

The High Desert Observer

January 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

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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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January Meeting --

Our next meeting will be on **Friday, January 25**, at the Good Samaritan Society, Creative Arts Room at 7:00 p.m.

The speaker will be Ron Kramer and the topic will be "The Astronomical League".

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.

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

January 2019

Well a new year has begun for ASLC and I hope it will be as good as last year. I don't see any major changes happening as we continue the primary mission of sharing the universe with astronomers and non-star gazers alike.

There is one change that I think we will have to make this year, though I don't see it as a major change. We must discuss the dues for our organization since the amount collected no longer covers our expenses. We can no longer depend on gifts from generous benefactors to pay our bills. As with anyone we must either increase income or cut expenses. Sometime between now and the next budget we must decide which path to take. I welcome any ideas you have!

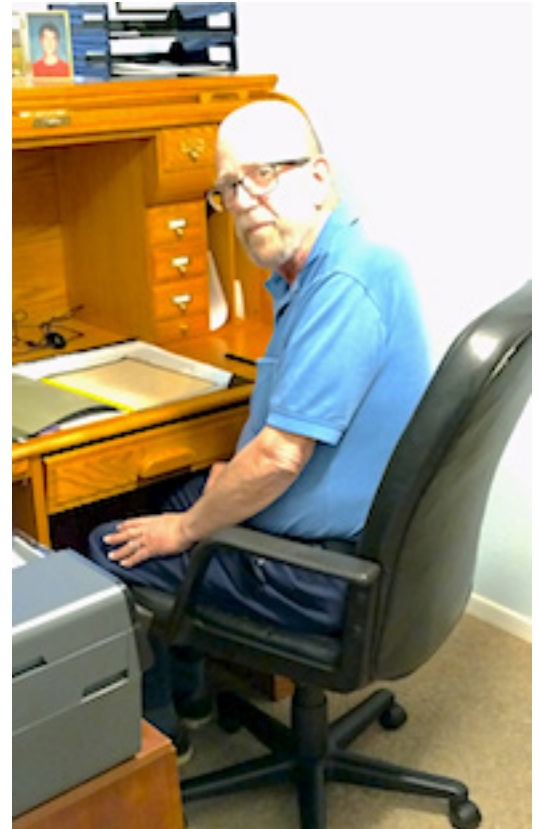
As always, we are planning to have some excellent presentations to continue the tradition of exploring the universe with such a fantastic group of minds such as yourselves. Our first speaker will be member Ron Kramer who is also the president of the Astronomical League. He will talk about what AL has to offer its members. I have invited Stella Kafka of the AAVSO to speak to us in February. I'm not sure exactly what the topic will be but do know she will talk some about their convention to be held here in Las Cruces. A good start but I would entertain suggestions about other speakers and topics. HELP!

Just finished Stephen Hawking's last book, probably way behind most of you. I found it interesting because there were a number of questions most of us have asked at one time or another. He has some interesting answers. Also interesting is Stephen did so much work on black holes and as I was reading his book an article appeared (forget exactly where) that said there is no black hole at the center of our galaxy. Need to explore this more.

THE ANSWER IS 42!

Tracy Stuart, ASLC President

January 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 ***2018 November-December Report*** by Jerry McMahan

Desert Springs Christian Academy, Thursday, November 8

Tracy Stuart, Steve Wood and Sid Webb brought 8 inch scopes. Chuck Sterling had his 4 inch refractor. I brought the ETX 125, and had problems with it binding in right ascension. Howard Brewington joined us as well.

It was a clear night with some clouds moving in late. The sky was pretty bright with city lights reflecting off of thin clouds. This made faint objects difficult to see. We did have a large group of observers attend the event. They seemed to enjoy the session.

Tombaugh Observatory, Friday, November 16

Clouds limited the available targets, but Steve Shaffer and Jerry McMahan had the Moon on the 12.5 inch scope. The club meeting was also on this night due to it being moved up for Thanksgiving. The other two domes did manage to find some targets through breaks in the clouds.

One little boy, four, or five years old, spent a while looking at the Moon. Later, his father brought him back because he was crying, wanting to see the Moon again

Moongaze, Saturday, November 17

Chuck Sterling and Jerry McMahan were at the International Delights. I had the ETX 125 and Chuck brought his 100 mm refractor. It was clear and a little cold, but we did see Mars, Saturn and the Moon. Meanwhile, Steve Wood was by himself at the other site. I did go by there after we finished at the International Delights. Steve had one customer that spent most of the evening there and said he intends to join the club.

Leasburg, Saturday, December 1

Dave Doctor opened the observatory. Bob Armstrong assisted. I hung around. Chuck Sterling set up his 100 mm refractor. Sid Webb was there for daytime viewing with his H-Alpha solar scope. Sid and Steve Wood tested a donated 8 inch Meade LX 200 GPS scope. It looks like it is usable.

It was clear, but again the sky seemed pretty bright. Las Cruces lights were probably reflecting off of high level clouds, or something else in the sky.

Rockhound State Park, Saturday December 1

The weather looked questionable, but Bill Nigg, Mike Nuss, and Charles Turner showed up anyway. We had to deal with passing clouds, but there were enough holes in the clouds to find objects. It seemed like the coldest night of the year, but that is relative. We had 3 telescopes, 3 operators, 1 helper, 1 park ranger, and ONE customer. We had a good time until our hands froze. The customer was very happy and already had some interest in astronomy!

Moongaze, Saturday, December 9, 2018

Actually it was another cloud watch night. Steve Wood, Chuck Sterling and I (Jerry McMahan) went to the International Delights. Howard Brewington was not feeling well, and did not make it to this event, not that he missed anything. We drank coffee and tea, while checking the clouds once in a while. The Moon was briefly seen through thin clouds, well enough that it would have been seen through a scope. A few minutes later, you could still see the Moon, but the view through a telescope would not have been very good. After that no Moon could be seen. Summary, no observing..

