The High Desert Observer

June 2019

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.*

ASLC Board of Directors, 2019

Board@aslc-nm.org

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Outreach: Chuck Sterling; csterlin@zianet.com
Web-Site: Steve Barkes; steve.barkes@gmail.com
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Masthead Image: February 10, 2017 From Las Cruces, Moon rising over the Organ Mts in Penumbral Eclipse.

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June Meeting --

Our next meeting will be on ***Friday, June 28***, at the Good Samaritan Society, Activities Meeting Room at 7:00 p.m.

No speaker is scheduled for this month. We will have a general discussion about the ASLC futue direction.

Member Info Changes

All members need to keep the Society informed of changes to their basic information, such as name, address, phone number, or emai address. Please contact Treasurer@aslc-nm.org with any updates.

Events

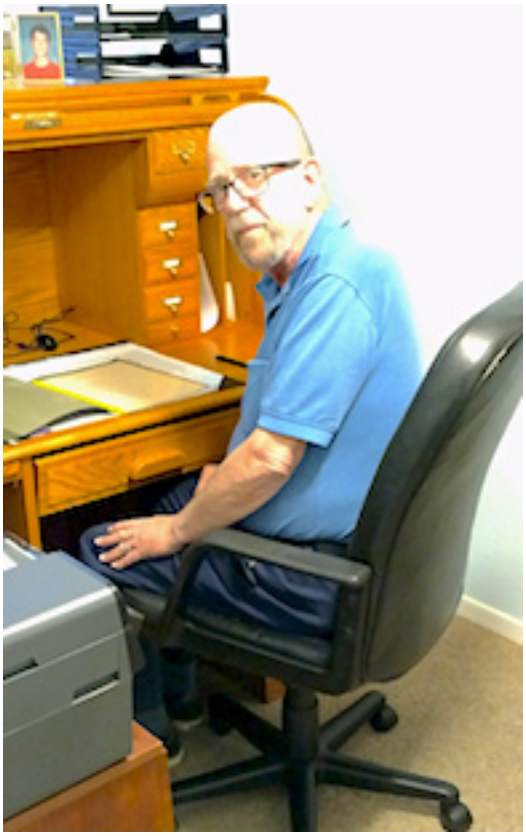
ASLC hosts deep-sky viewing and imaging at our dark sky location in Upham. We also have public in-town observing sessions at both the International Delights Cafe (1245 El Paseo) and at Tombaugh Observatory (on the NMSU Campus). All sessions begin at dusk.

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.

From the President's Desk

June 2019



As most of you probably know Murray Gell-Mann died May 24. For those of you who are not familiar with Dr. Gell-Mann's work he is the one who won the Nobel in Physics in 1969 for his work on "The Eight -fold Way" and the development of quark theory. "Three quarks for Master Mark!"

Professor Jeff Steinhauser, of Israel's Technion University, believes he now has proof of Hawking Radiation, the evaporation of black holes that was proposed by Stephan Hawking. Professor Steinhauer created a black hole in his lab using Bose-Einstein condensate. The Bose-Einstein condensate is a state of matter made up of gas and particles cooled to near absolute zero. The lab created black hole would not allow sound to escape. The lab created black hole did in fact eventually trickle away. Chalk one up for Stephan.

Rather than a speaker this month I propose that we talk about how we can make things better for you as far as what the origination has to offer.

THE ANSWER IS 42!

Tracy Stuart, ASLC President June 2019

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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 objects in the sky.

Outreach Events
2019 May Report by Jerry McMahan

Tombaugh Observatory, Friday, May 10

Steve Shaffer decided to call off our participation in the open house at Tombaugh observatory. He made the decision for good reason. There were clouds everywhere, with lightening seen and thunder heard. It became obvious that the clouds were enough to prevent observing.

Moongaze, Saturday, May 11

Howard Brewingtgon and Steve Wood went to the Pan Am Plaza site. Chuck Sterling and Jerry McMahan went to the International Delights. We had the Moon until about 8:30 PM when the clouds moved in to the extent that craters on the Moon were no longer visible. It was obvious that the clouds were going to get worse, with the possibility of rain, so we decided to pack up. Steve and Howard came to the International Delights and we were joined by Ed Montes. We spent the rest of the evening inside the restaurant, with Steve criticizing my sugar infused drink. The others also insisted on reading the label as well.

Leasburg Open House, Saturday, May 25

It was a clear night, but some clouds and dust in the air resulted in a fairly bright sky. Dave Doctor operated the 16 inch, aided by Jerry McMahan. Chuck Sterling assisted outside. Steve Wood set up the 11 inch Celestron. He trained Moe Bush in its use. John Gilkison ran another laser pointer program assisted by Steve wood.

There was a group of girl Scouts present. So we had a lot of observers.

City Of Rocks SP, Saturday, May 25

The weather looked very promissing all day at CoR and fortunately, it did turn out to be a very good night. Even the seeing was good.

We had a small but very engaged crowd of about 35 people, mostly adults,

Mike Nuss handed out our loaner red flashlights while I talked about how not to blind everyone with your million candlepower LED flashlight. I also covered dark adaption and why it is important, plus how to look through a telescope and other practical topics.

Bill Nigg did the main presentation and constellation tour. MIke Nuss manned the 14 inch Meade in the observatory, with assistance from Jan Farnum, a visiting amateur astronomer from El Paso. Charles Turner brought a 6 inch telescope and Bill brought a small telescope to entertain our guests with views of the heavens. Mike had a very difficult time with the Meade 14 again. We just bought a new hand control from our donation money, and it was not working. Mike thought he did something wrong or the new hand control just did not like him. Turns out we were zapped by the dreaded GPS Rollover Bug. We have patched and updated the firmware and hope to have it working normally at the June Starparty.

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Calendar of Events (Mountain Time - 24 hr. clock)

Jun	01	20:09	Sun Sets
	01	22;23	Mars Sets
	01	20:43	Jupiter Rises
	01	22:45	Saturn Rises
	01	20:30	OUTREACH; NPO Program at Rockhound SP, M. Nuss, B. Nigg, C. Turner
	03	04:02	New Moon
	08	20:30	OUTREACH; MoonGaze, International Delights Café
	08	20:30	OUTREACH; MoonGaze, Pan Am Plaza on University Ave
	09	23:59	First Quarter Moon
	10	10:00	Jupiter at Opposition
	11	21:33	Jupiter Multiple Moon Transit, Io and Ganymede, Alt= 16°
	21	09:54	Summer Solstice
	21	20:00	OUTREACH; Spaceport America Star Party
	22	20:30	OUTREACH; Dark Sky Observing at Leesburg Dam State Park
	22	20:30	OUTREACH; NPO Program City of Rocks SP, M. Nuss, C. Turner, K..Brown
	25	03:46	Last Quarter Moon
	28	19:00	ASLC Monthly Meeting; Good Samaritan Society, Activities Meeting Room
Jul	01	20:18	Sun Sets
	01	21;38	Mars Sets
	01	18:28	Jupiter Rises
	01	20:40	Saturn Rises
	02	13:16	New Moon
	06	20:30	OUTREACH; MoonGaze, International Delights Café
	06	20:30	OUTREACH; MoonGaze, Pan Am Plaza on University Ave
	09	04:55	First Quarter Moon
	16	15:39	Full Moon
	20	09:00	OUTREACH,Lynn Middle School: Over the Moon for Apollo 50 th Aniversary.
	24	19:18	Last Quarter Moon
	26	19:00	ASLC Monthly Meeting; Good Samaritan Society, Activities Meeting Room
	27	20:30	OUTREACH; Dark Sky Observing at Leesburg Dam State Park
	31	20:12	New Moon, Again!

