



In 1912, the Harvard astronomer, Henrietta Leavitt, made a key discovery about Cepheid variables. She determined that a Cepheid's pulsation period is linked to its luminosity or absolute magnitude. While studying Cepheid variables in the Large Magellanic Cloud (LMC), she discovered that the brightest LMC Cepheid variables had the longest period. This Period-Luminosity Relation (see figure below) holds true for our galaxy and in all other galaxies where Cepheid variables have been detected.



Astronomers use astrometry (the science of accurately measuring the positions of astronomical objects), specifically trigonometric parallax, to measure the distance to Del Cep to tie its brightness variations to absolute magnitudes. As late as 2002, astronomers have been refining the parallax of Del Cep. Hubble Space Telescope observations give a trigonometric parallax of 3.66 milli-arcseconds or a distance of about 278 parsecs (905 lightyears). From observations, we determine that Del Cep has an absolute magnitude in the V-band of -3.47.

Historically in the 1920s, the American astronomer, Edwin Hubble, used observations of Cepheid variable in M33 and other galaxies to

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## Variable Stars Part 3: Cepheid Variables, continued from page 3

make two important discoveries that gave birth to the branch of astronomy called cosmology. In 1923 applying the Period-Luminosity Relation to 12 Cepheid variables in M33, Hubble reached the conclusion that the Andromeda Nebula was so distant that it could not be in our own Milky Way, but must be a galaxy itself. By far, Hubble's most valuable contribution was his 1929 paper on the Velocity-Distance Relation. From his findings, Hubble devised a linear relationship linking cosmic velocities (found from spectral line red shifts) and distances. This relationship, known as Hubble's Law, is expressed as:  $V_r = H_0 d$ , where  $V_r$  is the recessional radial velocity,  $H_0$  is the Hubble Constant and  $d$  is the distance to the galaxy.

Cepheid variables are good standard candles. First, their luminosity is quite high. The most luminous Cepheids are 40,000 times more luminous than the Sun. Second, their luminosities can be computed from the Period-Luminosity Relation. However, Cepheid variables are good standard candles for distance determination only out to about 20 megaparsecs (65 million lightyears). Beyond that, we must use brighter objects. The Type Ia supernovae are the standard candle for greater distances. This type of supernova is 100,000 times brighter than the Del Cep variables. The biggest problem with supernovae is that they occur infrequently in individual galaxies.

## The Meade Heavy-Duty Wedge: Some Minor Improvements

By Chuck Sterling

For the last two years my astrophotography attempts have been conducted using a fork-mounted 10" Meade LX-200 Schmidt-Cassegrain telescope in turn mounted on a Meade Heavy-Duty Wedge, operating in Polar mode.

In order to use this arrangement for imaging, careful attention to alignment of the wedge and scope is required. Deviations from the goal of alignment perfection reveal themselves as streaks of light near the edges of the image, their length proportional to the alignment error, magnification, and length of exposure. When starting in imaging, I employed a very used Yashica 35mm camera similar to one I bought at the Freedom Hill Exchange near Da Nang one week before the building abruptly disappeared. I used ASA200 Kodak slide film to capture wide-field views of the Cygnus and Sagittarius areas in exposures of about 30 minutes each. These shots were done without guiding since the camera was not imaging through the telescope, and minor errors in pointing might well be ignored. Just the same, being new at this, the first few sessions of aligning the wedge took me close to two hours. That is a big bite out of my imaging night, especially since I turn into a pumpkin at midnight.



After a few sessions of wide-field photography, I decided to try attaching the camera in place of the telescope eyepiece, which would let me take less panoramic shots of smaller objects. I found that alignment was much more critical since longer exposures were needed to capture faint images, and alignment errors were more noticeable at higher magnifications.

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## Wedge modifications, continued from page 4

### Stage one: Adjustments and Frustration

Aligning the wedge is a necessary but tedious activity, and I set out to reduce the frustration. My first “mods” were simple adjustments, things like tightening up end play in the adjusting shafts and trying to find happy mediums between too much and too little drag between moving parts. I added nylon washers as thrust bearings in several likely locations. I found a good use for free AOL membership disks, which make an adequate azimuth bearing when placed between the tripod and wedge.

