

# The High Desert Observer



## May 2016



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The Astronomical Society of Las Cruces (ASLC) is dedicated to expanding public awareness and understanding of the wonders of the universe. ASLC holds frequent observing sessions and star parties and provides opportunities to work on Society and public educational projects. Members receive the *High Desert Observer*, our monthly newsletter, plus membership to the Astronomical League, including their quarterly publication, *Reflector*, in digital or paper format.

Individual Dues are \$30.00 per year

Family Dues are \$36.00 per year

Student (full-time) Dues are \$24.00

Annual dues are payable in January. Prorated dues are available for new members. Dues are payable to ASLC with an application form or note to: Treasurer ASLC, PO Box 921, Las Cruces, NM 88004. Contact our Treasurer, Patricia Conley (treasurer@aslc-nm.org) for further information.

*ASLC members receive electronic delivery of the HDO and are entitled to a \$5.00 (per year) Sky and Telescope magazine discount.*

### March Meeting --

Our next meeting will be on **Friday, May 27**, at the DACC Main Campus, Room 141, Technical Studies Building, starting at 7:00 p.m.

The speaker will be Alex Waronow

Topic: The Secret Life of Stars.

### ASLC Board of Directors, 2016

[Board@aslc-nm.org](mailto:Board@aslc-nm.org)

President: Daniel Giron; [President@aslc-nm.org](mailto:President@aslc-nm.org)

Vice President: Christina Lugo; [VP@aslc-nm.org](mailto:VP@aslc-nm.org)

Treasurer: Patricia Conley; [Treasurer@aslc-nm.org](mailto:Treasurer@aslc-nm.org)

Secretary: John McCullough; [Secretary@aslc-nm.org](mailto:Secretary@aslc-nm.org)

Director-at-Large: Tracy Stuart; [Director1@aslc-nm.org](mailto:Director1@aslc-nm.org)

Director-at-Large: Ed Montes [Director2@aslc-nm.org](mailto:Director2@aslc-nm.org)

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### Committee Chairs

ALCor: Patricia Conley; [tconley00@hotmail.com](mailto:tconley00@hotmail.com)

Apparel: Howard Brewington; [comet\\_brewington@msn.com](mailto:comet_brewington@msn.com)

Calendar: Chuck Sterling; [csterlin@zianet.com](mailto:csterlin@zianet.com)

Education: Rich Richins; [Education@aslc-nm.org](mailto:Education@aslc-nm.org)

Grants: Sidney Webb; [sidwebb@gmail.com](mailto:sidwebb@gmail.com)

Librarian: **\*\*\*OPEN\*\*\***

Loaner Telescope: Daniel Giron (Temporary) **\*\*\*OPEN\*\*\***

Membership: Judy Kile; [judykile3916@gmail.com](mailto:judykile3916@gmail.com)

Night Sky Network: **\*\*\*OPEN\*\*\***

Observatories:

Leasburg Dam: David Doctor; [astrodoc71@gmail.com](mailto:astrodoc71@gmail.com)

Tombaugh: Steve Shaffer; [sshaffer@zianet.com](mailto:sshaffer@zianet.com)

Outreach: Chuck Sterling; [csterlin@zianet.com](mailto:csterlin@zianet.com)

Web-Site: Steve Barkes; [steve.barkes@gmail.com](mailto:steve.barkes@gmail.com)

HDO Editor: Charles Turner; [turnerc@stellanova.com](mailto:turnerc@stellanova.com)

### Member Info Changes

All members need to keep the Society informed of changes to their basic information, such as name, address, phone number, or email address. Please contact [Treasurer@aslc-nm.org](mailto:Treasurer@aslc-nm.org) and [jkile3916@gmail.com](mailto:jkile3916@gmail.com) with any updates.

### Outreach

Outreach is a very important part of ASLC. We are always looking for more volunteers to help us educate the public. Even if you do not have a portable telescope to bring to the events, please consider attending our public outreach programs to help answer questions, share knowledge and point out constellations in the sky.

### Events

ASLC hosts deep-sky viewing and imaging at our dark sky location in Upham. We also have public in-town observing sessions at both the International Delights Cafe (1245 El Paseo) and at Tombaugh Observatory (on the NMSU Campus). All sessions begin at dusk.

At our Leasburg Dam State Park Observatory, we hold monthly star parties. Located just 20 miles north of Las Cruces, our 16" Meade telescope is used to observe under rather dark skies. Please see *Calendar of Events* for specific dates and times.

\* \* \*

## **Outreach Events**

by Jerry McMahan

### ***Tombaugh Observatory Open House, Friday April 15***

Besides tax day, it was very windy. I propped open the West door with a chair, but the wind blew the door shut anyway. Usually we take the bottom panel of the slit off and lay it out side on the roof of the observatory roof. We decided not to take the panel off due to the wind. It could have resulted in a low flying, metal, Unidentified Flying Object. We stayed on Jupiter the entire evening. Europa was in transit early, followed by it's shadow for the rest of the session. The wind caused Jupiter to blur in and out early on, but the view steadied the rest of the time as the wind died down. Steve Shaffer operated the scope as usual, and pointed out the position of the moon's shadow for the observers.