Be sure to visit our web site for ASLC information: www.aslc-nm.org

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Announcements

1. The June ASLC meeting will be held on June 28, 2019 at 7:00 PM at the Activities Meeting Room, Good Samaritan Society Las Cruces Village, 3011 Buena Vida Circle, Las Cruces, New Mexico. The program for the May meeting will be a general discussion about the direction of the ASLC.

2. The agreement to use the facilities at Good Sam for our meeting prohibits members from bringing in ANY food or beverages, except water in a container with a screw lid. Take note: no more Starbucks or Saturn Cookies!

3. The NPO does not usually have presentations at the Deming State Parks in the months of July and August. Experience has shown that rain and clouds are so common in these months that the chances of having a star party are very slim. If you look at a graph of average rain by month, July and August have double the rainfall, on average, as any other months.

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Meeting Minutes
ASLC Monthly Meeting
May 2019

Show and Tell:

Bob Kimball started the evening's Show & Tell session by displaying a 4 panel mosaic image of the Andromeda galaxy.

Fred Pilcher related jokes and stories he shared with Clyde Tombaugh and Walter Haas when he first visited Las Cruces nearly 30 years ago.

Charles Turner talked about public presentations that are made at the Leasburg Dam State Park (LDSP) and two (2) Deming-area state parks, City of Rocks and Rock Hound. He prefers starting with a 15-minute or less "sky tour"-type presentation then transitioning to any special object viewing that is available that evening. He noted that the National Public Observatory (NPO) is in the process of dis-incorporating and the Society may take over periodic presentations at these other venues. John Gilkison, current head of NPO, will be at LDSP 25 May to discuss this proposal further. Charles had example presentations to distribute to interested members.

Stephen Wood is in the process of transferring his Great Courses library to another format and has the CD/DVD versions available for interested members.

There were no additional items or topics offered at tonight's Show & Tell session.

Call to Order:

Tracy Stuart, President, called tonight's meeting of the Astronomical Society of Las Cruces (ASLC, the Society), to order at 7:30 pm on 24 May 2019, in the Creative Arts Room, Good Samaritan Society Las Cruces Village, 3011 Buena Vida Circle, Las Cruces, New Mexico.

President's Comments:

Tracy welcomed the group to tonight's meeting. The minutes for the April meeting were published in the May High Desert Observer (HDO), the Society's newsletter. Tracy asked if there were any changes or corrections required. Kim Morgan moved the April meeting minutes be accepted as published in the HDO, Fred Pilcher seconded. The minutes were accepted by acclamation.

Treasurer's Report:

Trish Conley, Treasurer, reported no recent activity in the Society's accounts.

Outreach:

Chuck Sterling, Program Coordinator, announced upcoming events. There will be 3rd quarter Moon events at LDSP on 25 May and 22 June. There will Moon Gazes at two locations, International Delights Café and El Milagro Coffee y Espresso, on 08 June and 06 July.

Apparel:

Howard Brewington, Coordinator, will bring a selection of apparel to next month's (June) meeting. Contact him via email if you desire particular apparel items/sizes.

Budget:

A committee to formulate a proposed Society budget for 2019-2020 is required. The proposed budget is presented to the membership at the July monthly meeting. The committee consists of the Society President (Tracy Stuart), Treasurer (Trish Conley), and a non Board member of the Society. "Mo" Bush volunteered to serve as the member-at-large.

New Business:

11. Tracy has received several email queries that he would like to pass on to the membership:
    a. Joelle Young, a student in the UK is doing dissertation research on dark sky conservation in New Mexico. She is particularly focused on how and why people in NM are trying to conserve dark skies. Tracy referred this to Vandy Starkweather and any other interested members for consideration.
    b. Bill Neely is giving away an observatory complete with a 24" Cassegrain telescope. He has a web site with more information. Tracy will distribute the information to anyone interested.
    c. Alberto Caballero is leading a project hunting for habitable exoplanets around non-flare G, K, and M-type stars and wants to utilize the LDSP observatory in the search. Are any members interested in taking on such a research program? Fred Pilcher wonders if this is a good use for the observatory and thinks members should consider this project, if legitimate. He noted it would involve a significant investment of time, which he doesn't have considering his own ongoing research. Contact Tracy for more information.

2. Future 2019 meeting presentations – Fred Pilcher has a presentation for October; Steve Barkes will be the presenter in November.

3. Mike Nuss was approached by Doug Delabar(?) at a star party at City of Rocks (CoR) State Park. Doug is from Las Cruces and is looking for help with a telescope.

4. Okie Tex Star Party registration is open

Presentation:

This month's presentation was by Vandy Starkweather on "Explaining Light Pollution to the General Public". She gave an overview of information available from the International Dark Sky Association (IDA) explaining how the loss of dark skies affects wildlife as well as people and their history, culture, and heritage. One of the most effective is a collection of satellite images taken over the last few years demonstrating the increase in lighting pointed towards space. She noted that although many communities in New Mexico have lighting ordinances, they are rarely or poorly enforced. Punishments/fines are almost non-existent. Getting residents and municipalities to make smart(er) lighting decisions is a challenger. She provided examples she has struggled with since relocating to NM specifically for the dark skies. Vandy is trying to stimulate a grass roots movement before it's too late and hopes the Society will be a part of that.

The May meeting of the Astronomical Society of Las Cruces concluded at 8:28 pm. A social time followed at Pecan Grill.

-Respectfully submitted by John McCullough, ASLC Secretar

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The Uranograph - June 2019.

By Bert Stevens

Constellation of the Month: : Boötes the Ox Driver

Boötes is often described as a kite in the night sky, but Boötes actually represents a herdsman or oxen driver. The name comes from the Sumerian for “Man Who Drove the Great Cart.” As with many constellations, the mythology behind Boötes comes from many sources, each with their own story.