City of Rocks SP, Saturday, December 9, 2018

Weather was finally cooperating. It was mostly clear and not as cold as some nights in December. Bill Nigg, Mike Nuss, and Charles Turner showed up with telescopes. We had a very good crowd of campers, mostly old folks and only a couple of kids. There were at least 3 amateur astronomers among the campers. They were helping us find things and answer questions for the other campers. Bill Nigg did the presentation. We had about 25 people and viewed quite a few of the tourist objects.

Leasburg, Saturday, December 29

Chuck Sterling opened the Observatory. Jerry McMahan assisted. No one else showed up. It was clear, but cold. Mars was observed, just to test the scopes alignment. That was the only observing done. No one came to the observatory. After an hour, Chuck decided to close up. We waited an hour to see if any other club members showed up. No one did. This was the last outreach event of the year.

Summary for 2018.

This was a slow year for outreach events. Based on my participation, we had only 60 percent of the events from two years ago. Part of this was due to cancellation of events due to weather. We also had competition from the NMSU Astronomy Department setting up star parties at schools. As Chuck Sterling said, competition still means that people were being exposed to Astronomy. Budget cuts also seem to have resulted in fewer school events.

The club members that did the most to support outreach, this year, included Chuck Sterling, Howard Brewington and Steve Wood.

Hopefully, we will have better luck in 2019.

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

Jan	01	17:13	Sun Sets
	01	00:00	New Years Day - All Day
	05	17:00	OUTREACH; NPO Presentation at Rockhound SP, B. Nigg, M. Nuss, C. Turner
	05	18:29	New Moon
	12	17:00	OUTREACH; MoonGaze, International Delights Café
	17	17:00	OUTREACH; MoonGaze, Pan Am Plaza on University Ave
	13	23:46	First Quarter Moon
	20	19:00	Total Lunar Eclipse (see Announcement 3)
	20	22:15	Full Moon
	25	19:00	ASLC Monthly Meeting; Good Samaritan Society, Activities Meeting Room
	26	17:00	OUTREACH; Dark Sky Observing at Leesburg Dam State Park
	26	17:00	OUTREACH; NPO Presentation at City of Rocks SP, C. Turner, M. Nuss
	27	14:11	Last Quarter Moon

Feb 01	17:41	Sun Sets
01	23:04	Mars Sets
04	14:04	New Moon
09	17:00	OUTREACH; MoonGaze, International Delights Café
09	17:00	OUTREACH; MoonGaze, Pan Am Plaza on University Ave
12	15:26	First Quarter Moon
15	19:00	OUTREACH; Tombaugh Observatory Open House: 7:00 to 8:00 PM
18	22:21	OCCULTATION, Sirius is occulted by asteroid (4388) Jurgensstock
19	08:54	Full Moon
22	09:00	Sacramento Mountains Spectroscopy Workshop; 22nd, 23rd, 24th all day +evening
22	19:00	ASLC Monthly Meeting; Good Samaritan Society, Activities Meeting Room
23	17:45	OUTREACH; Dark Sky Observing at Leesburg Dam State Park
26	04:28	Last Quarter Moon

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

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Announcements

1. The January ASLC meeting will be held on January 25, 2019 at 7:00 PM at the Creative Arts Room, Good Samaritan Society Las Cruces Village, 3011 Buena Vida Circle, Las Cruces, New Mexico. The program for the January meeting will be a presentation by Ron Kramer, President of the Astronomical League on the AL and all the things it does for its members.

2 There is a total eclipse of the Moon coming on Jan 20, 2019. From Las Cruces, the Moon will go into eclipse about 7 pm when it is low in the east, and it will last for several hours.

Some of you may have noticed that the HDO has a masthead photo. I took that photo in Feb 2017 during another total Lunar Eclipse. I wanted something more distinctive than text on a white paper or a colored background. Well this is another chance to do better. I am not an accomplished photographer and I really did not plan properly for the event.

I want to invite all you “real” photographers to show up at the “Big Bird” rest area **WEST** of LC, or where ever is convenient for you, and make a better photo for the masthead. Bring your results to the next club meeting in January.

3. There is another rare astronomical event coming to Las Cruces in February. On Feb 18, 2019 at about 10:21 pm, asteroid (4388) Jurgensstock will occult the bright star Sirius for almost 2 seconds. It is not too soon to begin planning for this event. Perhaps we can get one of our experienced members to explain what it is, why it is important, and what you need to do to record this event

4. Congratulations Fred! The Central Bureau for Astronomical Telegrams (CBAT), the official outlet for astronomical alerts issued Central Bureau for Electronic Telegrams #4592 announcing the discovery that minor planet (2337) Boubin is actually a binary asteroid whose two components orbit each other every 16.09 hours. This result is based on photometric observations of this object. One of the discoverers is “F. Pilcher, Organ Mesa Observatory, Las Cruces, NM, U.S.A.”.

5 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!

6. The second Sacramento Mountains Spectroscopy Workshop (SMSW-2) will be held in Las Cruces, New Mexico on February 22, 23 and 24, 2019. Visit the Workshop website for info and details on program, speakers, and how to sign up: www.smswweb.com

The first Sacramento Mountains Spectroscopy Workshop was designed to be a bootcamp to help our friends and neighbors get started and move forward with amateur astronomical spectroscopy. We were very successful but we had to turn away interested attendees due to lack of space. SMSW-2 will be bigger and better and we will be able to accommodate many more people, but the goal is still the same. We want to help newbies get started with astronomical spectroscopy and we want to help experienced amateurs learn more and get better. As far as we know, our workshop is unique. You won't find a bootcamp like this anywhere else in the world.

