
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 electronic delivery of *The High Desert Observer,* our monthly newsletter, plus, membership in the Astronomical League, including their quarterly publication, *Reflector,* in either paper or digital format. ASLC members are also entitled to a $5 (per year) discount on *Sky and Telescope* magazine.

**Annual Individual Dues are $30**
**Annual Family Dues are $36**
**Annual Student (Full Time) Dues are $24**

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, P.O. Box 921, Las Cruces, NM 88004. Contact our Treasurer, Patricia Conley (treasurer@aslc-nm.org) for further information.

**ASLC Board of Directors 2019;** board@aslc-nm.org
**President:** Tracy Stewart; president@aslc-nm.org
**Vice President:** Ed Montes; vp@acslc-nm.org
**Treasurer:** Patricia Conley; treasurer@aslc-nm.org
**Secretary:** John McCullough; secretary@aslc-nm.org
**Director-at-Large:** Steve Barks; director1@aslc-nm.org
**Director-at-Large:** Kevin Brown; director2@aslc-nm.org
**Past Pres:** Howard Brewington; comet_brewington@msn.com

## Committee Chairs

**ALCOR**: Patricia Conly; tconly00@hotmail.com
**Apparel**: Howard Brewington; comet_brewington@msn.com
**Calendar**: Chuck Sterling; csterlin@zianet.com
**Education**: Rich Richins; education@aslc-nm.org
**Grants**: Sidney Web; sidwebb@gmail.com
**Loaner** Equipment: Sidney Webb; sidwebb@gmail.com
**Membership**: (Position Open)
**Observatories**:
Leasburg Dam: David Doctor; astrodoc71@gmail.com
Tombaugh: Steve Shaffer; sshaffer@zianet.com
**Outreach**: Chuck Sterling; csterlin@zianet.com
**Website**: Steve Barkes; steve.barkes@gmail.com
**HDO Editor**; Rob Westbrook; robwest63@yahoo.com

## Table of Content



## 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 with any updates .

## February Meeting

Our next meeting will be at 7pm, on **Friday, February 28th,** Our guest speaker will be member Bill Stein. His topic is the July 2019 solar eclipse as seen from Chile.

## Events

ASLC hosts deep-sky viewing and imaging at our dark sky location in Upham. We also have public in-town observing sessions at the Pan Am Plaza (on University Ave.) 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" telescope at this site is used to observe under rather dark skies.

*Masthead Image: Moon rising over the Organ Mtns. Las Cruces, in Penumbral Eclipse, February 10, 2017.*

# From the Desk of the ASLC President

Tracy Stewart

**THE ANSWER IS . . . .**

Sixty-five years ago the question was asked, can the first one hundred natural numbers be expressed as the sum of three cubes. That is $x^3 + y^3 + y^3 = k$. From 1954 to 2000 the solutions for the easier ones were found. In 2000 Noam Elkes wrote an algorithm to work on the harder ones. By 2019 only 33 and 42 remained without solutions. That year Andrew Booker wrote a new algorithm to work on these last two numbers. Using a supercomputer he found the solution to 33 in just three weeks. He then enlisted the aid of Andrew Sutherland. They decided they needed more computing power and so used ***Charity Engine***, an initiative that spans the globe. It harnesses unused computing power from over 500,000 home PCs. A planetary wide supercomputer. After only one million hours of computing time the two mathematicians found the solution.

**THE ANSWER IS $(-80538738812075974)^3 + 80435758145817515^3 + 12602123297335631^3$**

---

## What'cha Packin?

**With the holidays over, in-laws out of the house, more clouds than ever and sub-Arctic (feeling) weather, I'm sure many of us have spent some time contemplating our next gear acquisition(s) and are studiously choosing our next celestial targets. Or, maybe there was something astronomically shiny under the tree and we have been dreaming of those perfect, dark skies to train our new baby on.**

**So, whad'ja get and wha'cha gonna shoot with it? Or, maybe you want to try a new target on your trusty old kit?**

**Either way, email in and let us know!!!**

**Subject line (Attn: HDO) Please.**

# Minutes, January 2020 ASLC Meeting

(January 2020 Monthly Meeting of the Astronomical Society of Las Cruces (ASLC, the Society) occurred 24 January 2020, in the Creative Arts Room, Good Samaritan Society–Las Cruces Village, 3011 Buena Vista Circle, Las Cruces, New Mexico.)

**Show and Tell:**

ASLC member Alex Woronow showed a video demonstration of Topaz Denoise for refining astro-images. The software stretches and “cleans up” astro-images. He will provide additional information after the meeting.

Fred Pilcher is looking for assistance reading Right Ascension (RA) and declination using a Meade hand controller. Please contact him following the meeting.