One of the oldest myths is from Greeks. According to this legend, Boötes is the son of Zeus and the nymph Callisto. Zeus’s jealous wife, Hera transformed Callisto into a bear. The young Boötes was out hunting one day and saw the bear. Not realizing it was his mother, he shot at her, but she escaped. To keep her safe, Zeus took Callisto into the sky where she became the Great Bear. When Boötes

The Constellation of **Boötes the Ox Driver** *with neighbors.*

became of age, his brother sent him away penniless. Needing money, he invented the plow. The plow was mounted on a cart that was drawn by oxen (hence, the “Man Who Drove the Great Cart”). With his plow, Boötes became a successful farmer. His mother, Callisto, was so pleased that she asked Zeus to put Boötes in the sky and Zeus complied. In the Odyssey, Homer mentioned Boötes, making it one of the first references to a constellation in literature.

The brightest star in Boötes is Arcturus, which comes from the Greek meaning “guardian of the bear”. Arcturus is the fourth brightest star in the sky. It is an old star, now in the red giant phase. In this phase of a star’s life, the star is burning its remaining fuel stores more quickly than ever. This additional heating causes the atmosphere of the star to expand far beyond its previous size, signaling the star has entered its giant phase. Even though the total energy output of the star is very high, it is spread over a much larger surface area. This makes the surface much cooler than the surface of stars like our Sun. Just as with any hot object, when they are really hot, they glow white. As they cool, they fade into the red. So even with a high total energy output making Arcturus very bright, it glows with a reddish hue. Someday, far in the future, Arcturus will run out of fuel to burn, and will fade out of sight.

One easy way to find Arcturus in the sky is to first find the Big Dipper (Ursa Major) in the northern sky. If you follow the arc of the handle (or tail) southward, you will quickly come to Arcturus. If you continue the arc, you will come to the star Spica. Amateur astronomers remember this with the phrase, “Arc on to Arcturus, speed on to Spica”. This gets you at least two reference stars in the spring sky.

We use our telescopes to observe objects in the sky, but in the direction of Boötes there is something we cannot see, the Boötes Void. This is an area of space where there are almost no galaxies. It is an empty sphere that is almost 330 million light-years in diameter, about seven hundred million light-years away from us.

This void was first discovered during a galactic red-shift survey conducted by Robert Kirshner et al. published in 1981. Red-shift is one side of the Doppler Effect. Doppler shift causes the frequency

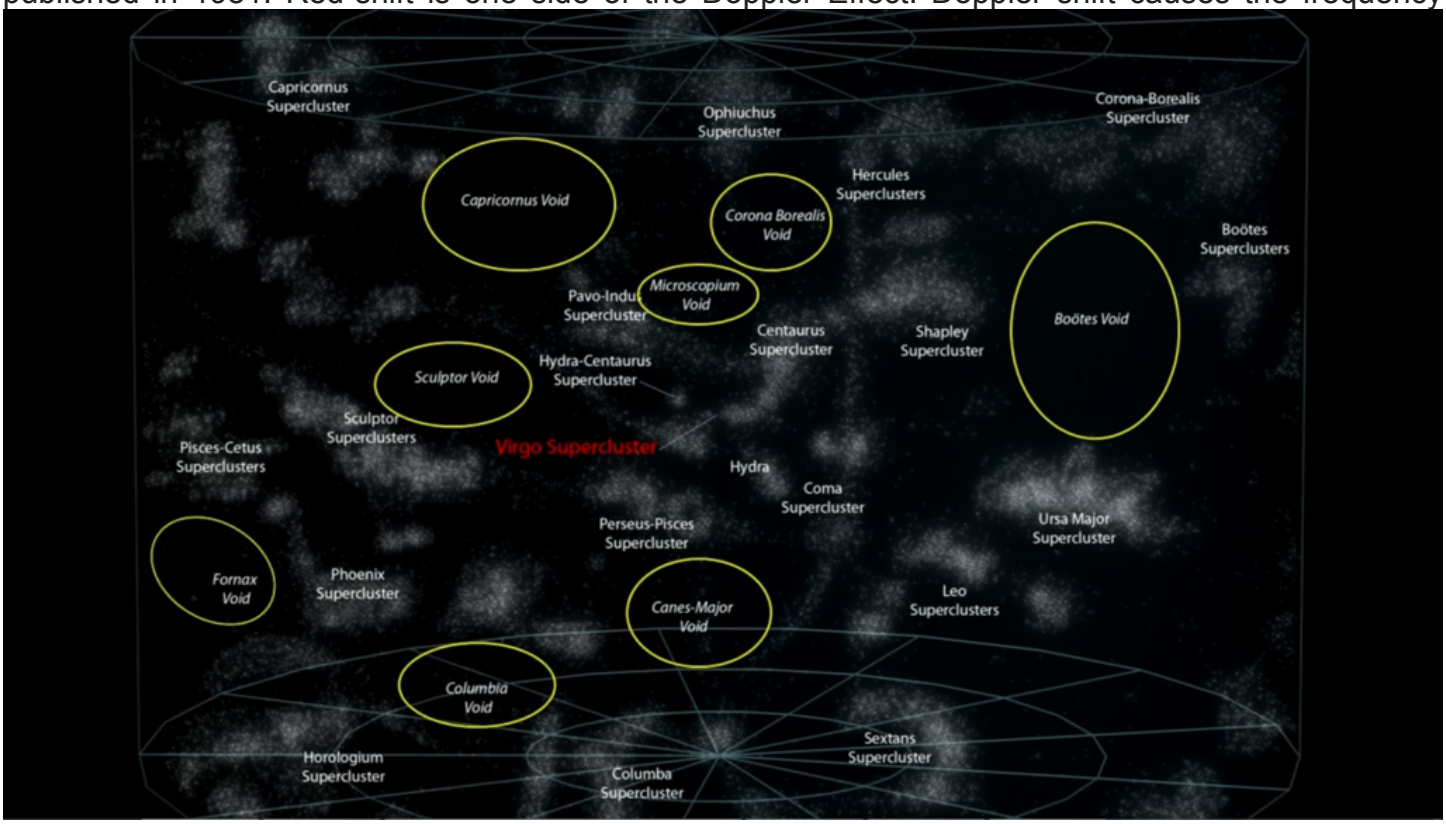


Diagram 1: Extrapgalactic map showing voids and superclusters.

of electromagnetic radiation like light to shift if the object emitting the light is moving relative to the observer (us!).

If the object is moving toward us, the frequency of the light is shifted toward the blue relative to light from objects that are at rest relative to us. Light from objects moving away from us shift toward the red. Measurements of the shift are done spectrographically, with the spectral lines of an element like hydrogen generated here on Earth compared to the lines emitted by the distant galaxy.

Due to the expansion of the universe, almost all the galaxies appear to be moving away from us, giving it a red shift. The galaxy's red shift depends on its distance. The further away from us it is, the faster it is moving away from us, and the more it is red shifted. Astronomers often state the distance to a galaxy by citing its red shift.

When Robert Kirshner and his team measured the red shifts of the galaxies, they were able to build a three-dimensional map of the universe. This map allowed them to see the emptiness that was named the Boötes Void. Since then, there have actually been sixty galaxies discovered in the Void.