I did find that the LX 200, in the North dome, is a 12 inch model. The lady that operated the scope found the focal length on the tube. Knowing that it was an f/10, I got out my calculator to compute the size of the mirror. She used her calculator and beat me by a full second. Why was I slower on the draw with the calculator? Is it because I am getting older, or because my calculator is getting older? Oh come on! I have had this calculator for a while. Maybe I can get a re-match for the scope in the middle dome.

### ***Moongaze, Saturday, April 16***

Club members John McCullough, Ed Montes, Chuck Sterling, Daniel Giron, Carol and Stan Chiochio and Jerry McMahan made an appearance.

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Chuck set up his 10 inch, I had the 5 inch, Daniel gave away more prizes, Ed and John answered questions. One lady, who is working toward her doctorate in Biology, was very interested in the science and kept Ed busy explaining how the Right Ascension and Declination moving coordinate system works. The Moon and Jupiter were the telescope targets. One lady, a student, asked Daniel if she could join the club. She has attended Moongaze before, so she has a definite interest.

It was a clear evening. The earlier wind had died down and rain had passed to the North missing us, in the afternoon. It was not very cold and the seeing was decent

### ***Highland Elementary, Friday, April 29***

This was our third straight elementary school outing on a Sunday. Actually is was Friday and the other two were on Thursdays, but it ended before Sunset so it was a Sun viewing event. It was also a Windsday. The wind blew and it was cloudy in the beginning. The sky did clear, but the breeze made it cold enough to put coats on.

Chuck set up the 100mm refractor and I had the ETX 125. We only had white light filters. Chuck did explain hydrogen alpha filters to some of the observers. We didn't have many observers since there were many indoor activities for the schools career day event. The weather may have kept people inside. It was also hard to compete against the drug sniffing dog.!

\* \* \*





**Meeting Minutes**  
by John McCullough

***Minutes, April 2016 ASLC Meeting***

***Show & Tell:***

There were no informal presentations prior to tonight's meeting.

***Call to Order:***

Daniel Giron, President, Astronomical Society of Las Cruces (ASLC), called the March 2016 business meeting to order at 7:31 pm., 22 April 2016, Room 141, Doña Ana Community College (DACC), Las Cruces, New Mexico.

***President's Comments:***

Daniel Giron, President, welcomed the group to tonight's meeting and asked that all members be sure to check in on the roster and visitors and guests sign the guest list and that all present register for door prizes to be presented at the conclusion of the meeting. He then asked if all members had received the latest edition of the Society's newsletter, the High Desert Observer (HDO), had a chance to read the March meeting minutes and if there any were any comments, issues, or concerns. Noting none, he asked for approval of the March minutes as published in the HDO. Ed Montes moved for approval, Carol Chiocchio seconded, and the March minutes were approved by acclamation.

***Treasurer's Report:***

The Treasurer, Trish Conley, was not present at tonight's meeting. There was no Treasurer's report.

***Committee Reports:***

***Outreach Committee:***

Chuck Sterling, Outreach Coordinator, reported on pending events. A mostly solar-viewing event will be held at Highland Elementary on 29 April. Texas Star Party (TSP) 2016 will be 01 May through 08 May. Plans for the Mercury Transit on 09 May are still being coordinated with New Mexico State University (NMSU) with possible viewing taking place at Leasburg Dam State Park (LDSP). A star party will be held at Tombaugh Elementary on 13 May. Astronomy Day 2016 will be 14 May. There will also be a Moon Gaze at International Delights Café (IDC) on 14 May. Members can check the yahoo group for details and to volunteer.

***Membership:***

There were several potential members attending tonight's meeting. Randy Clark and daughter Grace were attending because of her interest in science. Chris Kelly, Alexa Davis Mike Edwards and Cal Estrada were attending because of their interest in astronomy specifically. Mark Dehain(?) was videoing the meeting and presentation.

***Civic Lighting:***

John Gilkison reported on his follow-up meeting with City of Las Cruces staff and planners regarding new street lighting. The City has agreed to limit new LED lighting fixtures in residential areas to 3000°K. However, main thoroughfares and streets will continue to have the hotter, bluer 4000°K fixtures installed. John feels this is the best compromise the astronomy community is likely to achieve and if the City follows through will reduce blue light pollution and back scatter significantly. Daniel thanked John for his efforts on behalf of dark skies.

***Astronomy Day, 2016:***



**Announcements:**

**Items for Sale:**

A Meade guide camera is offered by Alex Woronow for \$5 - **ED** - Hurry!.

**General Announcements:**

Albert and Ann Grauer provided fliers announcing the celebration of the Cosmic Campground being named the first International Dark Sky Sanctuary in North America. The celebration will be 04 June at the Cosmic Campground 8 miles north of Alma, NM. More details at [cosmiccampground.org](http://cosmiccampground.org). RSVP at [nmcanopus@gmail.com](mailto:nmcanopus@gmail.com).

Matt and Karla Zajac attended Philip Altman's observatory open house near Animas.

Texas Star Part (TSP) 2016 registration is still available at [TEXASSTARPARTY.org/registration/](http://TEXASSTARPARTY.org/registration/).