There were several remaining problems. For example, the azimuth screw had too much play, and to reverse the direction of adjustment, a full turn of the knob might produce no motion at all. Then, as the play was taken up, the wedge would tend to stick a bit, then release suddenly and wind up moving too far, after which one would have to reverse direction again. To combat this, I tightened three screws between the azimuth plate and the tripod, increasing drag and hopefully decreasing overthrow. The unexpected side effect was to twist the substantial frame of the wedge enough to throw the altitude adjustment out of whack. A similar effect of adjusting altitude and inadvertently affecting azimuth was also evident.

These are the “before” pictures, showing the assembled wedge with original hardware in place.



### Stage two: Improving Altitude Adjustment

The altitude threaded bar was a fairly simple item, consisting of a 1" O.D. steel tube with a 1/2" x 20 coupler nut brazed into a hole drilled in its center, then ground flush with the tube on both sides. There's not much to discuss there, and it is pretty well explained by its pictures. The important point is that the original 1/2" x 13 threads per inch (TPI) lead screw and threaded bar were replaced with similar items using 1/2" x 20 TPI threads. This provided a finer adjustment with less force required to move the hand wheel.



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## Wedge modifications, continued from page 5

The other altitude modification was done because there was enough drag as the altitude plate moved to cause the image to drift in azimuth as altitude was adjusted. The altitude plate has a 3/8" bolt at each upper corner that are its pivot points. The design is such that the bolts cannot be tightened completely or the plate would not move at all, and the plate pivots directly on the bolt threads. I used slightly longer bolts and added a 1/2" O.D. sleeve over each one, just long enough to extend out past the outer edges of the side castings, which were drilled to accept the sleeve. The bolts can be tightened completely, which locks the sleeve in position, but allows the sleeve to float in the side casting. A bit of chassis grease completed this modification.



## Stage three: Azimuth Modifications

The original narrow follower nut on the azimuth lead screw is made from 1" bar, and much of the lost motion in azimuth adjustment, especially when reversing direction, is due to its poor fit. In addition, it is 1/2" x 13 TPI, which provides only a coarse adjustment. Like the altitude parts, it and the lead screw were replaced with 1/2" x 20 TPI parts.

The photo shows the replacement azimuth follower, constructed from a length of 1" O.D. tubing with a 1/2" x 20 TPI nut inside at each end. The nuts are held in place with 10-32 setscrews. The 1/4" rod engages a fixture on the tripod and holds the follower stationary as azimuth is adjusted, forcing the wedge to move. The rod was tapped 1/4" x 20 and threaded into a matching nut brazed to the 1" tube, then locked in place with a jam nut.



This follower yields an azimuth adjustment with very little slop. As you can see in this photo, it covers a much wider span of azimuth screw than the original, and exhibits almost no tilt when reversing directions.

The last detail in tuning up the azimuth adjustment was to reduce the side play between the 1/4" rod and the fixture on the tripod. I'm sure there are better ways to accomplish this than my method, but this works, and

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The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding members and public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties, and provides opportunities to work on club and public educational projects. Members receive *The High Desert Observer*, our monthly newsletter, membership in the Astronomical League, including AL's quarterly *A.L. Reflector*. Club dues are \$35 per year. Those opting to receive the ASLC newsletter electronically, receive a \$5 membership discount. Send dues, payable to A.S.L.C. with an application form or a note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004

ASLC members are entitled to a \$10 discount on subscriptions to *Sky and Telescope* magazine. S&T subscribers MUST subscribe and renew through the Society Treasurer for the special club rate. To avoid a lapse in delivery, this must be done when S&T sends their reminder, 4 months in advance.

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## Minutes, April 2007 Meeting

**Call to Order:** Bert Stevens, ASLC President, called the meeting to order at 7:35 pm.

**Secretary's Report:** The minutes of the March general meeting were presented as published in the High Desert Observer (HDO), the ASLC newsletter. Janet Stevens made a motion to accept the minutes as submitted. Steve Barkes seconded the motion. The minutes were accepted by those present by voice vote. There was not an additional secretary's report.

**Treasurer's Report:** The treasurer gave a report on the status of the Club's finances (contact her for details). Paid membership in the Club is currently 79 members. A bill of \$400.00 for the Club's membership in the Astronomical League (AL) is due. The treasurer queried those members present if they desired to continue as part of the AL, noting that the Club maintains its liability insurance through the AL. After additional discussion, Vince Dovydaitis made a motion that the Club remain affiliated with the Astronomical League for the coming year. Cecil Post seconded the motion. The motion was passed by voice vote. There was not an additional treasurer's report.