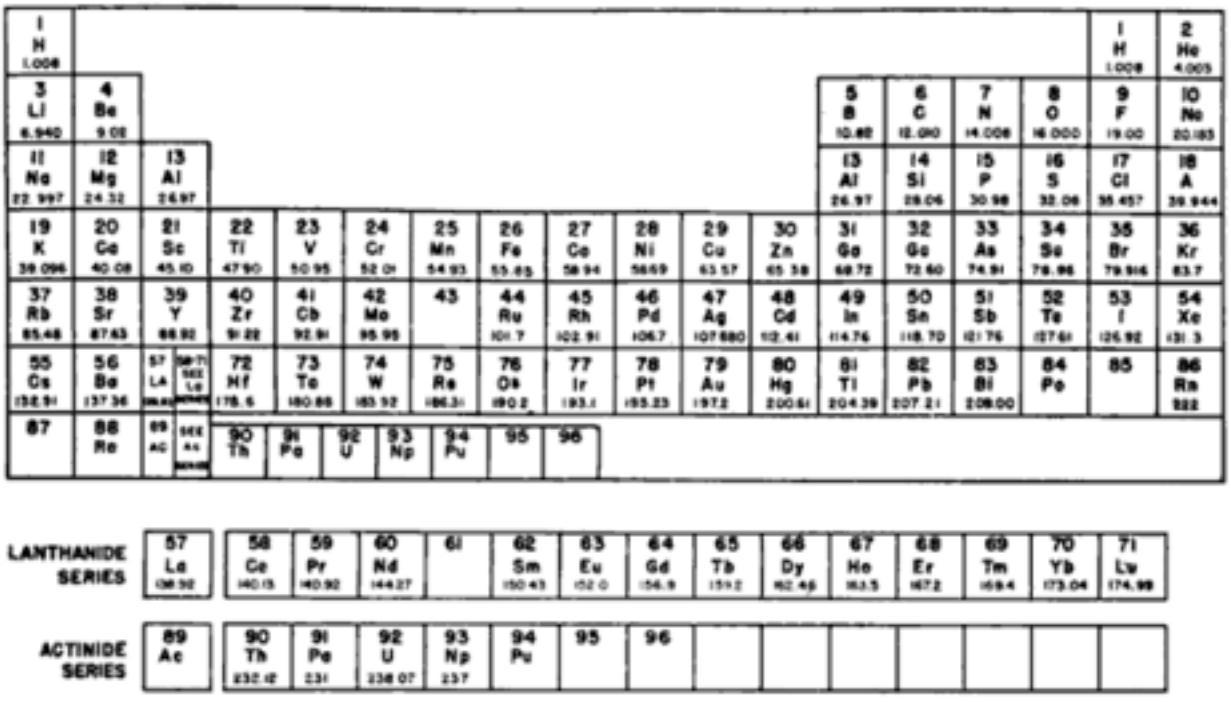
The Void is probably the result of a low-density area that formed right after the Big Bang. The Big Bang did not result in a homogeneous spread of material. There were denser areas that became the nucleus of superclusters of galaxies and the sparser areas became the voids. The result is that we see in our current universe the echoes of the Big Bang spreading down through the ages.

* * * *

SUPER HEAVY ELEMENTS IN NATURE
The Stars as a Source

(Authors Note: This is a revision of a paper I originally wrote in 1974 as a student of Cliff Keiser at NM Tech).

In the late fifties when I took my first chemistry class the periodic table was quite different than what we see today.



Glen Seaborg's group at Berkeley had just begun their work on producing elements in the laboratory with the first major success being element 101.

In 1969 he and Justin L. Bloom discussed the synthesis of the trans uranium elements in a series of articles published in Scientific American. In these articles Seaborg suggested that elements beyond 104 might begin to reverse the trend of shorter and shorter half-lives. They even suggested that element 110 might have a half life of one thousand years and could be found in nature. These elements were said to lie on the "island of stability", a term Seaborg used but was coined earlier by Myers and Swiatecki.

This led to a number of attempts to find the "super heavies" on Earth. In 1969 in an article in "Science", Anders, Heymann and Dieter discussed the attempts to locate elements 112 and 113 in meteorites. Then in 1972 Thompson and Tsong published an article in "Science" in which they reviewed attempts to find element 110 outlining the work of the Berkeley group. A number of other groups have conducted searches for these elements but with no conclusive evidence of their existence.

Because cyclotrons were not capable of achieving the energy necessary to use the very heavy, proton rich projectiles needed to produce these elements as they had the other trans uranium elements (in excess of 200 Mev) in 1974 I suggested that it might be possible to find these elements in the stars.

In the original paper I reviewed nuclear synthesis in stars however this audience is quite well versed in the life of a star so I won't go through the whole process. We believe that in a star formed from hydrogen the end point is probably iron. Second and third generation stars are built up from the debris of earlier stars. They follow the same burning sequence as population one stars, hydrogen burning followed by helium burning. However, the presence of metals (astronomers call any element beyond helium a metal) makes possible, in the helium burning stage, the production of elements beyond iron. Since it does proceed at a very slow pace (102 – 105 years per neutron capture step) production of elements beyond Bismuth cannot be carried out.

So how do we get the other elements? Uranium and beyond owe their existence to neutron capture chains that takes place on a much shorter time scale in an enormous neutron flux. Those conditions exist in a supernova. This is why I suggested that the place to look for Seaborg's super heavy elements was in supernova remnants.

So how do we find them? We can calculate the spectrum of any element using the Rydberg equation.

$$1/\lambda = \mathbf{R}\,(\,1/n^{2}_{1} - 1/n^{2}_{2})$$

where

R = Rydberg constant which is equal to 109677.58 cm^(-1)