**Recognitions/Achievements:**

***There were no recognitions or achievements announced at tonight's meeting.***

***The business portion of the meeting was adjourned at 7:54 pm.***

**Presentation:**

April's presentation was by Dr. Guy McPherson. Dr. McPherson is professor emeritus of natural resources and the environment at the University of Arizona, where he taught and conducted research for twenty award-winning years. His scholarly work, which has for many years focused on conservation of biological diversity, has produced more than a dozen books and hundreds of articles. He is a renowned public speaker.

Dr. McPherson's topic was "Triggering Human Extinction/Abrupt Climate Change". Dr. McPherson described Earth as being in the midst of abrupt climate change. This ongoing phenomenon has several precedents, including a 5° C global-average temperature rise over 13 years that occurred about 55 million years ago. The attendant loss of habitat for our species represents a tremendous existential threat to Homo sapiens, i.e., us.

Door prizes – Member: Ed Montes, a book, "The Earth".

Guest: Randy Clark, a PBS DVD, "Earth and Space".

The April meeting of the Astronomical Society of Las Cruces concluded at 9:16 pm.

-Respectfully submitted by John McCullough, ASLC Secretary

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## Back at the Telescope

by Bert Stevens

Early in my astronomy career, I was looking for a way to contribute to the science of astronomy as well as enjoy observing. One of the many options was variable star work. The American Association of Variable Star Observers ([www.aavso.org](http://www.aavso.org)) was promoting the observation of variable stars by amateur astronomers. Their argument was (and is) that amateur astronomers have plenty of telescope time available with their own instruments, while professionals are always competing for time on large telescopes.

Professionals have equipment to measure an object's brightness on their telescopes called photometers. These devices can accurately measure the brightness of a faint object in the sky. While they can take accurate measurements, the limited telescope time available to them meant they could only observe the object for a short period of time. The amateur could not afford to purchase a photometer, but they had plenty of telescope time.

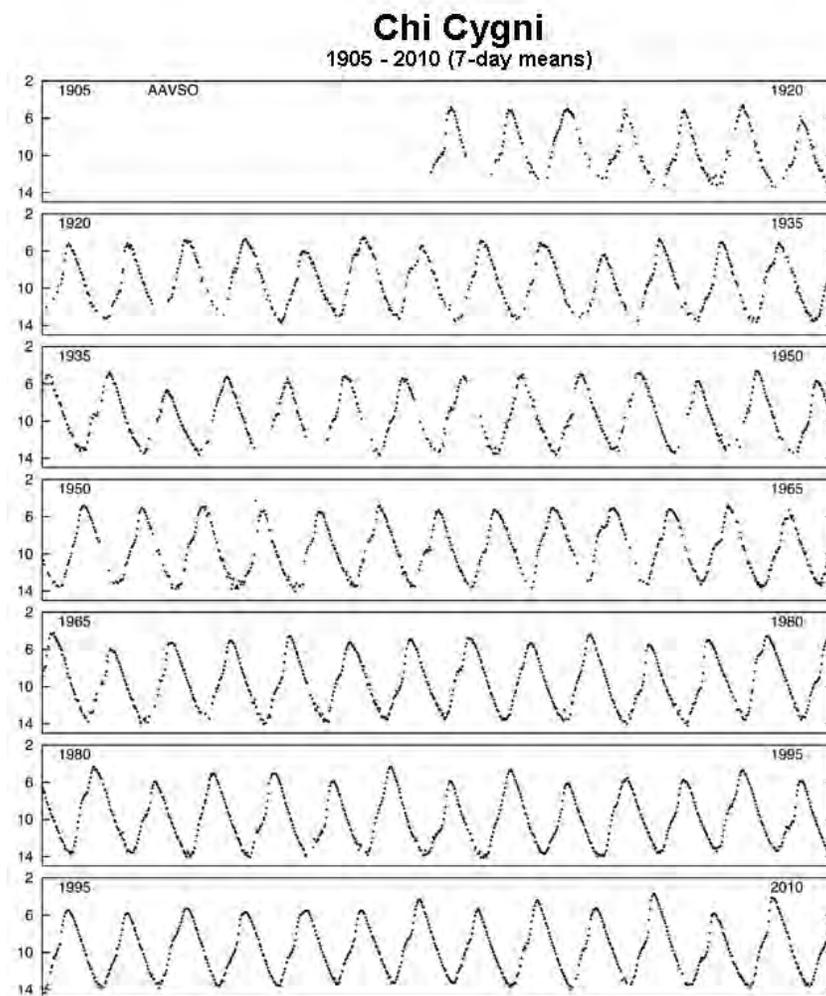
With a trained eye, the amateur could learn to make accurate measurements of a star's brightness. It would not be as good as those made with a photometer would be, but amateurs could make many more observations spread over a much longer period of time. Multiple amateurs could contribute

observations of a variable star. The more observations, the more accurate the resulting light curve. The AAVSO provided a central repository for combining these observations so that a light curve of the object could be constructed.