**Presentation:**

This month’s presentation was by Dr. Wladimir Lyra of New Mexico State University (NMSU) and the Jet Propulsion Laboratory (JPL) on “The Europa Clipper Mission”. Dr. Lyra started by comparing the sizes and surfaces of Jupiter’s moons. He discussed Io’s vulcanism and how that relates to what has been photographed of Europa’s surface. He also discussed the theories being put forward to explain the surface features of Europa and his efforts to model the mechanisms that shape the surface. Finally, Dr. Lyra discussed the experiments planned for the Clipper mission that might occur in the next decade.

**President’s Comments:**

Tracy Stuart, ASLC President, thanked Dr. Lyra for a very interesting and informative presentation. Tracy noted that the Society’s newsletter, the *High Desert Observer* (HDO), was not published in January but the October 2019 meeting minutes (not available for the November issue of the HDO) were distributed to the membership by the Secretary via email. If there are no corrections, additions, or amendments, Tracy asked that the October minutes be accepted as distributed. The October minutes were accepted by acclamation.

**Treasurer’s Report:**

Trish Conley, Treasurer, was not present at tonight’s meeting. In her absence, Steve Barkes gave a brief report on the Society’s accounts. The Society took in $210.90 since the November 2019 meeting, primarily membership dues. Society membership dues for 2020 were receivable as of 01 January 2020. Steve collected $324 in dues payments tonight.

**Outreach:**

Chuck Sterling, Outreach coordinator, announced upcoming events. There will be a school star party at Monte Vista Elementary on 30 January. There will be an open house at Tombaugh Observatory on 31 January. There will be a Moon Gaze at Milagro Coffee y Espresso in Pan Am Plaza on 01 February.

**Apparel:**

Howard Brewington, apparel committee chair, has items available tonight. Several members had contacted him requesting specific items.

**New Business:**

**Classroom Presentation(s) –** A local teacher had contacted the Society regarding classroom presentations to precede star parties. Rich Richins, Chuck Sterling, and Tracy Stuart are working on this.

**Public Television Segment** – KRWG, the local PBS affiliate, is still interested in producing a segment featuring the Society, perhaps in March this year. Tracy is working to coordinate time(s) and place(s) with the producer.

**Astronomy on Tap** – A “science café” effort beginning 31 January at the Bosque Brewing Company featuring short talks on astronomy.

**Holiday gathering –** Thanks to Tracy Stuart and his wife for hosting Society members and guests in their home on 14 December. There were copious amounts of excellent food and everyone that attended had a very enjoyable time.

The January 2020 meeting of the Astronomical Society of Las Cruces concluded at 8:26 pm. A social time followed at Pecan Grill.

-Respectfully submitted by John McCullough, ASLC Secretary

## Outreach Report by Jerry McMahan

## Moongaze, January, 2020

The first Moongaze of 2020 was attended by Steve Wood, Howard Brewington and Jerry McMahan.

Steve set up his 8 inch Celestron. Howard brought his 8 inch, homemade Dobsonian and I brought the ETX 125. Unfortunately I for got to bring the mount for the scope (again). I did bring a 4.5 inch Newtonian, but balance problems made it difficult to aim it at even the Moon.

It was cold but clear. We did not have a lot of visitors, but those that did come to observe seemed to enjoy it.

## *January, 2020 OUTREACH REPORT cont...*

**Tombaugh Elementary School, Friday, January 17**

As usual, there was a large group of people there to look through the telescopes. Two students from the Astronomy Department were in attendance. They indicated a desire to join our club. I set up the ETX 125 and stayed on Venus the entire evening. Chuck was also present. Steve Wood had his 8 inch pointed at the Orion Nebula. Howard Brewington was on the Pleiades (always a crowd pleaser), with his 8 inch Dobsonian. It was a clear night, but a slight wind made it feel pretty cold, especially near the end of the session.

**Leasburg Dam State Park, Saturday, January 18**

When I arrived, the gate was already closed. Chuck was already in the observatory, ready to operate the 16 inch, so I called him and he had someone come to open the gate. It seems that the park did not realize that we were scheduled to be there. As a result, people in the park were not told about us, so no one came by to look through telescopes. Steve Wood did set up the 11 inch Celestron and Ed Montes came with his 2 power binoculars.

Without any observers, we gave up and shut down.

**Monte Vista Elementary, Thursday, January 29**

Chuck Sterling, Howard Brewington, Tracy Stuart, Steve Wood and Jerry McMahan set up telescopes. A young man also set up a Newtonian. It was a good thing we had so many scopes since there was a big crowd. The long lines waiting to observe was similar to those we get at Tombaugh Elementary.