λ= the wavelength

n = principal quantum number

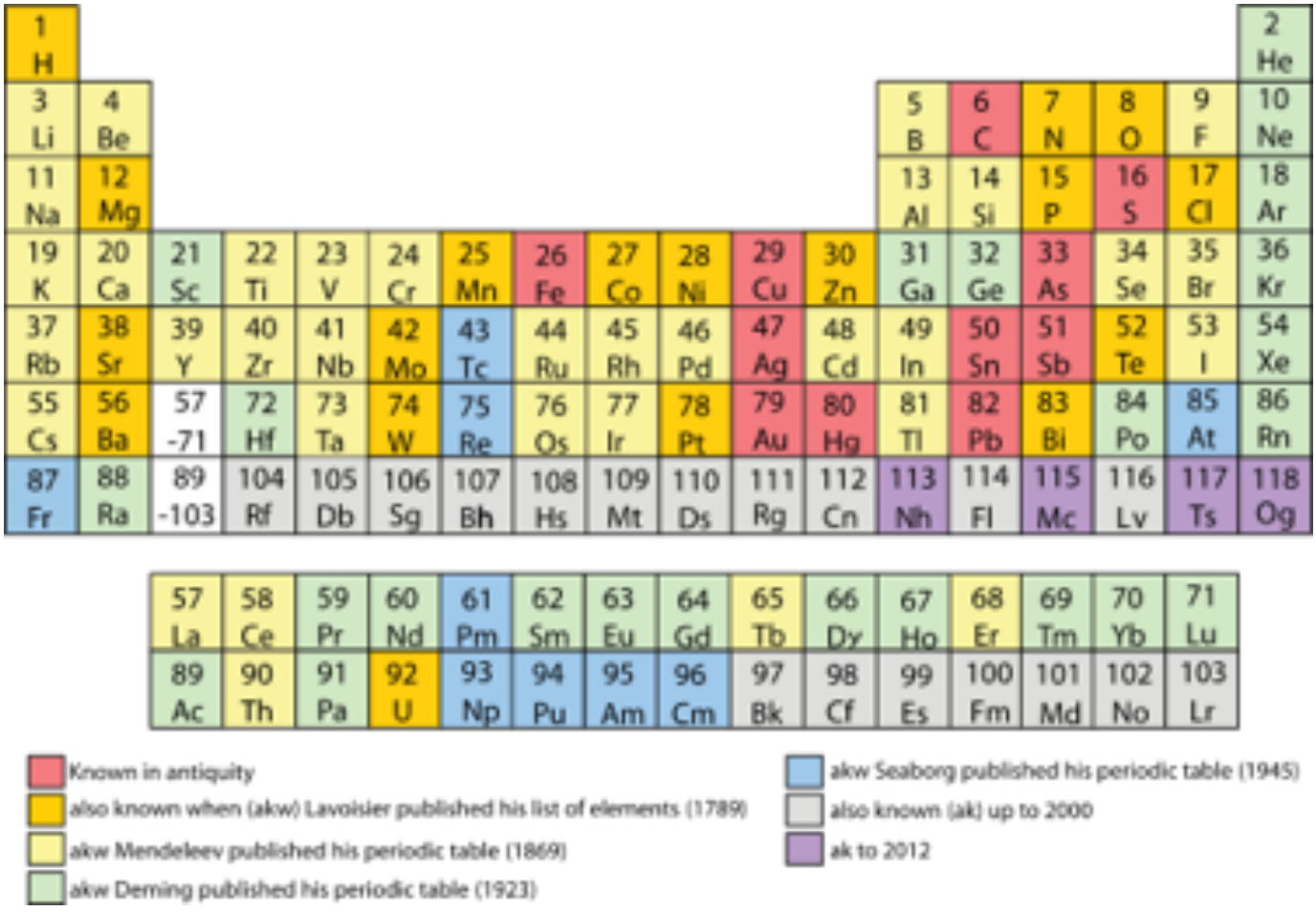
After calculating the spectrum, it is a reasonably simple matter to examine the spectra of supernova nebula.

As far as I am able to determine only one attempt has been made using this idea. Conway and Hulet were unable to identify the emission spectrum of Californium in IC 4182 and NGC 1003. I believe the idea is sound and if elements in the "island of stability" exist in nature this is how they will be found.

IC 4182

NGC 1003

Since the original paper was written our machines have gotten must better and we have expanded the periodic table but still haven't found Seaborg's "island of stability". Nor have we found any of these elements outside the laboratory.



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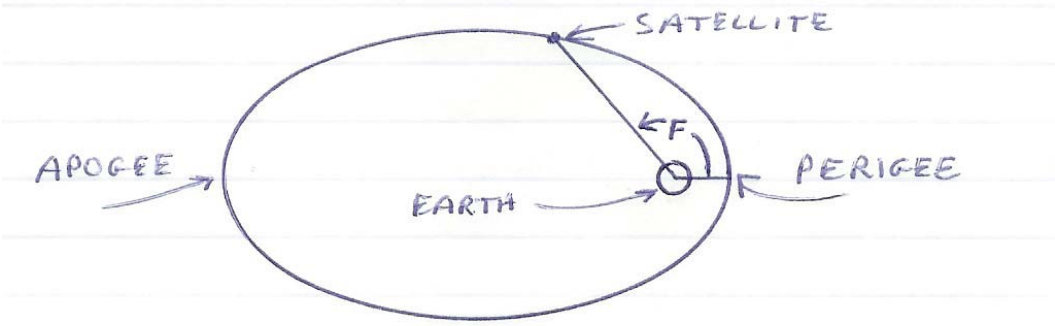
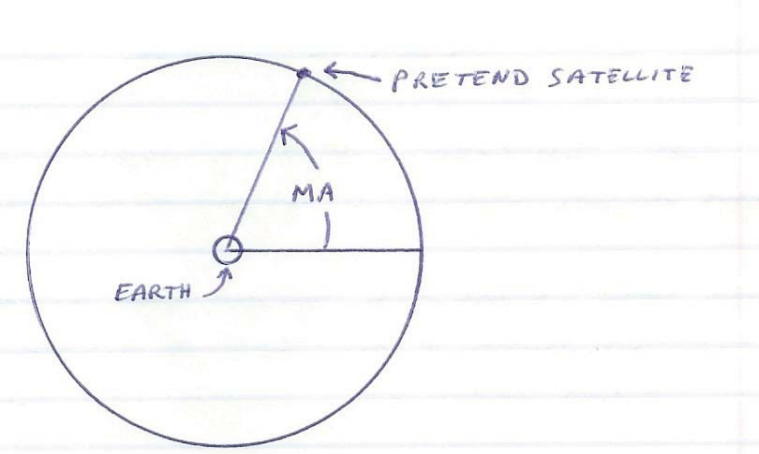
#2 More Ellipses

This article describes how to determine the position of an Earth satellite in its orbital plane.

Satellites orbit the Earth in ellipses. The point in the orbit closest to the Earth is called perigee and the point farthest from the Earth is apogee.



The angle F (from perigee to the satellite) is the true anomaly. The purpose of this article is to find F given the time. Because the orbit is elliptical the satellite speeds up and slows down as it goes round and round. It is moving fastest at perigee and slowest at apogee. This makes it difficult to find F. If the orbit was circular the angle F would increase at a constant rate because the satellite would move at a constant speed at a constant distance from Earth. In order to find F we will make use of a pretend circular orbit which has the same period as the elliptical orbit.



The angle MA is the mean anomaly. MA equals zero when F equals zero. To calculate MA you need to know the rate that MA is changing and you need to know MA at a given time.

Example:

- MA = 123.0284° at T_{epoch} = 86047.23985
- MM (Mean motion) = 14.82164 revolutions per day
- What is MA at T = 86052.94217?

$T\text{-}T_{epoch}$ = 5.70232 days

5.70232 * 14.82164 = 84.51773 revolutions (but we can get rid of the 84)
.51773 * 360 = 186.3828°

MA = 123.0284 + 186.3828 = 309.4112°

To find F, the true anomaly, we make use of one more angle, EA, the eccentric anomaly. There is an equation, known as the Kepler equation that relates EA and MA

$$EA = MA + e * \sin(EA)$$

where e is the orbital eccentricity. Note that when e=0 (a circular orbit) that EA = MA. When e > 0 we can't solve the equation for EA (i.e. we can't get EA all by itself on one side of the equal sign with everything else on the other side). If we make a guess at what EA is (EA = MA is a good first guess) and put it in the right hand side (R.H.S.) of the equation we will get a new EA on the left side. If we keep putting the new EA into the R.H.S. we will eventually get the same answer twice. For small values of e the equation converges in just a few iterations.