As a veteran of the first Spectroscopy Workshop, your editor can tell you that the speakers are world-class and you will not find anything like the breadth and depth of knowledge and experience anywhere else. The program was comprehensive and thorough. It is hands-on with respect to learning how to capture, calibrate and process the data to produce those valuable spectroscopic profiles.

It is also a wonderful experience to learn along side other amateur astronomers. For me, it was the most fun I have had at an astronomy event in a long time.

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Meeting Minutes
ASLC Monthly Meeting
October 2018 Minutes

Show and Tell:

Sid Webb announced the "Turn Back the Sun" event to be held at Leasburg Dam State Park (LDSP) on 01 December from 12:00 to 8:00 pm. ASLC members are welcome to bring solar scopes for day time viewing. This will also be the ASLC monthly event at LDSP, so members are encouraged to stay for stellar viewing after sun down with the 16" Meade and the Celestron telescopes. Sid also announced the recent donation of a Meade LX200 10" SCT to the Loaner program.

Bert Stevens has RASC handbooks for those who requested them, \$26 each.

Howard Brewington gave a report on the 2018 Okie Tex star party, where it mostly rained, a lot

Call to Order:

Howard Brewington, President, Astronomical Society of Las Cruces (ASLC, the Society), called the November 2018 business meeting to order at 7:15 pm, 16 November 2018, Creative Arts Room, Good Samaritan Society Las Cruces Village, 3011 Buena Vida Circle, Las Cruces, New Mexico.

President's Comments:

Howard Brewington, President, welcomed the group to tonight's meeting. He asked all members and any visitors to sign in on the rosters at the rear of the room. He welcomed Leon Getz who is visiting Las Cruces from Alaska. Kent DeGroff is also visiting but plans to join the Society tonight. He has a remote controlled 18" telescope in an observatory outside Silver City.

Howard reminded the group that annual membership dues are now payable. Because of liability insurance accountability for outreach, current membership is a requirement. He also noted the possibility that the Society may have to increase dues for the 2020 membership year to not operate in the red.

Storage is also an issue for telescopes in the Loaner program, RenFaire material, etc. The Society is currently renting a 5' X 10' unit for \$30 per month.

This year's December meeting will be a holiday party at Rich Richins' home on 08 December starting at 6:00 pm. More details to follow.

Howard thanked Charles Turner for the November issue of the High Desert Observer (HDO) and Mike Nuss for his article on the visit to the Mt. Graham International Observatory (MGIO) in Arizona.

The minutes of the October meeting were published in the HDO. If no corrections or discussion are required, Howard asked that the minutes be accepted as submitted; they were accepted by acclamation.

Treasurer's Report:

Trish Conley, Treasurer, provided a summary of the Society's finances available. She noted that \$23.50 interest had been earned by the Society's CD. She has also collected \$89.50 in membership dues.

.Outreach:

Chuck Sterling, Program Coordinator, announced upcoming events. There will be Moon Gazes on 17 November and 15 December at two locations: International Delights Café and El Milagro Coffee y Espresso in the Pan Am Plaza. The Society will also support two events at LDSP: 01 December: "Turn Back the Sun" (see above) and 3rd Quarter Moon on 29 December.

Howard thanked the members for supporting him as President the past two years. Tracy Stuart will assume the President's position effective 01 January 2019

Astronomical League (AL):

Ron Kramer is currently serving as Vice President and acting President of the AL. The AL has published a calendar for 2019 that has extensive astronomical and AL information included. Cost is \$13 per calendar (the same price as the Planetary Society calendar). Ron has several calendars with him tonight and if members are interested can provide additional copies.

Presentation:

This month's presentation was by Society member Dr. Bill Stein, "What is AAVSONet and How You May Use It". The AAVSONet is a dispersed, shared robotic telescope network operated by the AAVSO. Bill explained how members and non-members may submit proposals for an observing program on variable stars to the AAVSO Bright Star Section.

Bill also noted that the Section is proposing that the Fall 2019 meeting of the AAVSO be held at New Mexico State University (NMSU) on 25 26 October 2019. The meeting will cover several topics and volunteer help from the community is desired and encouraged.

The November 2018 Monthly meeting will be held on 16 November to not conflict with the Thanksgiving holiday.

The October meeting of the Astronomical Society of Las Cruces concluded at 8:20 pm. A social time followed at Pecan Grill.

-Respectfully submitted by John McCullough, ASLC Secretary

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In Case You Missed it, News from the Heavens
By Kevin Brown



Yerkes Observatory Closed

Yerkes Observatory, home of the 40" Alvan Clark & Sons refractor, the largest refractor ever built, closed to researchers and visitors on October 1, 2018. There are no current prospects or plans to reopen it. The observatory was established in 1897 at Williams Bay, Wisconsin by George Ellery Hale with financing from businessman Charles T. Yerkes.