A light curve is a plot of the star's brightness over time. For a non-variable star, the light curve will be a horizontal line. If you plot the individual observations (the object's brightness at different times), you will see a scattering of the plotted observations above and below the horizontal line. In building a light-curve, the horizontal line is fitted to the observations. In other words, a mathematical process takes all the observations and determines the height of the horizontal line (which is the constant brightness of the star). A similar process will fit a wavy light curve to a variable star.

While a single amateur's observation of a star's brightness (usually good to 0.1 magnitude) is less accurate than

**Historic Light Curve for Chi Cygni**  
AAVSO generated light curve of the variable star Chi Cygni from the period 1905 to 2010.



This Mira-type variable varies from magnitude 3.3 all the way down to magnitude 14.2, the largest known magnitude range of a Mira-type variable. This pulsating star varies in brightness as it changes in size, shifting its light output from visual to infrared and back.

the accuracy of a photoelectric photometer (0.02 magnitude), the many observations provided by multiple observers greatly increases the accuracy of the light curve by mathematically combining their observations. AAVSO observers have contributed to light curves of stars going back over a century.

While amateurs have made visual observations of variables well before the AAVSO was founded in 1911, the number of observations started to increase more rapidly with their training, data collection and reduction programs. In the 1970s, the AAVSO was still providing paper star charts marking the brightness of the stars surrounding the variable, so the observer would have comparison stars of known magnitude in the same field of view.

I was not confident enough in my visual skills to contribute observations to the AAVSO. I continued to make occultation observations and take astrophotos. Still, variable star work was of interest to me, but I did not want to make estimates with my eyes, but wanted to make observations with a photometer.

In the early days (when vacuum tubes reigned, long before transistors), the photoelectric photometer (PEP) was built around the phototube. This vacuum tube, first demonstrated in 1887, has a negatively charged photocathode and a positively charged anode. The photocathode is coated with a material that is sensitive to light. This photoemissive coating is typically composed of cesium, antimony, or a combination of the two sometimes built on an oxidized silver base. Changing the mixture changes the region of the electromagnetic spectrum that will cause the tube to respond. Photons strike the photocathode, knocking an electron out of its surface through Einstein's photoelectric effect. The negatively charged electron is attracted to the positive anode and a microscopic current flows out of the tube. The current

is directly related to the number of photons striking the photocathode.

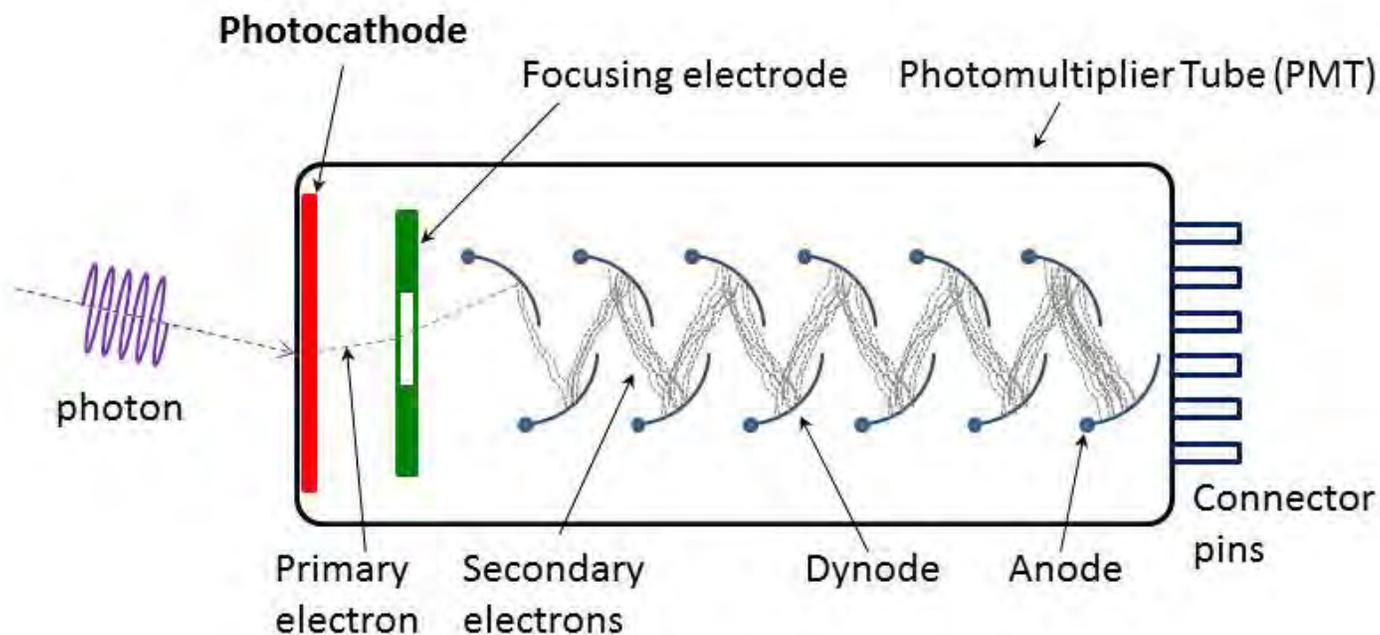
Since astronomical objects are faint, the few photons that reached the photometer produced a very weak current even when looking at bright astronomical objects. While the current could be amplified, this introduced noise that made getting an accurate reading very difficult.