Once we have EA we can get F using this equation:

$$F = 2 * \tan^{-1}\left[\sqrt{\frac{1+e}{1-e}} * \tan\left(\frac{EA}{2}\right)\right]$$

We will also want to know the distance of the satellite from the center of the Earth.

$$R = [1 - e * \cos(EA)] * 42241.1 * MM^{(-2/3)}$$

Example: e = .03, EA = 1.2 radians, MM = 14.5 rev/day, then R = 7026.56 km

Problem: Given that

- T1 = T_{epoch} in days
- MA = Mean anomaly @T1 in degrees
- E = e
- MM = Mean motion in Rev/day

Find F and R at Time = T2

Use this BASIC algorithm

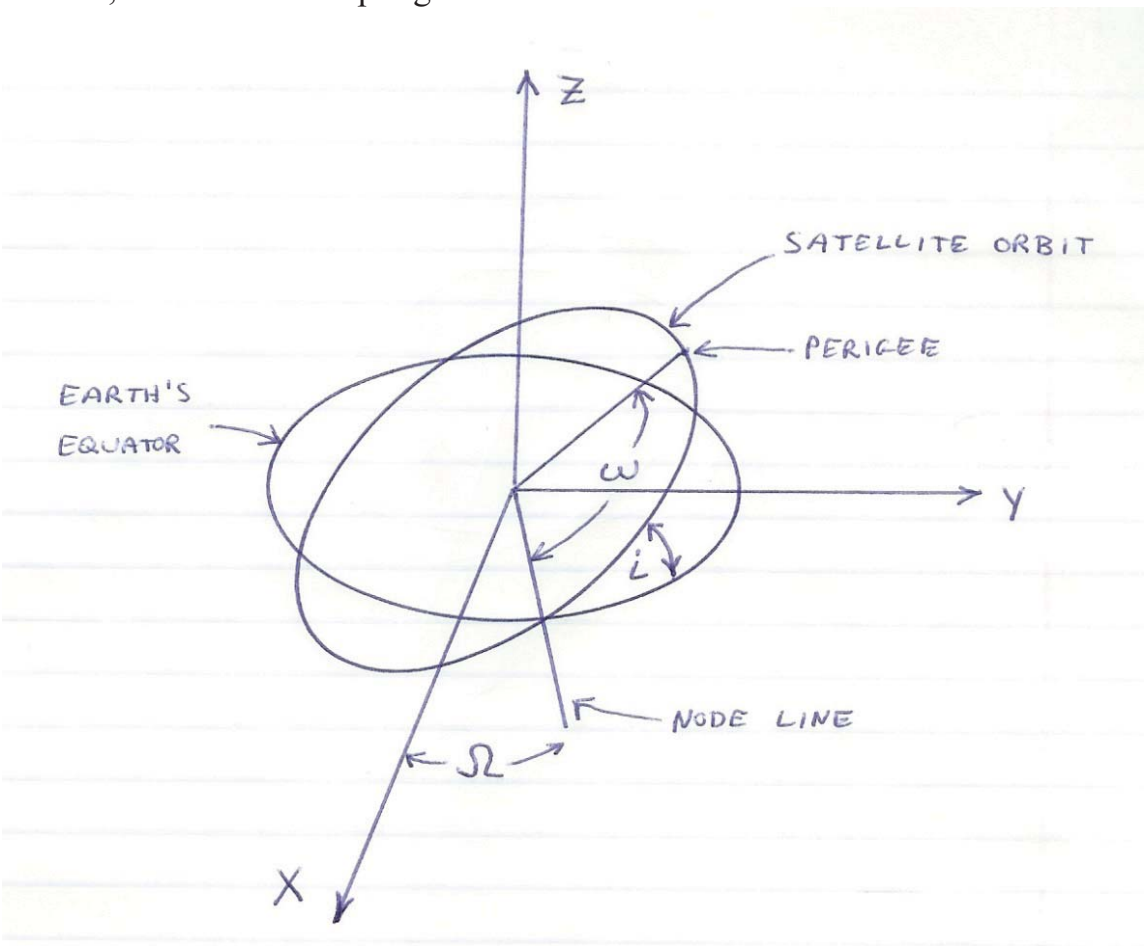
```
100 REM convert MA to revolutions
110 MA = MA / 360
120 REM find MA at T2 (in radians)
130 MA = MA + (T2-T1)*MM
140 MA = (MA - INT(MA))*6.283185
150 REM  find EA using Kepler's equation
160 X = MA : Y = MA : EA = MA
170 EA = MA + E*SIN(EA)
180 IF EA = X OR EA = Y GOTO 210
190 X = Y : Y = EA : GOTO 170
200 REM Find F and R
210 F = 2*ATN(SQR((1+E)/(1-E))*TAN(EA/2)
220 R = (1-E*COS(EA))*42241.1*MM^(-2/3)
```

#3 Where In Space?

In article #1 we found how to find the x, y, and z coordinates of an observer on Earth, given the longitude, latitude, and time. In article #2 we found how to get the true anomaly (F) and distance from the center of the Earth (R) of a satellite, given the time and satellite orbital elements. In this article we will see how to get the x, y, and z coordinates of the satellite, given R and F.

So far we are familiar with the mean anomaly (MA), eccentricity (e) and mean motion (MM). Knowing these three orbital elements we can get R and F for any time we want. There are three more orbital elements: i is the inclination, Ω is the longitude of the ascending node, and ω (little omega) is the argument of perigee.

For Earth satellites, i is the angle between the plane defined by the Earth's equator and the plane defined by the satellite's orbit. Ω is an angle measured in the equatorial plane. It is the angle, seen from the Earth's center, from the positive x-axis to the point where the satellite crosses the equatorial plane, going in a northerly direction. ω is measured in the plane of the orbit. It is the angle, seen from the Earth's center, from the point where Ω is measured to, to the satellite's perigee.



The x, y, and z coordinates of the satellite are:

$$X = R * \cos(F + \omega) * \cos(\Omega) - R * \sin(F + \omega) * \cos(i) * \sin(\Omega)$$
$$Y = R * \cos(F + \omega) * \sin(\Omega) + R * \sin(F + \omega) * \cos(i) * \cos(\Omega)$$
$$Z = R * \sin(F + \omega) * \sin(i)$$

Because the Earth is not spherical two of the orbital elements change from day to day. These elements change due to the weird gravitational field surrounding our oblate Earth. Ω and ω change significantly each day. If you want to know where a satellite is and you have orbital elements that are weeks old you will need to use these fudge factors.