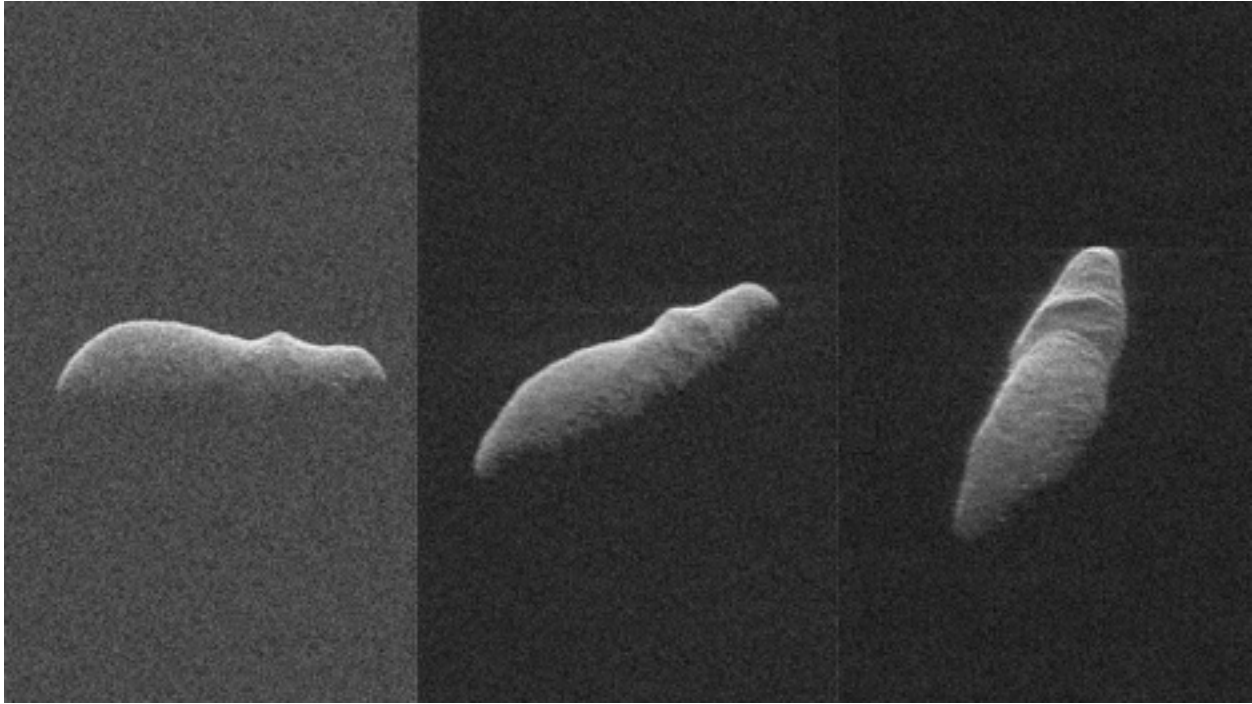
Yerkes Observatory was owned and operated by the University of Chicago Department of Astronomy and Astrophysics and also housed 40" and 24" reflectors. The university decided that due to the light polluted location the quality of research that could be conducted did not justify the \$500,000 per year needed to maintain the observatory.

Voyager 2 Reaches Interstellar Space

In early November 2018 the Voyager 2 spacecraft crossed into interstellar space where the environment is dominated by cosmic rays ejected by other stars rather than the charged particles of the solar wind. This occurs about five years after Voyager 1 made the transition to interstellar space. Although Voyager 2 was actually the first of the two spacecraft launched in 1977, it's different trajectory resulted in Voyager 1 reaching interstellar space much earlier. Unlike Voyager 1, the plasma detecting instrument on Voyager 2 is still functioning and able to provide data.

NASA Radar Images Holiday Asteroid

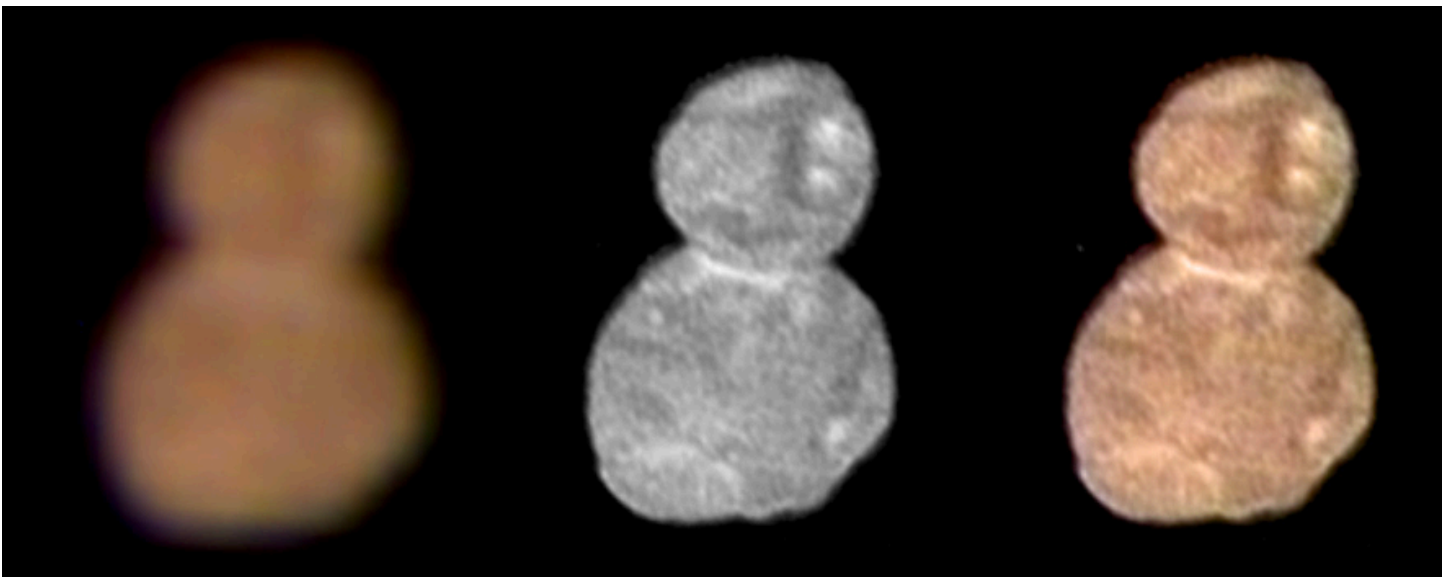
Asteroid 2003 SD220 flew past earth at a distance of about 1.8 million miles on Saturday, Dec. 22. This was the asteroid's closest approach in more than 400 years. Astronomers took this opportunity to obtain detailed radar images of the asteroid's surface and shape and to refine the orbit. The images were obtained by coordinating the observations of three instruments: NASA's 70 meter antenna at the Goldstone Deep Space Communications



Holiday Asteroid: Some think it looks like a flying hippopotimus.