In 1934, electronics engineers perfected the photomultiplier tube to replace the phototube in the photoelectric photometer. The photomultiplier tube (PMT) also has a photocathode, but in addition to the anode, a series of dynodes are added to the tube. Each dynode has a higher voltage than the previous one, with the anode having the highest of all.



### **Phototubes**

Here are two different types of phototubes. The RCA 918 is on the left and a Cetron 1P40 is on the right. The photocathode is the large curved piece of metal in the each tube. The photosensitive coating was placed on the inside of the curved piece of metal. The electrons would flow toward the central rod (the anode).



**The Photomultiplier Tube (PMT)**

*The photomultiplier tube (PMT) was an outgrowth of the phototube. After a photon strikes the photocathode at the end of the tube, a primary electron is released and accelerated by a focusing electrode to the first dynode where the primary electron knocks off more electrons, which heads toward.*

The incoming photon strikes the photocathode of the PMT and knocks out an electron. This primary electron is pulled toward the positive charge on the first dynode. The primary electron strikes the first dynode, knocking out two electrons. These secondary electrons, in turn, are pulled by the higher voltage at the second dynode and stream toward it. Each of the two electrons knocks out two more electrons, for a total of four heading for the next dynode. Each dynode doubles the number of electrons. The more dynodes there are in the tube, the more electrons will flow through the tube from a photon strike. After the electrons finish being multiplied by the dynodes, they strike the anode and flow out of the PMT tube as a pulse of electrical current.

The outgoing pulses can be averaged with a capacitor to give an analog current reading like a phototube, or the pulses can be counted to get a digital measurement of the brightness of the star. The digital mode is called photon-counting mode. The actual counting system includes a timer, so it uses a precise (but adjustable) interval during which the photons would be counted. These systems were rather large when they were constructed out of vacuum tubes, but became smaller when transistors and then integrated circuits became available.

If photons are coming one-by-one, then the pulses coming out of the PMT are well separated and easy to count. When photons strike the photocathode more frequently, two photons could strike at almost the same time. This results in one pulse for two photons. Even two photons that are separated by a very short time interval can result in one long pulse instead of two normal length pulses. The more photons that reach the PMT, the more likely it is that there will be an undercount of the photons.

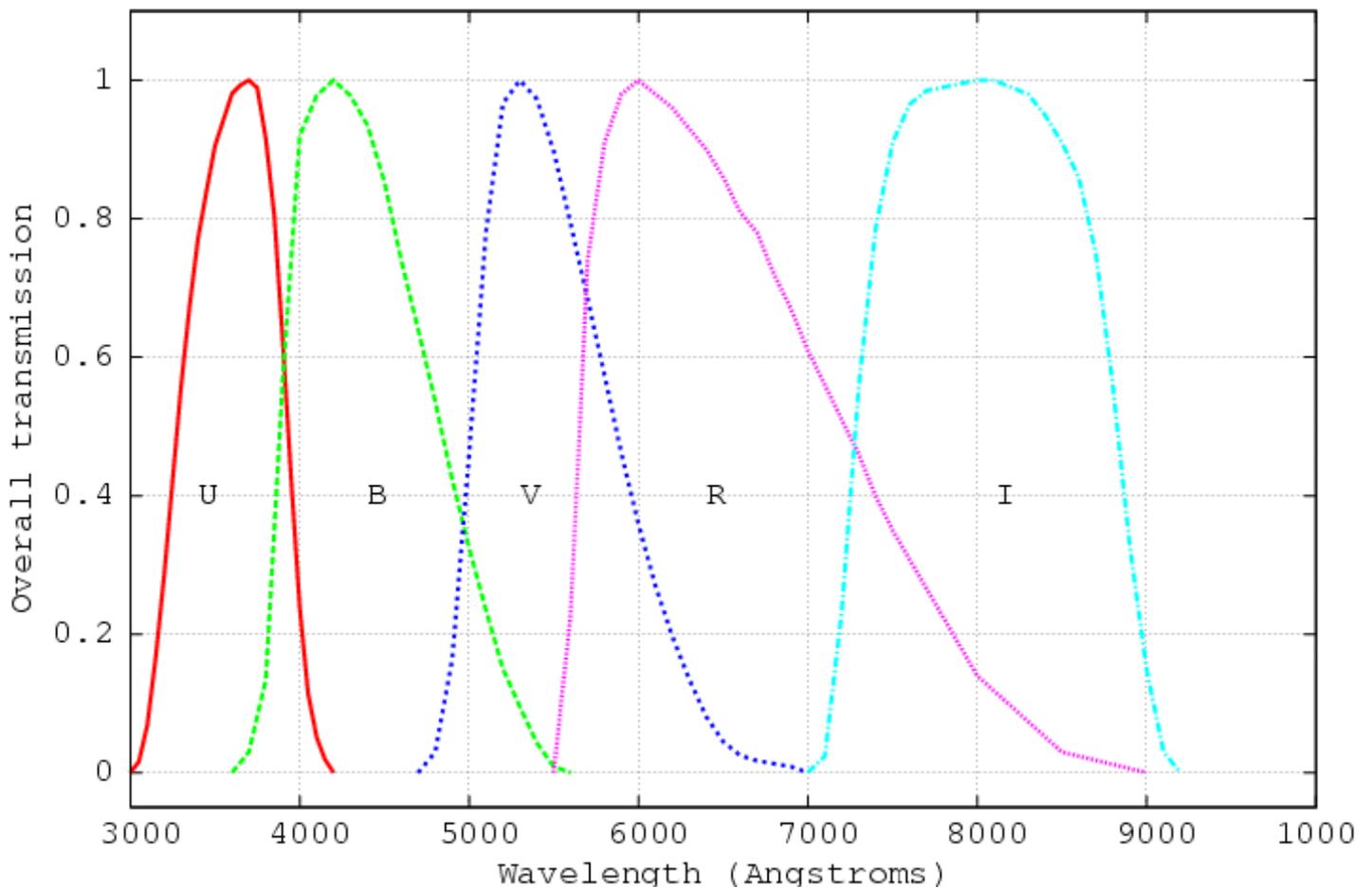
Astronomers define the interval from a photon strike to the next time that a photon can strike the photocathode and still produce a separate pulse as the “dead time”. During the dead time, the tube is insensitive or “dead” to another photon strike. Each photoelectric photometry system has a different dead time and it must be calibrated to determine the dead time value. Once this calibration is complete,