It was cold with thin clouds. The clouds limited the number of targets so most of us were on the Moon. The Pleiades and Orion Nebula did make an appearance.

**Tombaugh Observatory, Friday, January 30**

The open house was attended by Steve Shaffer, Steve Wood and Jerry McMahan. We had the 12.5 inch scope on the Moon. The other domes had scopes pointed at M37 and M42. The sky was clear, and cold again. For the second straight night, big crowds were the story. We had a near record crowd of people looking through the scopes. Steve Shaffer counted 110 people who looked through our scope.

**Moongaze, Saturday, February 1**

Howard Brewington, Chuck Sterling and Jerry McMahan rapped up the three consecutive event string of club events.

Steve Wood, Howard Brewington, Chuck Sterling and Jerry McMahan attended Moongaze. It was clear and cold (have I mentioned that it has been cold lately). We had a good turnout of observers early. We had a lot

# HYGIEA - A NEW DWARF PLANET?

by Fred Pilcher

Minor planet 10 Hygiea is the fourth largest object with an orbit entirely between the orbits of Mars and Jupiter, diameter about 430 kilometers. It is only the tenth in sequence of discovery, 1849 Apr. 12, by A. de Gasparis at Naples. The lateness of its discovery may be due to its being far below fourth brightest. It is dark, reflects sunlight poorly, and is farther from Sun and Earth in the outer part of the asteroid belt. One might think that the fourth largest asteroid would have been fully described decades ago. In the last year it was found that much of what we thought we knew about it was wrong.

Many photometric lightcurves, some made decades ago, were interpreted that it was considerably elongated, rotation period about 27.65 hours, with two maxima and minima per rotational cycle as in Figure 1. P. Vernazza and 46 co-authors have published in Nature Astronomy Letters (https://doi.org/10.1038/s41550-019-0915-8) observations made in 2017 and 2018 with the SPHERE (Spectro-Polarimetric High-contrast Exoplanet REsearch) instrument on the 8 meter VLT (Very Large Telescope) at the European Southern Observatory in Chile. High angular resolution images made with SPHERE have produced disk resolved images (Figure 2) that reveal Hygiea to be nearly spherical, about 450 x 430 x 425 kilometers with a large dark spot.

The brightness varies as the bright and dark sides alternately rotate toward Earth and Sun with a sidereal rotation period of 13.82559 hours. There is only one maximum and minimum per rotational cycle, as in Figure 3. A disclaimer. Hygiea is not half bright and half dark as on the simplified Figure 3. The dark region consists of splotches and mottlings concentrated on one hemisphere. The rotational pole is at right ascension 319 degrees (21h 16m), declination -46 degrees, hence the rotation is retrograde, as is the rotation of the planet Venus.

I have obtained independent photometric evidence of this result with a phased lightcurve on 5 nights 2019 Nov. 26 - Dec. 6 (Figure 4). It shows only one maximum and minimum over an interval of 13.827 +/- 0.002 hours, agreeing with Vernazza et al. within my own error of observation.

Vernazza et al. offer an explanation of Hygiea's nearly spherical shape. A collision with another asteroid perhaps 2 billion years ago shattered the original body into fragments. Most of these fragments were reassembled by gravity. Of the nearly one million asteroids now known, about 5000, all smaller than 15 kilometers, have orbits very similar to Hygiea's orbit. These objects are fragments from the original collision that escaped the collective gravitational attraction of the assembly but remain within the Sun's much stronger gravitational realm.

# ***Hygiea cont...***

Among the asteroids whose orbits lie between the orbits of Mars and Jupiter, Hygiea may qualify as the second dwarf planet, after Ceres. The other objects in our solar system that have also been classed as dwarf planets all lie beyond the orbit of Neptune:  Pluto, Eris, Haumea, and Makemake. Some people lament Pluto being "demoted" from planet to dwarf planet. No matter how it is classified, Pluto is a fascinating and varied object, as was amply demonstrated by the New Horizons spacecraft encounter in 2015.

According to the official International Astronomical Union definition, both a planet and a dwarf planet (a) have orbits around the Sun rather than another planet, and (b) have enough mass that their own gravity compress them into hydrostatic equilibrium (departing significantly from spherical only by an equatorial bulge caused by rotation and centrifugal force). But to be classified as a planet, the object has (c) cleared the neighborhood around its orbit of small bodies orbiting the Sun.  By this condition there are only eight planets, Mercury through Neptune.  Pluto, Eris, other large trans-Neptunian objects, and the asteroid Ceres have not cleared out the smaller bodies in the neighborhoods around their orbits, and are not planets. Thus there are many small asteroids orbiting in the space between the orbits of Mars and Jupiter. There are also many smaller objects orbiting with Pluto in the space beyond the orbit of Neptune. Among the many objects beyond Neptune, Pluto, Eris, Haumea, and Makemake satisfy all three conditions (a) through (c).