**Committee Reports:** There were no standing committee reports.

**Old Business:** There following old business was discussed:

1) The possibility of establishing a Club observatory at Leasburg State Park to utilize a larger diameter telescope continues to be discussed. It was noted that viewing is very good in several directions from the park, but not in others, particularly towards the Las Cruces/El Paso light domes. Vince Dovydaitis reported that there has been no update on the possibility of obtaining a 16" telescope from New Mexico State University. Siting such a telescope at Leasburg, using a dome already owned by the Club, might involve discussions with National Public Observatory personnel. Siting discussions with the Chihuahua Desert Nature Park (CDNP) on this same matter have not progressed, although it is believed that the proximity of the CDNP to the University Ranch area should help insure protected skies. Vince and Bill Stein plan to continue this effort.

2) Tim Barnett-Queen has returned the key that he had to the Club PO box. There are currently two (2) keys, one is held by the Club treasurer, the other by the Club secretary.

3) So far, there has been limited response to the treasurer's request for location(s) of Club assets. Nils Allen has reported that he has the Club's projector, Vince Dovydaitis has an 8" Celestron, Dick Olson has a 10" telescope, and Joseph Mancilla has the Unitron telescope, all belonging to the Club.

**New Business:** The following new business was discussed:

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## April meeting minutes, continued from page 7

- 1) The Alamogordo Astronomy Club will be hosting the 4<sup>th</sup> Desert Starlight Astronomy Weekend at Brantley Lake State Park, Friday and Saturday, 15 and 16 June. See the [aslcnm@yahoo.com](mailto:aslcnm@yahoo.com) email for details, including no camping fee for the first ten registrants.
- 2) Rich Richins announced that the X-Prize Cup Expo will not be held at Las Cruces International Airport in 2007. It will be combined with the Holloman Air and Space Expo at Holloman Air Force Base (HAFB) near Alamogordo. The dates will be 26 October (Education and Media Day, not open to the public) and 27-28 October (Full Show Days, free and open to the general public). If the Club plans to participate as an exhibitor this year, a coordinator other than Rich needs to volunteer soon. It was suggested that it would be beneficial to team with the Alamogordo and El Paso clubs on this effort. The president will send an email with additional information.

**Announcements:** The following announcements were made:

- 1) Joseph Mancilla announced he is having a CD release concert at the Farm and Ranch Heritage Museum on 01 June.
- 2) Chuck Sterling announced that this month's MoonGaze will take place at International Delights Café on 28 April beginning at dusk, weather permitting.

A motion to adjourn the business portion of the meeting was offered by Vince Dovydaitis, seconded by Joseph Mancilla, and passed by voice vote. The business meeting was adjourned at 8:00pm.

**General Announcements:** The following announcements were made:

- 1) High Point catalogs (with ASLC discount) are still available on the Publications/Information table in the back of the room. There are also announcement flyers and registration information for the 4<sup>th</sup> Green Bank Star Quest (both visual and radio astronomy) in West Virginia, 04-07 June.
- 2) Janet Stevens announced that she has received a letter from *Sky & Telescope* magazine announcing a change in policy for Club discounted subscriptions. Members can now renew directly to *S&T* rather than going through the treasurer. Additional details will be published in the HDO.

**Observations:** There were no observational reports.

**Presentation:** The speaker for this month's meeting was Mr. Berton Stevens. Mr. Stevens, current president of ASLC, spoke on planning for and observing solar eclipses. He talked about the three players in all eclipses: the Sun, Moon, and Earth, and how their relative positions, distances and arrangement constitute partial, total or annular eclipses. He described how to observe an eclipse, how to develop an observing program, and how to set up for an observation. Bert has been in the path of totality for seven (7) solar eclipses. He displayed images from several of these eclipses including video of one observed from on board a cruise ship. Discussion followed. This presentation was not recorded for playback via the Internet. Other meeting presentations can be seen on the web at <http://www.aics-research.com/lectures/aslcnm/>.

Respectfully submitted by John McCullough, Secretary

## June Issue HDO

Articles for the June issue should be to me by Saturday, June 9. Material should be sent as email ([gmlcnm@msn.com](mailto:gmlcnm@msn.com)) or as an attached Microsoft Word document. If you have any questions about submitting something to the HDO, please don't hesitate to contact me (532-5648 or via email). Thanks in advance! George Hatfield, Editor, ASLC Newsletter.