a formula allows the measured photon count to be converted to the actual number of photons that hit the PMT.

Another issue with the PMT's photocathode is that its surface is not perfectly uniform. One spot on it may be more or less sensitive than another spot. If you focus a star on a less-sensitive spot, there will be fewer or no electrons emitted from a photon strike. To counter this effect, a lens is added to spread the light over most of the photocathode. This lens is called a Fabry lens and it is between the diaphragm (an aperture that only allows the light from one star to reach the photometer) and the PMT tube. This lens was first proposed by the French physicist Charles Fabry. The Fabry lens also acts to stabilize to counter the effects of seeing and guiding errors on the light hitting the photocathode.

Another element of the photometer's optical system is a filter wheel. The filters used in the filter wheel are not the RGB filters commonly used for taking color astrophotos, but UBV filters for measuring the object's brightness in a standard color. These filters limit the color of the light that reaches the photomultiplier tube. The U-filter allows mostly ultraviolet light to come through. The B-filter passes blue light, the V (for visual) allows yellow-green light and finally R allows red and near-infrared light through.

The Bessell approximations to UBVRI passbands



### **Bessell Bandpass**

*This diagram shows the passbands of the UBVRI filters. The filters overlap slightly but still allow the color of the object to be determined. These different colors can provide clues to the physical nature of the object. The original Johnson-Cousins system only had the UBV filters defined because the photometer was insensitive to the red and infrared colors of the spectrum. Newer photomultiplier tubes were developed that could detect these longer wavelengths and the R and I filters were defined.*



Observing through these filters gathers additional information about the object. With a full set of measurements, the over-all color of the object can be measured which can help determine the physical characteristics of the object. Once the measurements in each color have been calibrated, you can subtract the magnitude observed through one filter from the magnitude observed through a different filter to get a color index. For example, the B-V color index is an indicator of stellar surface temperature. This greatly increases the value of the observation, because variable stars can change their color as they change their brightness.

The original definition of this system (called the Johnson-Cousins System) was based on observations of ten relatively bright stars in the northern hemisphere. This system was developed in the 1950s by American astronomers Harold Lester Johnson and William Wilson Morgan. They used a 13-inch telescope and the 82-inch telescope at McDonald Observatory, by making very careful and repeated observations of constant stars through the various filters.

Later, Arlo Landolt would extend the system by providing a list of red and blue stars that were near each other. These star-pairs were carefully measured stars with different color standard filters. Since these stars are near each other, the effect of the atmosphere at different elevations is minimized. When these stars are measured with a new photometer, its color sensitivity through the different filters can easily be determined. For his work, Arlo Landolt received the Astronomical League's 2015 Leslie C. Peltier award at ALCon 2015 here in Las Cruces.

After having learned all these technical details about doing photometry, I obtained a Starlight-1 photometer "head". The head contained all the optics, filters, and electronics to operate the photomultiplier. Jack Spindler, a fellow amateur and electronics engineer designed a controller for the Starlight-1 and I wrote the programming to make it work. It was designed to be used either independently (operated through a keypad and display) or connected to a computer through a serial port.



**Starlight 1 Photometer:** *The EMI-Gencom Starlight-1 photometer head. The Starlight-1 had an optical train that could send the starlight to the photomultiplier tube or with the flip of a mirror, up to an eyepiece to verify that the correct star was centered. The electronics provided the high voltage that the PMT needed and the basic pulse counting circuitry.*

**The Counter:** *The home-built photon counter designed by Jack Spindler and programmed by myself. It could operate from a computer or be utilized in a stand-alone mode.*





The Starlight-1 was mounted on an 8-inch f/20 Cassegrain. The long focal length spreads the image out so only one star's light can pass through the diaphragm. The typical process was to power up all the equipment and let the temperature stabilize. The mount was not computer controlled, so manual pointing was required.