Complex in California, the NSF's 100 meter Green Bank telescope in West Virginia, and the Arecibo Observatory's 305 meter antenna in Puerto Rico.

NASA Flys-by Snowman in Space



This first color photo of the Kuiper Belt object Ultima Thule reveals the object's red color as seen by NASA's New Horizons spacecraft from a distance of 85,000 miles (137,000 kilometers) during a Jan. 1, 2019 flyby. From left to right: an enhanced color image, a higher-resolution black and white image, and an overlay that combines both into a more detailed view.

Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

On Jan 1, 2019 the New Horizons spacecraft flew past a Kuiper Belt Object called 2014 MU69 and nicknamed Ultima Thule. The successful encounter filled the spacecraft's data recorders, but at over 4 billion miles distant it will take over 20 months to send back the fruits of the mission. The first closeup images show the 21 mile long KBO to be a contact binary. Planetary scientists are very happy and very busy!

The Uranograph - January 2019

By Bert Stevens

Constellation of the Month: Andromeda, The Princess

This month's constellation is not a warrior, or a doer of great deeds, but a princess who kept a promise. Andromeda is a member of the royal family of the ancient kingdom of Æthiopia (not in present day Ethiopia, but Israel). Most of this royal family and the other characters in this story have ended up as constellations in our sky.

The king at the time was Cepheus. He had journeyed with Jason and the Argonauts in search of the Golden Fleece. After his adventures, he settled down as the King of Æthiopia. He married the beautiful, but vain, Cassiopeia. Soon after their marriage, Queen Cassiopeia presented her husband with a daughter, Princess Andromeda. Andromeda inherited her mother's beauty. Cassiopeia was very proud, and boasted that she was more beautiful than even Nereids, a sea nymph. When Nereids overheard her boasting, she became very jealous and went to Poseidon, god of the Sea, who sent Cetus, the sea monster, to lay waste to the coast of Æthiopia, kill its people, cattle and laying waste to the land.

Cetus, in the form a huge whale, began destroying the towns along the coast of Æthiopia and killing the people. King Cepheus, wanting to stop the slaughter, consulted an oracle. The oracle told him to offer his daughter to the sea monster, and this would appease Poseidon and save his people. Cepheus was faced with an agonizing choice, but as king, he was responsible for his people. He had his daughter chained to the rocks along the seacoast and left for Cetus to devour. Cetus abandoned his destruction and headed toward the chained Andromeda.

Just by chance, Perseus, flying home from dispatching the gorgon Medusa with Hermes winged shoes on his feet, flew over Æthiopia. He saw Andromeda chained to the rocks, and Cetus heading toward her. Taken by her beauty, Perseus flew down and asked her why she was chained up. Andromeda explained the situation. Perseus then flew to King Cepheus and offered to slay Cetus to save Andromeda if Cepheus would give him her hand in marriage and a kingdom. Cepheus immediately agreed.

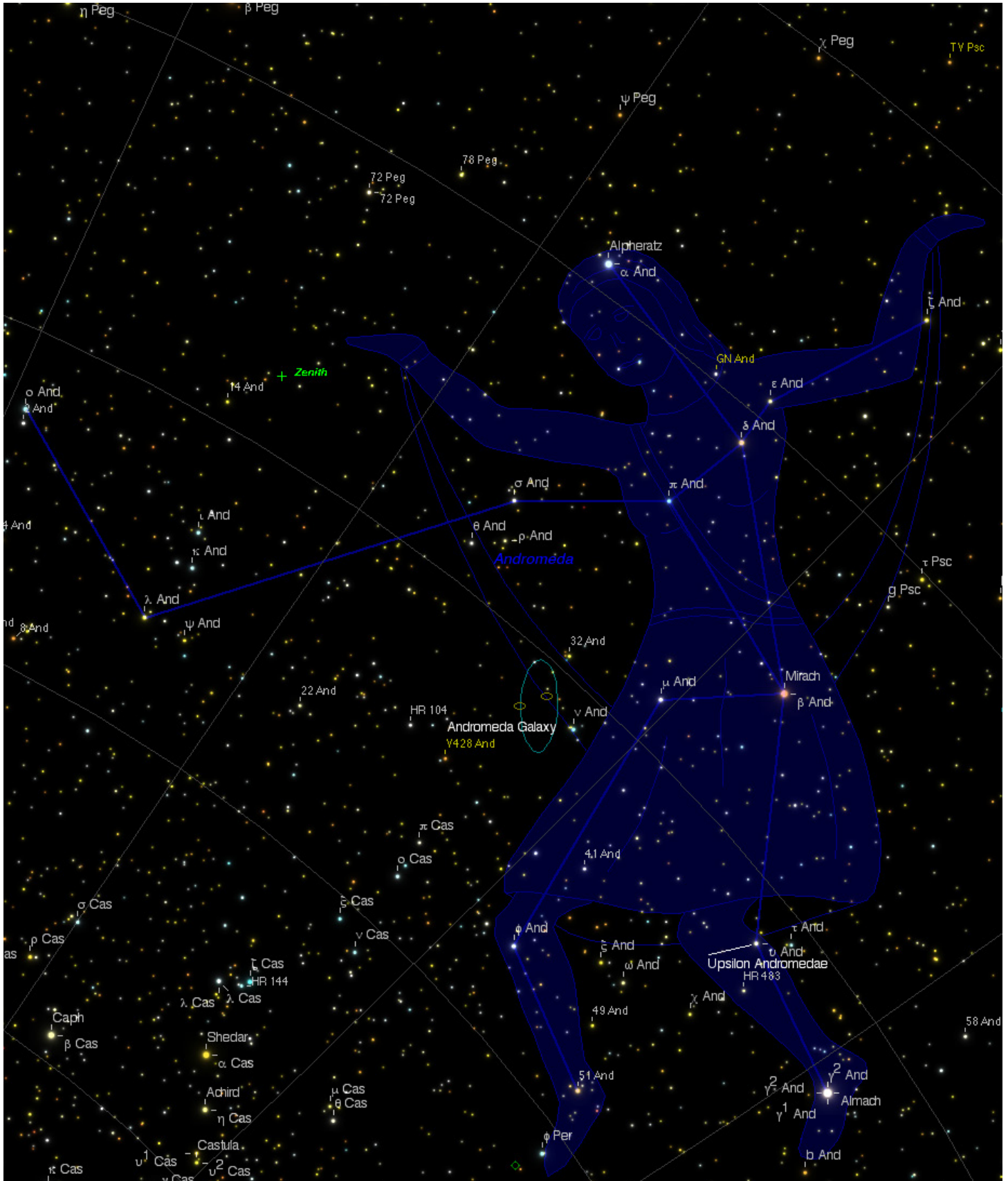
Perseus returned to Andromeda and attacked Cetus. One version of the story has Perseus using Medusa's head to turn Cetus to stone. Another version has his slaying Cetus with his sword, thrusting between Cetus' armored scales. In either case, Cetus came out on the short end of the battle and Perseus vanquished the sea monster. Freeing Andromeda, they returned to Cepheus and Cassiopeia only to find them with Andromeda's former suitor, Agenor, who claimed that Andromeda belonged to him and he had an army to back him up.