Because Hygiea has an orbit around the Sun and its gravity has compressed it into hydrostatic equilibrium, and there are many other bodies orbiting around the Sun in its region of space, Hygiea should qualify as a dwarf planet. It will require future approval by the International Astronomical Union to make this designation official.

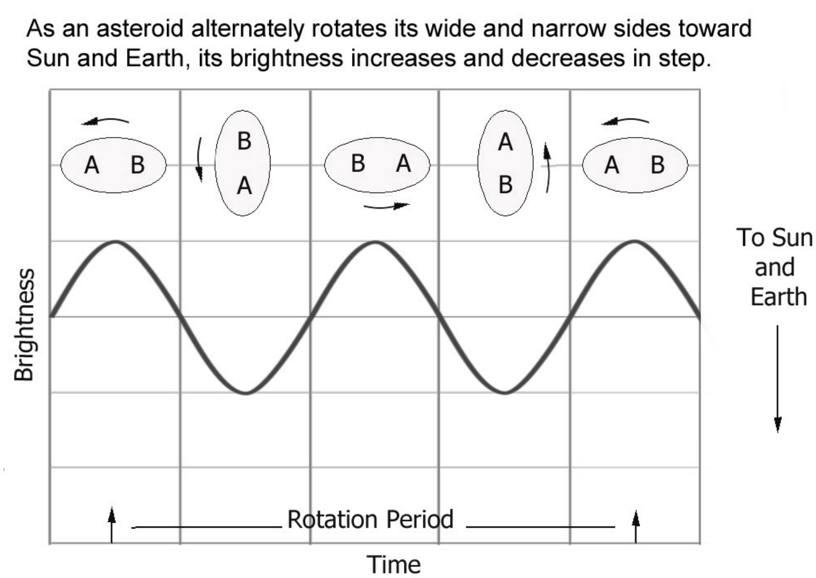



Figure 1

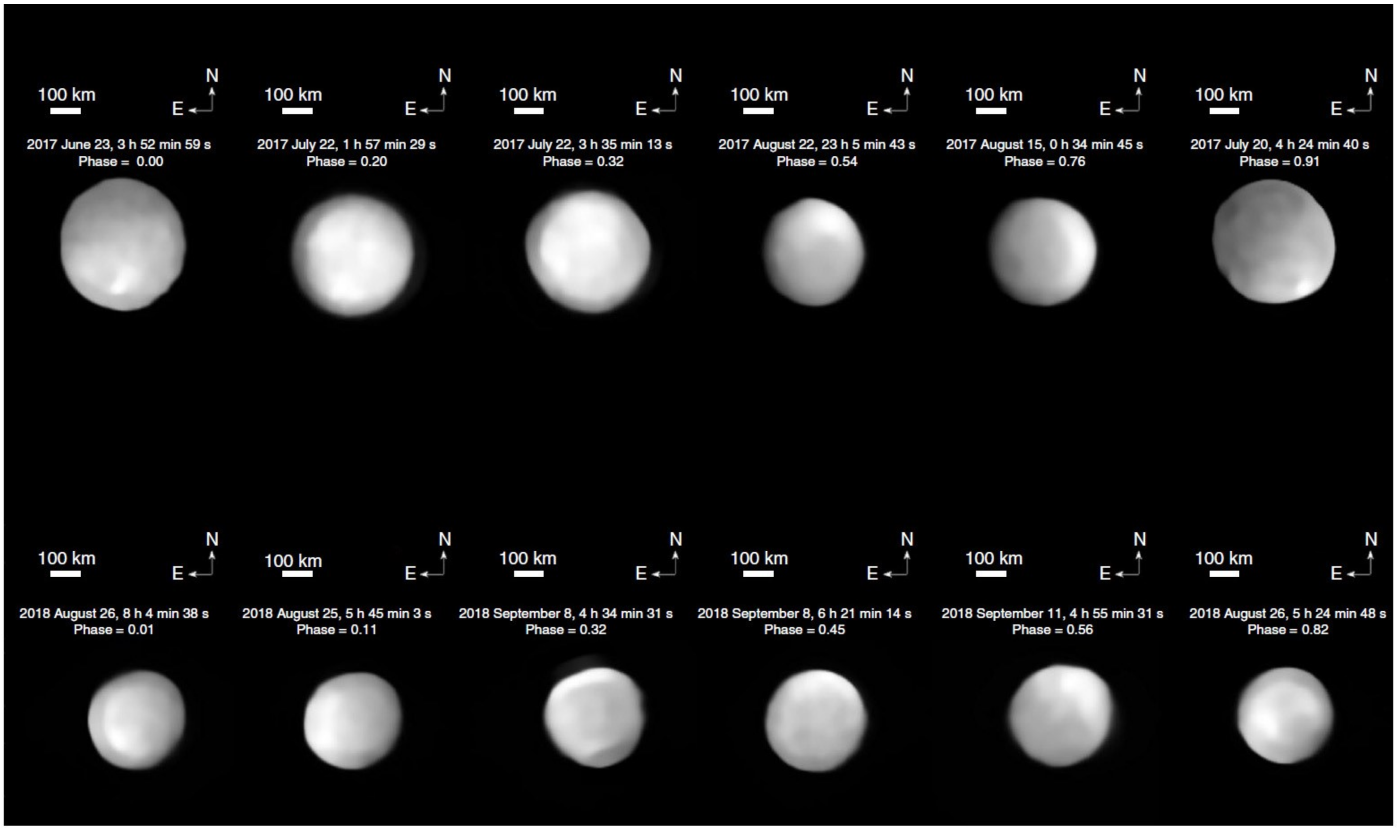



Fig. 2. Disk resolved images of 10 Hygiea at a sequence of rotational phases in 2017 (above) and 2018 (below) as recorded at the 8 meter VLT at the European Southern Observatory.

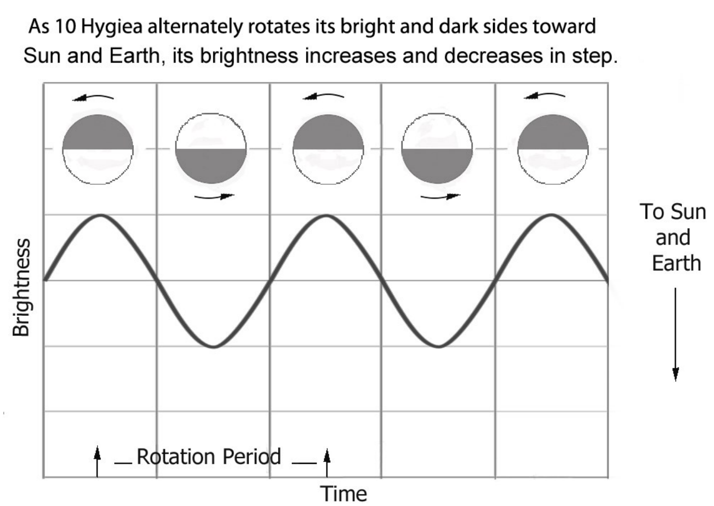



Fig. 3. The boundary between dark and bright sides is not as abrupt as on this idealized diagram.

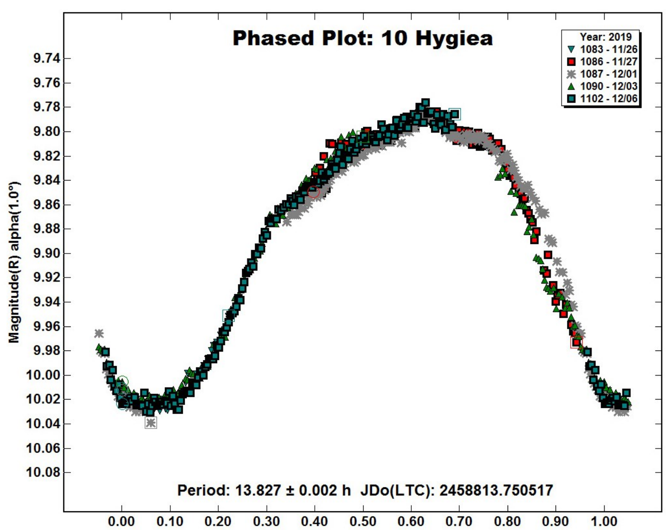



Fig. 4 Photometric lightcurve of 10 Hygiea.

***(Editor's Note: Apologies for inconsistent format, rather than re-typing the article and risk making an error, it was decided to publish the piece as submitted. Could not get the piece to accept MS Publisher format even though it was a TXT file.)***


*Taurus, the Bull, almost jumps out of the sky, with the easily recognizable "V" of stars that marks his head. The +0.87 magnitude red giant star Aldebaran is at the top of the southeast end of the "V". This bright star appears as the red eye of the bull, but its name means "the follower", seeming to follow the Seven Sisters, the Pleiades across the sky.*

## The Uranograph - February 2020

### By Bert Stevens

#### Constellation of the Month: Taurus, The Bull (Part I).

It's a lot of bull, Taurus, the Bull, that is, our constellation of the Month. There is so much to say about this constellation, we will be covering it both this month and next. This is a truly ancient constellation. The Caves of Lascaux in France contain wall paintings that are over 16,500 years old. There, in the Hall of Bulls, there are many paintings of bulls, including one where the bull has a small group of stars near it. This group of stars represents the Pleiades, which is near Taurus in our sky, making Taurus the oldest known constellation.