Once the system had stabilized, the procedure would include first getting a measurement of a comparison star. The telescope was then moved to the target star and another measurement was taken. The comparison star is then measured again and the two comparison star readings are averaged so if there is any drift in the system, it is averaged out. In addition, a check star is also observed to confirm the comparison star's constancy.

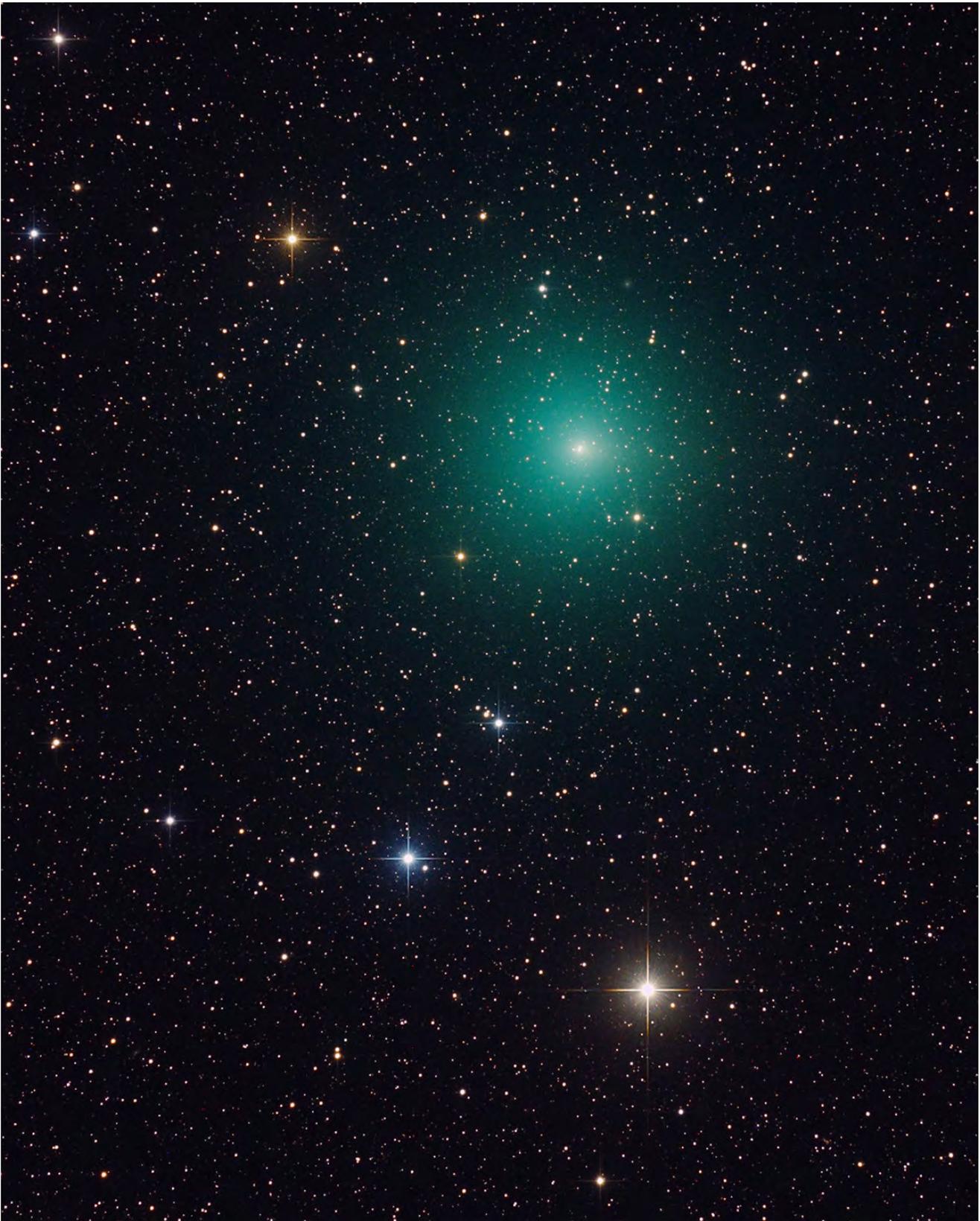
This was a difficult procedure and I had problems getting everything to work. While I never did manage to report a PEP observation, I learned quite a bit about this aspect of astronomy. Next month, I will go into the more modern ways of making precise measurements of an object's brightness with a CCD system.