First calculate this number

$$XX = \frac{-2.3265E-4}{(1-e^2)^2} * MM^{(7/3)}$$

The amount that Ω changes each day (in radians) is

$$\Omega = XX * \cos(i)$$

The amount that ω changes each day (in radians) is

$$\omega = XX * (2.5 * sin^2(i) - 2)$$

Example: e = 0.001, MM = 14.5 rev/day, i = 45°

XX = -0.1192939
Ω = -0.08435 radians / day = -4.833° / day
ω = 0.08947 radians / day = 5.1263° / day

Photo of the Month

Sunset in New Mexico

New Mexico is famous for it's sunsets. Since I have been here, I have seen many beautiful sunsets. This one is special! Captured by Gary Starkweather from his front yard, about 20 mi north of Deming, NM, looking northwest on June 9th using an iPhone X.

Photo of the Month

More Sunsets in New Mexico

This photo was taken by Mike Nuss from his front yard, about 10 miles south of Deming, NM, also on June 9, 2019. Captured with a Samsung Galaxy S9 cell phone on automatic settings.

M 64 (Black-Eye Galaxy)

OTA: RCOS (14.5" f/8) Camera: SBIG STX-16803 Observatory: Deep Sky West
EXPOSURES (used): Red: 17 x 1200 sec Blue; 10 x 1200 Green: 12 x 1200 Lum.: 21 x 1200 Hydrogen: 12 x 1800
Total exposure 26 hours Image Width: ~1/2 deg
Processed by Alex Woronow using PixInsight, Matlab & Aurora Photo in 2019

A relatively isolated galaxy lying at about 17M light-years from us. It is said to be a barred spiral galaxy with tightly wound arms. It is a Seyfert galaxy (a high-energy radiator with a super-massive central black hole) and almost as brightly shinning. The gas in the outer regions of this M64 is rotating in the opposite direction from the gas and stars in its inner regions. This strange behavior can be attributed to a merger with a satellite galaxy over a billion years ago. (Source: largely Wikipedia & NASA)
Processing Notes:
The main challenges are 1) getting detail in the central part of the galaxy, and 2) seeing any galactic-arm structure at all. The main tool used for both of these was an implementation of Local Laplacian Pyramids in Matlab. Output from that procedure was then further sharpened using Laplacian-of-Gaussian processing and wavelets for noise suppression and a touch more sharpening. I just barely used Unsharp Mask, and what little artifacts there are arose from that, I believe.

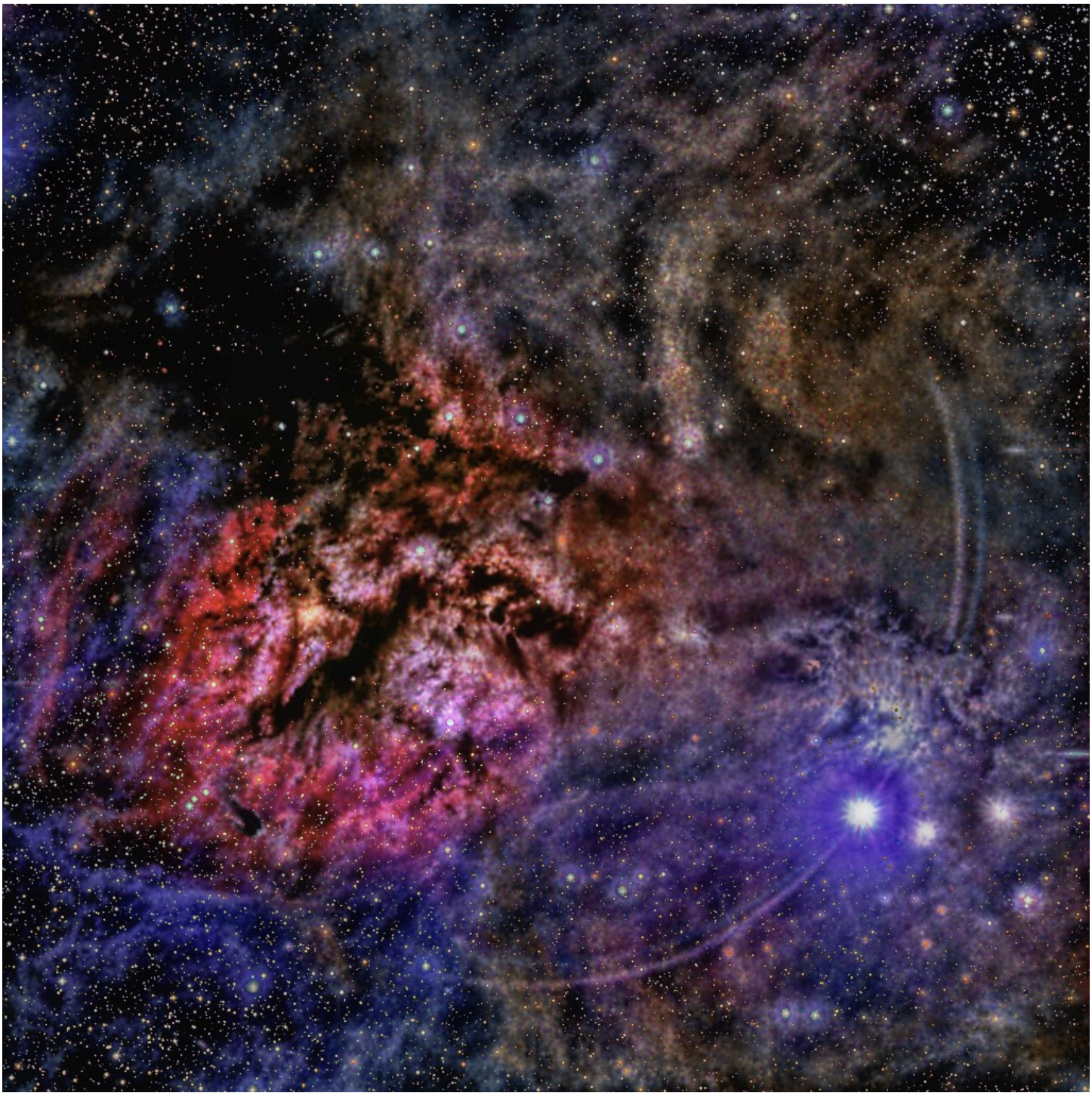
Photo of the Month

Catch of the week is **NGC4725** in Coma Berenices.

I had not observed this 9th magnitude galaxy before- I'm impressed! This image is 60x2 minutes one shot color (2 hours total) Image was taken on the nights of June 6th and 7th 2019 from Covered Bridge Observatory in New Mexico, under remote control from Kitt Peak. This is an interacting galaxy with NGC4747, visible in the upper left corner. The small spiral beneath it is NGC4712, magnitude 12.8. No flats were used, perhaps on an exposure this long with this telescope they become needed. The camera cooler was also having trouble keeping up early in the night, perhaps this also contributed to the faint glow in the center. Alternatively, it may be a real feature. The outer portions of NGC4725 and NGC4747 that were captured strongly suggest that a longer exposure may very well reveal a complete tidal bridge between the galaxies. Telescope was the C-14 Hyperstar with QHY183C camera.