## Wedge modifications, continued from page 6

when it started working I stopped fixing it. The fixture has a  $\frac{1}{4}$ " hole drilled to accept the rod, but there is a bit of play, a few thousandths of an inch, since the rod is actually 0.247" in diameter, not 0.250", and the  $\frac{1}{4}$ " drill makes a hole slightly larger than  $\frac{1}{4}$ ". I added two bolts to capture the  $\frac{1}{4}$ " rod and eliminate side play.



A few final notes:

All these modifications were done with hand tools, an ancient portable Black and Decker drill press, and a portable oxy-acetylene torch, in my backyard shop.

The hand wheels all had to be rethreaded  $\frac{1}{2}$ " x 20. I found out the hard way that it is very easy to start the tap crooked and wind up with a wobbly hand wheel. On a positive note this can be corrected without learning any new swear words.

Don't, repeat don't use loctite or any other thread locker on the hand wheels or other  $\frac{1}{2}$ " hardware. Use jam nuts instead. You've been warned.

I was in the habit of storing the  $\frac{1}{2}$ " x 13 nut holding the wedge to the tripod on the altitude adjustment screw between sessions. I could no longer do that with the fine thread adjustment screw, so I added a  $\frac{1}{2}$ " x 13 bolt on the side of the wedge in one of the existing openings, to provide a handy storage point. No drilling involved.

And that's it. I do not hold that this set of minor improvements will make the Meade wedge an equal to a Mitty or Milburn. That was never the goal. The goal was to make it usable for portable astronomy, where you take the whole mess to an observing site and set it up the same night you intend to observe, and don't have to spend half the night getting the polar alignment "close enough." I think I accomplished that, had some fun doing it, and for a small fraction of the price of a better wedge.

## You might be an astronomer if...

By Nils Allen

- You might be an (obsessed) astronomer if...
- you own more than one red-light flashlight.
- you can see clouds in the dark.
- the first thing you do when visiting beautiful spots in the country is measure your Naked Eye Limiting Magnitude.

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## You might be an astronomer if... continued from page 9

- you can easily tell the difference between a meteor, an airplane, a weather balloon, and a satellite.
- you not only know the difference between a meteor, a meteoroid, and a meteorite, but you have one of them.
- you snicker when someone complains about getting “only” five or six hours of sleep the night before.
- you think it’s nothing usual to see the sunrise just as you go to bed.
- your family is tired of watching “Contact” over and over.
- you’ve dreamed of blowing out all of the streetlights near your house, or actually tried to do that.
- you’ve ever decorated your home with some sort of reproduction of your favorite portions of the night sky.
- you have debated (probably more than once) about whether or not Pluto is a planet.
- someone calls you a “wimp” and you wonder what dark matter has to do with you personally.
- you consider anything except for hydrogen and helium a metal.
- the last “dirty snowball” you saw was beautiful.
- you not only know what an H-R diagram is, you can draw one from memory.
- you’ve said several times that “we are all made of stardust.”
- the phrases “a mere billion years” or “a mere million light-years” are not contradictions to you.
- the word “Messier” makes you think of galaxies, nebulae, and clusters.
- you think that -1 is bigger than 6 (well, brighter anyway).
- you can tell what time it is by looking at the sky — but you’re much more accurate at night.
- you know what APOD stands for.
- you know how to say “armpit” in Arabic.
- terms like “Gamma UMa,” “Alpha Boo,” and “OU Oph” make sense to you.
- you can correctly pronounce Bootes.
- most of this list made sense to you.

## ASLC Gallery: A new feature on the club website

Rich Richins has created a place for members to post their astrophotographs on the ASLC website. Check it out at <http://aslc-nm.org/Gallery/>. Here is one of Rich’s albums, a recent image of the moon. Rich comments, “It was clear and calm last night, so I took out my C11 and shot the moon with my 300D through a newly acquired 4x PowerMate. Here’s a pic of the Apennine’s and Archimedes. I took 50 images and had

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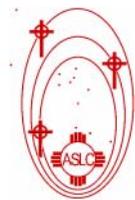
## ASLC Gallery, continued from page 10

intended to stack them all, but I forgot to set the C11 to track at lunar rate. Amazing how fast the moon moves at f/40. Anyway, here's a short stack. Details: stack of 2 images, 0.3 sec exposure @ ISO 100 through C11 @ f/40. Stacked, cropped, levels, & unsharp mask using photoshop CS. Noise Ninja to smooth things out a bit."



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**ASTRONOMICAL SOCIETY of Las Cruces**  
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With Our Community  
for Over 50 Years