Perseus again produced Medusa's head and turned Agenor and his army to stone. Andromeda consented to marry Perseus, thus keeping her parents promise. For this, the goddess Athena placed her in the heavens when she finally died. Andromeda left her home to marry Perseus who later became the king of Tiryns and Mycenae.

The star Upsilon Andromedae has been identified as having four planets circling it. This was the first star similar to our Sun that has been identified with planets orbiting it. This suggests that most stars may have planets, and this greatly increases the chance of finding life elsewhere in the universe.

But the most amazing object in Andromeda is the Great Spiral Galaxy, M31. At only 2.4 million light-years away, it is visible to the naked eye from a dark-sky location. See our sky map for its location in

Andromeda. While you can make out the smudge that is M31 with the naked eye, larger optical aids will give you more detailed view. A telescope will also bring in two of its eleven companion galaxies, M32 and M110. A very large telescope brings the spiral structure into focus. A telescope over 10-inches in diameter allows you to find a few of the brightest of Andromeda's own swarm of globular clusters.



M31 is a spiral-type galaxy, similar to our own Milky Way galaxy, which is actually a barred spiral. It allows astronomers to study features in Andromeda similar to features in the Milky Way that are obscured by the dust and gas in our galaxy. The spiral structure was only seen when M31 was first photographed in 1887.

Just like the Milky Way, M31 has a black hole at its heart that weighs in at 30 million times the mass of our Sun. M31 actually has two nuclei, indicating that M31 has absorbed at least one other galaxy in the past. Being so close, M31 has figured prominently in the history of astronomy, including the determination of the distance scale of the universe, and the evolution of galaxies. So remember, when you look at M31, you will be looking 2.4 million years into history at the same time you are looking at a famous object in the history of astronomy.

* * * *

Colors 2

Star Colors and Black-Body Radiation

by Alex Woronow

There is a reason that stars have the colors they do: Main Sequence stars largely radiate as Black Bodies. That is, their colors arise from black-body-radiation profiles. Those profiles, as we shall examine, relate the apparent star colors to their temperatures.

An object that absorbs all radiation falling on it, and re-emits it as thermal radiation, is called a Black Body. A true black body does not exist in nature or lab. It is a conceptual ideal that relates the temperature of an object, in complete thermal equilibrium, to the spectrum (wavelengths) of light (visual and not) that it emits. A black body might look something like Figure 1, where atoms (and walls) in a perfectly insulated sphere repeatedly radiate and absorb thermal photons until all the atoms achieve thermal

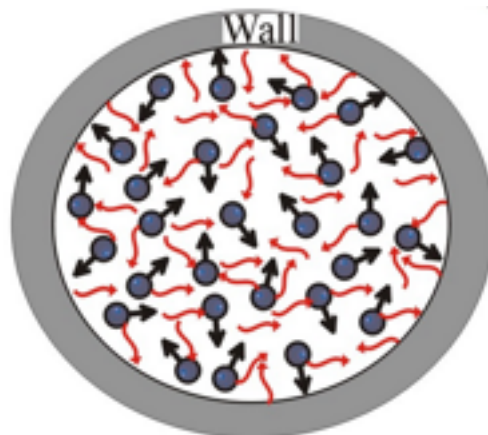


Figure 1: One depiction of a black-body situation where the atoms (spheres) repeatedly radiate and absorb thermal energy and achieve thermal equilibrium. !

equilibrium. Then, if we measured the ensemble of photon wavelengths inside the sphere, we would find it follows a particular profile indicative of the overall temperature inside the sphere.