Chris Brownewell

Photo of the Month

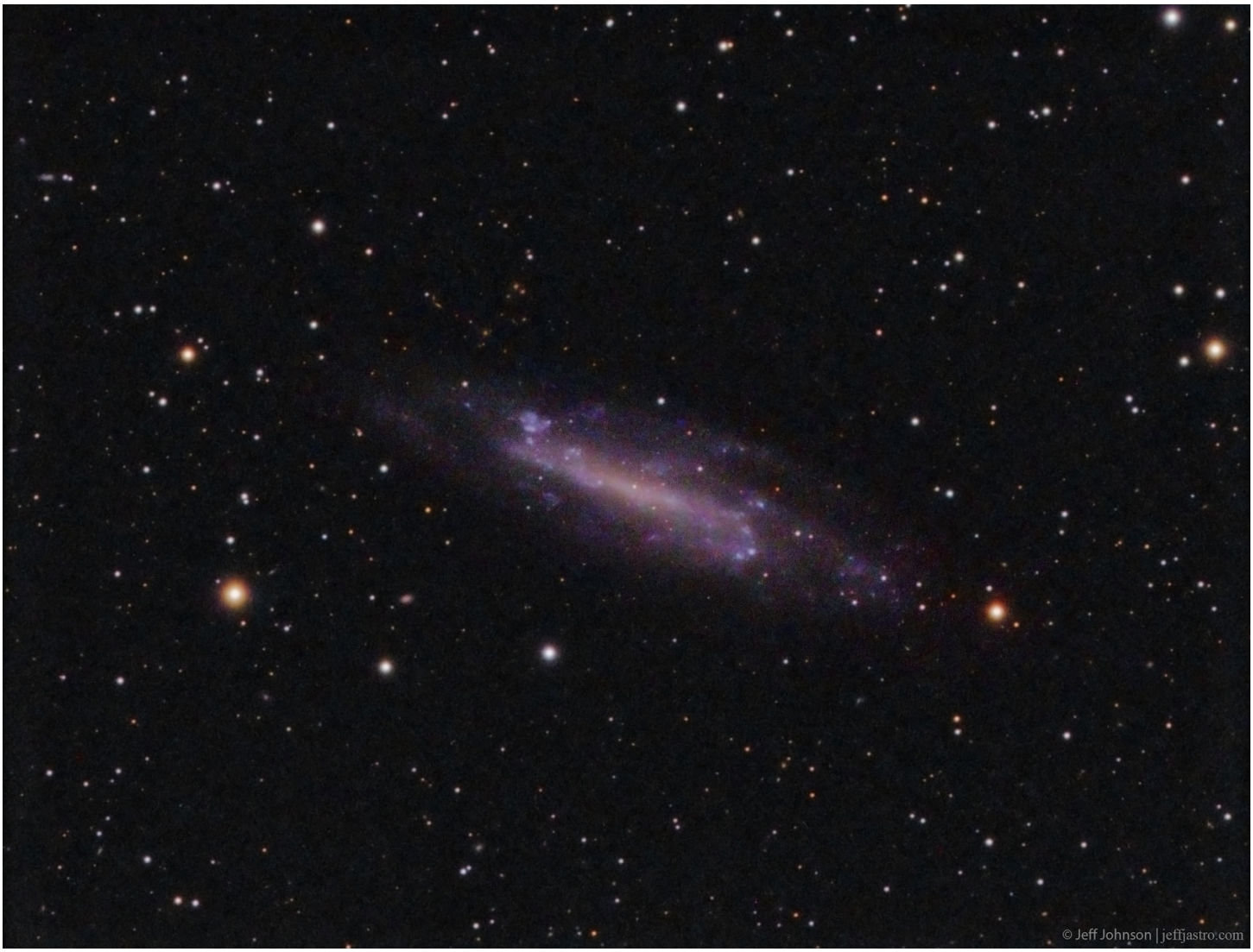


IC 1985 Emphasizing the rarely-imaged structure in the nebulae (also shows LDN1472,1468,749,758,1470/B4,601, B3, IC348--and more)

OTA: RH-305 (12" f/3.5)Camera: SBIG STX-16803 Observatory: Deep Sky West
EXPOSURES: Red: 26 x 300 seconds Blue: 36 x 300 Green: 23 x 300 Lum.48 x 300
Hydrogen: 15 x 1200 Total Exposure ~16 hours Image Width: ~2 deg
Processed by Alex Woronow using PixInsight, StarNet++, Matlab, Aurora HDR in 2019

Note: the arc running through the bright star at the lower right is likely due to internal reflections in the optical train. As always, comments and suggestions for improvements welcomed. Alex

Photo of the Month



NGC 4236 - lesser-known barred spiral galaxy (imaged from my backyard in Las Cruces)
Distance: 11.7 million light years

Equip: TOA-130F, EM200, QSI690wsg
Data: 6x10min L (bin1x1); 3x5min ea RGB (bin2x2); 10xdarks/flats/fdarks/bias
Date: 3 May 2019

More details: http://jeffjastro.com/dso/NGC4236_3May19.htm

Jeffrey O. Johnson

Photo of the Month

LDN 1622
OTA: Star-Fire 175 (f/8) Camera: FLI - PL16070AE Observatory: Deep Sky West
EXPOSURES: Red: 15 x 600 seconds Blue: 21 x 600 Green: 20 x 600 Luminosity: 31 x 600 Hydrogen: 12 x 1800 Total exposure ~22 hours Image Width: ~1.4 deg
Processed by Alex Woronow using PixInsight, StarNet++, Matlab, Aurora HDR in 2019

LDN 1622 lies in the constellation of Orion and at a distance of about 500 light-years. This is considerably closer than the Great Nebula of Orion, in Orion's sword.
Observations at microwave frequencies show anomalously strong radiation that correlates with infrared radiation intensities. This correlation is consistent with the "spinning dust model." This model suggest that extremely small (nanometer) dust grains, rapidly spinning (10-60 GHz), and carrying a dipole electric charge give rise to both the observed microwave radiation and thermal IR radiation.
(Source: largely Wikipedia)

Processing: Initial culling, alignment, and stacking of images occurred in PixInsight. Ha image data were mixed into the R channel and the L channel. After stretching, the stars were removed from the LHRHGB image using StarNet++ and the star-free image was exported to MatLab. MatLab preformed a Local Laplacian Pyramid sharpening and some edge-aware smoothing (which is an artifact-free algorithm). Back in PI, the image was further smoothed and sent to Aurora HDR for color adjustments and detail enhancement. Final touches to color, with subsequent star-reintroduction occurred in PI.
Keeping busy learning Matlab and applying my rudimentary knowledge to images--hence the attached! Comments and suggestions always welcomed.
(the attached image is down-sampled 2x from the full-sized image) Alex