In more recent times, only about 6,000 years ago, the Egyptians would hold their bull festivals at the beginning of spring when the Nile would overflow its banks, depositing a new layer of fertile silt for the summer growing season. In those days, the Sun would be entering the constellation Taurus around the spring equinox each year.

For the Greeks, this constellation is the bull that Zeus disguised himself as when he wanted to woo the Phoenician princess Europa. Since her father kept her guarded at all times, his disguise as a white bull with golden horns allowed him to mingle with the King's herd. When Europa saw the beautiful bull, she went over to it, talked to it, and fed it. Charmed by the friendly bull, she climbed on his back and he slowly ambled toward the sea. Before she knew it, the bull had carried her into the sea and it was too late to dismount. The Bull carried her all the way to Crete.

After wooing her, Zeus realized he could not marry her. He gave her in marriage to Asterius, King of Crete. Their child was a half man, half bull creature called the Minotaur. Theseus was eventually forced to slay it to save the young people of Athens who were being eaten by the Minotaur, but that is another story.

Even more recently, in 1054 A.D., Chinese astronomers noticed a new star in Taurus, which they called a "Guest Star". But they were not the only ones. The Anasazi Indian artists (here in Arizona and New Mexico), also made drawings that depict the new star near the crescent Moon as it would have appeared July 4, 1054. These drawings can be found in Navaho Canyon and White Mesa (Arizona) and Chaco Canyon National Park (New Mexico). This star was near the horns of Taurus and shined at magnitude -6, so bright that it was easily visible in the daytime for twenty-three days and at night for over two years. This was, of course, the famous Supernova of 1054 A.D.

The supernova is some 6,300 light-years away, so the explosion actually occurred while the Egyptians were holding their bull rituals along the Nile. Seven hundred years after the supernova, John Bevis of England found a faint nebula in Taurus. It was rediscovered by Charles Messier, which prompted him to start his catalog. This nebula becomes M1, his famous catalog's first entry of fuzzy objects that should not be mistaken for comets. Lord Rosse's drawing of M1 resulted in the name Crab Nebula.

The Supernova of 1054 AD was a Type II supernova. A supergiant star, some 10 times more massive than our Sun, had reached old age, and was "burning" (fusing) silicon and sulfur to make iron in its core. As these lighter elements fuse, they give off energy, but fusing elements heavier than iron, absorbs energy. This makes iron and heavier elements relatively stable. As the “lightest” of the non-fusing elements, it is iron that accumulated in the core of the star, unable to fuse into anything heavier.

When the iron core reached 1.4 solar masses, its own gravity was so strong that the core collapsed, shrinking from five thousand miles across to just a dozen. The electrons and protons of the iron core were forced to merge together by that tremendous gravity to become neutrons, emitting vast quantities of energy in the process. Most of the energy was carried off by tiny massless particles called neutrinos.

The rest of the star, no longer supported by the iron core fell inward toward the new smaller neutron-core. The gas nearest the new core struck the hard surface of the neutron-core and bounced off. Now moving upward, it immediately struck material still falling inward, triggering a massive nuclear fusion explosion.