Obviously stellar temperatures vary with radial position within stars; therefore, they are not in complete thermal equilibrium, no less being perfectly insulated. So then, do they radiate like black bodies? Actually, the photosphere of a star, where the light we see arises, is pretty nearly in thermal equilibrium. A photon is bounced around many times--absorbed, emitted, many times. So many times, in fact, that photosphere's atoms nearly come into thermal and radiative equilibrium, as per a black body. The occasional photons that escape to space and, perhaps eventually reach our telescopes or eyes, sample the black-body temperature of the photosphere. So, Main Sequence stars generally exhibit black-body colors.

If you placed a piece of iron in a furnace, as it heats, it first becomes red-hot, then white-hot, and eventually, blue-hot. Red-hot objects glow at long wavelengths (~480 nm) and blue-hot objects glow at short wavelengths (~650 nm). This range replicates the color range of stars, as Figures 2 and 3 appear to validate, at first glance anyway.

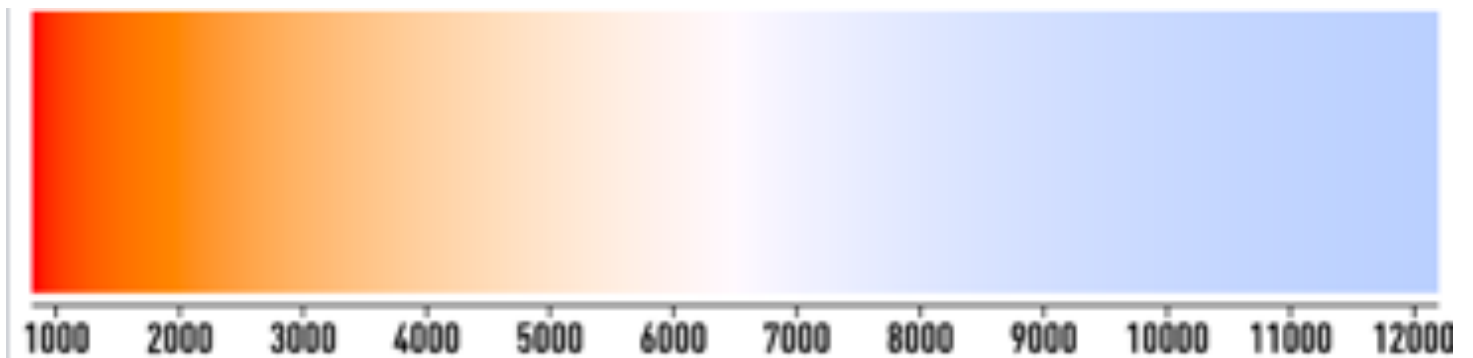


Figure 2: Perceived colors of black-body radiation. The bottom scale is temperature in degrees K.

However, there's a significant difference between the two figures (other than the reversal of color ordering). Why do we not have "green-hot" radiation--where are the green stars? Where are the really hot violet-colored stars (~400 nm)? The answer to these questions is, they actually do exist, but human color perception does not register green stars, green-hot iron, or violet stars. Much more about human perception of color will be covered later in this series.

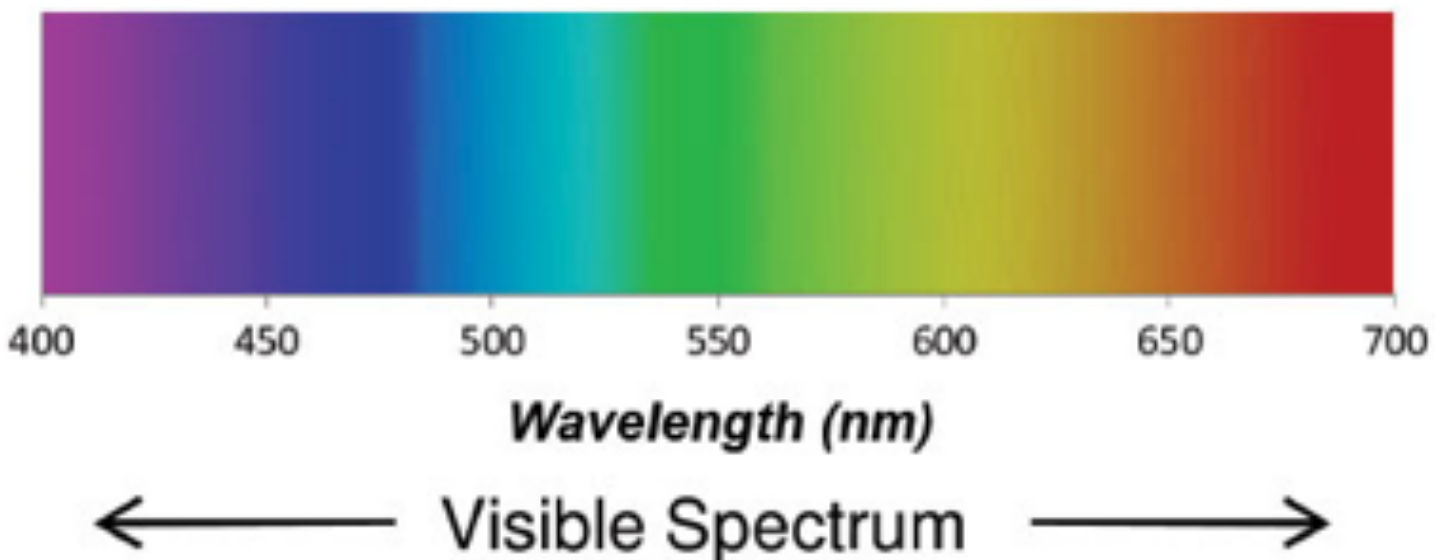


Figure 3: Colors with corresponding wavelengths.