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### **8 Inch Cassegrain Telescope**

*My eight-inch f/20 Cassegrain telescope with the Starlight-1 mounted at the Cassegrain focus. The mount had electric slow motions to allow careful pointing of the telescope.*

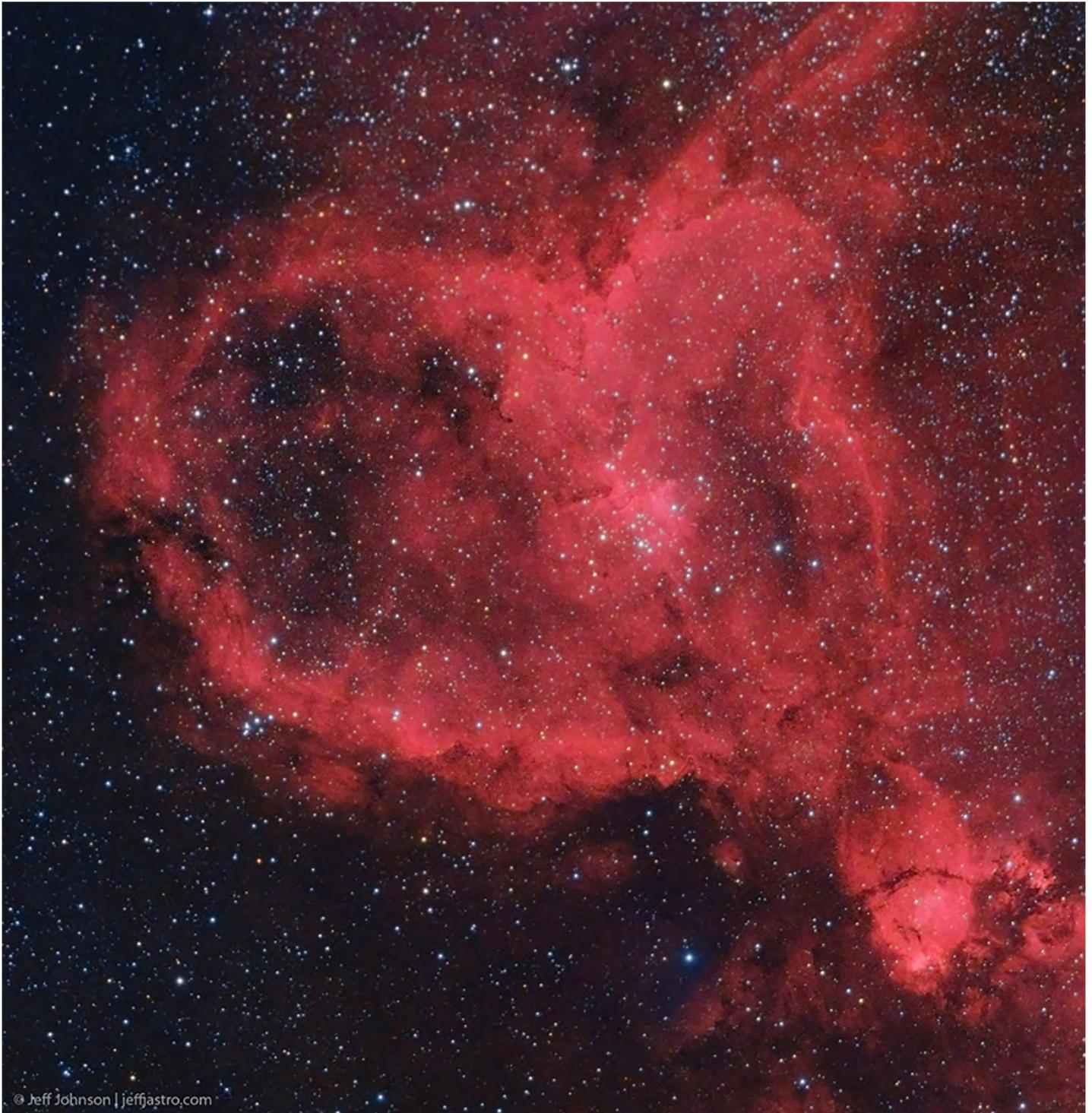
***Photo of the Month***



**Comet 252P/LINEAR**

This image was taken on April 12, 2016 at Rancho Hidalgo near Animas, NM. This is the same comet that shed a chunk that was later found to have a tiny tail. It was one of the closest comets to approach Earth in many years. A single 8 minute exposure, using a Canon 5D mkIII camera on a 10 inch f/5 reflector, mounted on a Paramount MX. Remotely controlled from my Michigan basement. Copyright by Brian D. Ottum, Ph.D.

## Photo of the Month



**OBJECT: IC 1805** The Heart Nebula. Distance: 7500 light years

Telescope Takahashi FS-60C @ f/6.2 Mount Takahashi EM200 Temma II  
Camera QSI 540wsg @ -15C Filters Astrodon Ha (3nm), Astrodon Tru-Balance I-Series LRGB Gen 2  
Guider SX Lodestar Settings 12x20min Ha, 4x5min L (bin1x1); 4x5min ea RGB (bin2x2); AstroArt5,  
CS4 (slightly cropped, 10xdarks/flats/fdarks/bias)  
Date/Location Notes 2 November 2015 - Las Cruces, NM  
Published as Astronomy Magazine Picture of the Day, 22 Mar 16  
This image is LHaRGB, where Ha was used in combination with Luminance and Ha:R (80:20) was used for  
the Red channel. Copyright Jeffrey O. Johnson

**Yuk of the Month**



Submitted by Alex Woronow