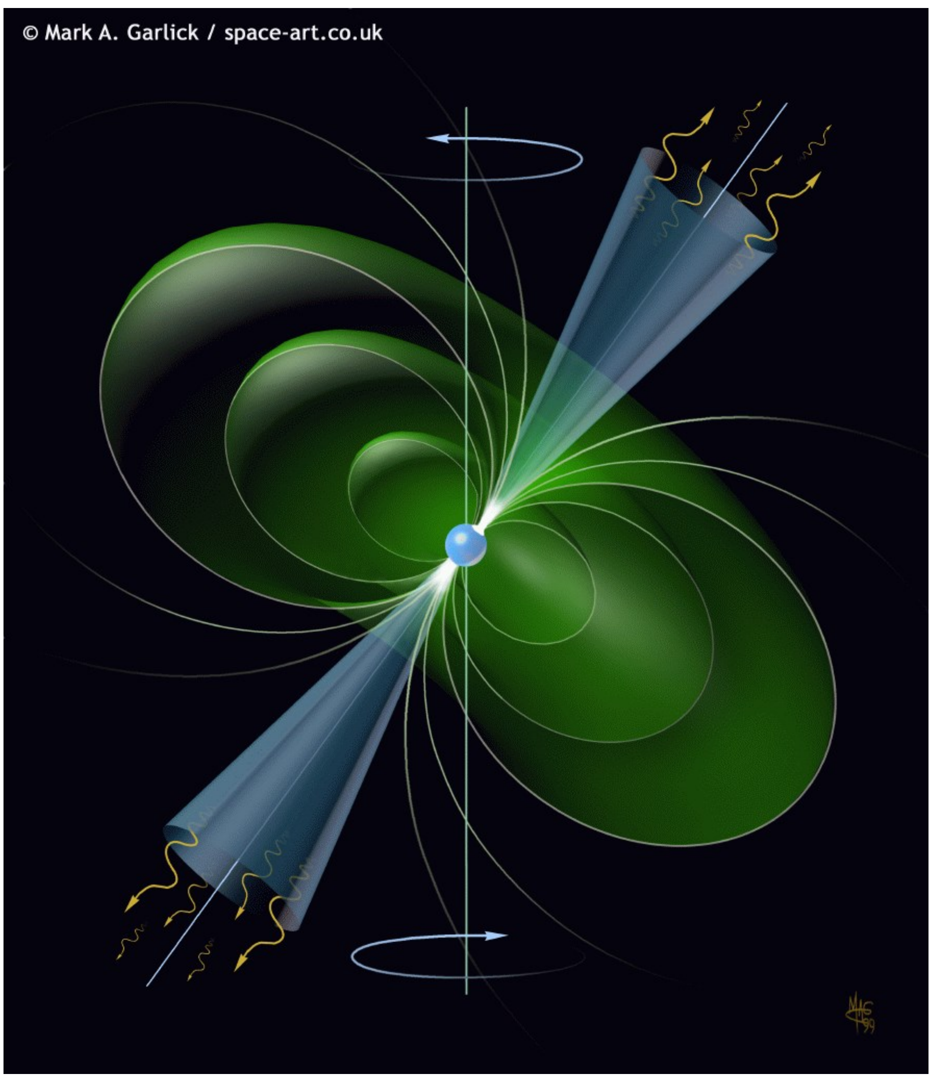
The explosion created shockwaves that traveled upward through the rest of the star, causing explosive fusion throughout the remainder of the star. So much energy became available that the resulting fusion created all the elements heavier than iron. This is the only time elements heavier than iron can be created. As the shock wave reached the surface of the star, it flung the outer layers of the star into space, forming the Crab Nebula. The neutron-core spun-up during the collapse just as a figure skater spins faster as they bring their arms inward, through the conservation of angular momentum.

## *Uranograph cont...*

Even though the core had collapsed, it still had its original magnetic field with its original magnetic poles. An intense beam of electromagnetic radiation is emitted along each magnetic pole. But the magnetic poles are not aligned with the rotational pole, so the magnetic pole and its beam of radiation describes a circle in the star's sky as the core (now a neutron star) spins. The Earth is almost right on that circle and when the magnetic pole points toward the Earth the beam of electromagnetic energy is directed toward the Earth and we see a bright flash of light, radio and x-ray radiation. This happens an amazing thirty times every second.

Given the name "The Crab Nebula Pulsar", this stellar remnant was first discovered in the radio spectrum using the 300-foot Green Bank radio antenna in late 1968. While this gave an approximate position, it took the Arecibo radio telescope to define the period and location of the pulsar on November 10, 1968.

This is an almost unique pulsar as we know exactly when it was formed. We also can see the flashes of light from the pulsar in addition to the radio pulses, which is true of only a few pulsars. The Crab Nebula and its pulsar are a source of continuous study as we learn about neutron stars, pulsars, and planetary nebula, all in this one small section of the sky.




**LEFT**

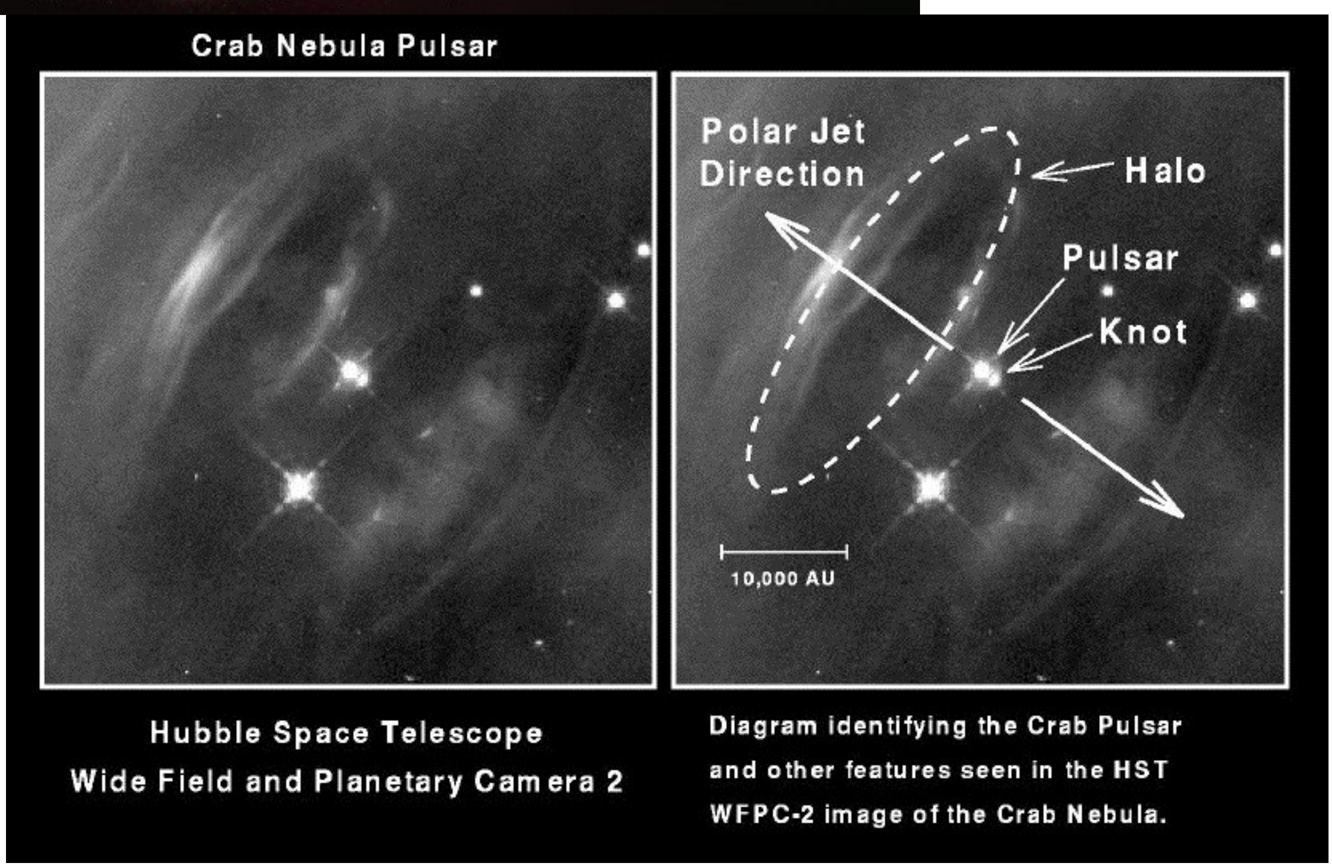
***The tiny neutron star still retains its original magnetic field that is not aligned with the axis of rotation. Each magnetic pole emits radiation across the spectrum and when that pole points toward the Earth, we get a flash of light. This very young neutron star has not had much time to lose its rotational energy, making one rotation every 0.0335028583 seconds.***

**NEXT PAGE, TOP**

***The Crab Nebula taken in multiple wavelengths and coded into a color image. An X-ray image from Chandra is codes in light blue. Hubble Space Telescope images are coded in green and dark blue. An infrared image from the now-retired Spitzer Space Telescope is coded in red. The pulsar is the white dot near the center of the image. Most of the X-ray energy is concentrated***

**Below**

***An annotated image of the core of the Crab Nebula showing the pulsar and a knot of material near it. The pulsar is shining by the residual heat in the neutron star that formed there a thousand years ago. It also flashes thirty times a second as the magnetic pole points in our direction. One woman looking through the University of Chicago's telescope was able to actually see the flashing visually.***



# Member Astrophoto


**In a colored follow-up to his submission in our previous issue Jeffrey O. Johnson writes:**

Here is my latest (and first complete result from the new darker backyard).

M81 (Bode's w/Holmberg IX) and M82 (Cigar) (and NGC 3077, bottom right)
FS-60C, EM200, QSI690wsg
20x10m L (bin1x1); 5x5m ea RGB (bin2x2)

Notes: From my new darker location in Las Cruces (moved in October 2019), the very faint Integrated Flux Nebula (IFN) can be seen - bottom Lum-only image (at link). Much more easily seen than in my prior work from my location in the north/bright part of the city! The IFN is a little-studied complex of diffuse dust and clouds in our own Milky Way Galaxy ~ (text from APOD).

More details: http://jeffjastro.com/dso/M81M82_25Oct19.htm

Jeffrey O. Johnson