Now, let us look at the spectra of black-body radiation of stellar photospheres (Figure 4). The photosphere of the Sun is about 5778° K (and roughly fits a black-body temperature 5520° K). The peak black-body radiation at this temperature is in the green, just where our eyes are most sensitive. This, of course, is evolution at its finest; not a fortuitous coincidence! But it does raise the question, “Why does sunlight appear white, and not green?” Figures 3 and 4 suggest that a 5520-5780° K star should appear greenish, but Figure 2 says we will see it as white. Why? For now, I will say that all three figures are correct, when you factor in human color perception (as we shall see in subsequent articles).

As a physics sidelight, we can see from Figures 2 and 4 that as the radiative temperature of a star increases, its color shifts toward shorter wave lengths. Shorter wavelengths carry higher energies than longer wavelengths. Specifically,

$$E=hc/\lambda$$

where E is the energy of the photon, λ is its wavelength, c is the speed of light, and h is a constant, “Planck’s Constant”.

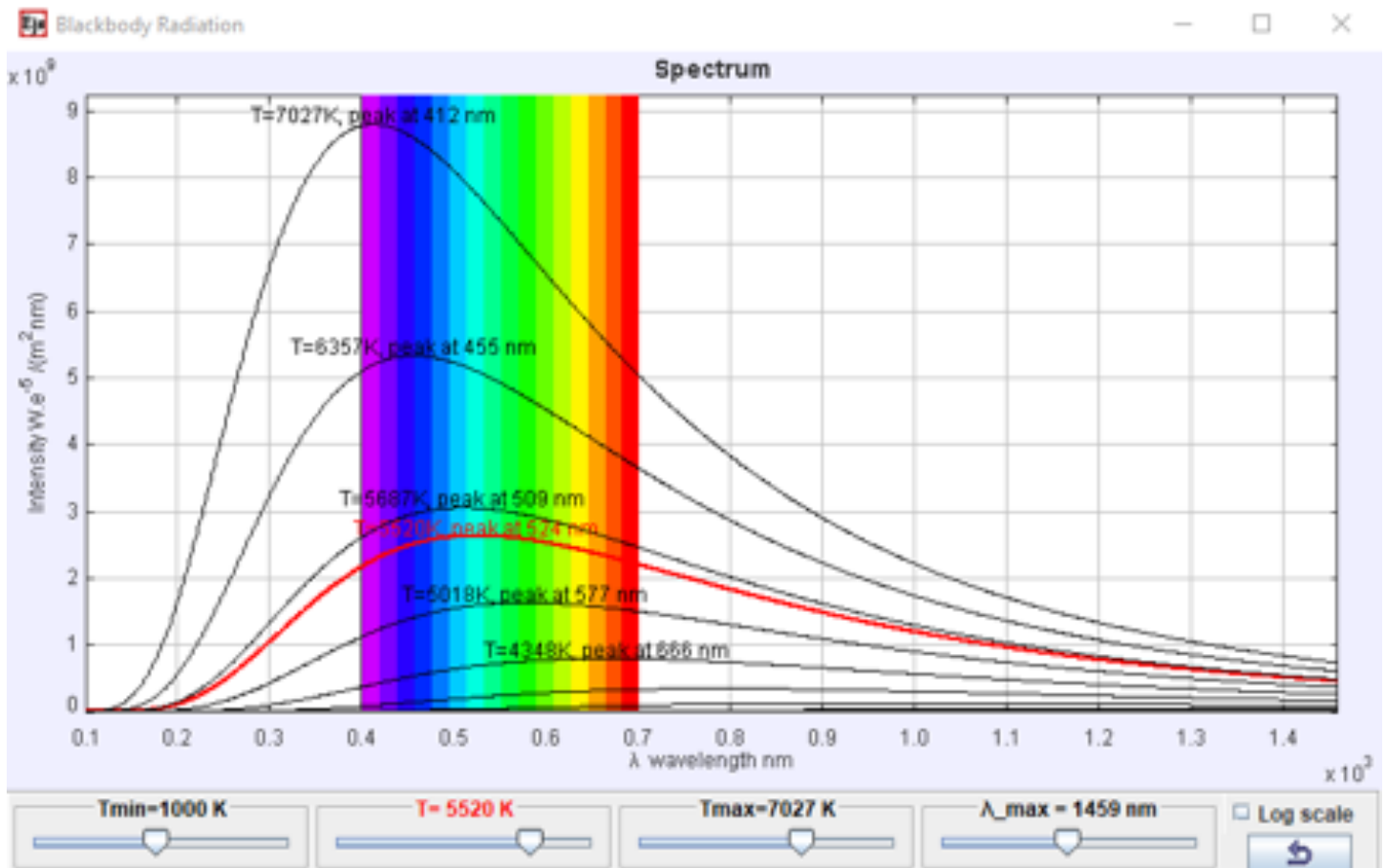


Figure 4: : Curves of black-body radiation for different temperature black bodies. The Red curve approximates the Sun’s radiation. Note: the above is an interactive app available

A PBS online article with the title, “Planck’s Constant: The Number That Rules Technology, Reality, and Life,” clearly touts the importance of this constant! In fact, when its intellectual value was discovered, Max Planck (early 1900s) was trying to explain black-body curves (e.g., Figure 4). He found that he could not use the current “Classical Theory of Radiation,” (Rayleigh-Jeans law), to do that. Therefore, he resorted to the assumption that radiation is emitted as discrete quanta with discrete energy levels. Years later, Einstein received his only Nobel Prize for validating Planck’s assumption of quantization of

radiation emissions through his photoelectric effect experiment. So, Planck's work marks the birth of Quantum Physics. But I digress, somewhat...Getting back on track....

Finally, let's look at the spectrum distribution of radiation from our Sun (Figure 5). Obviously, the radiation spectrum seen through our atmosphere is a shabby remnant of what hits the top of the atmosphere. Atmospheric molecules absorb great proportions of the light in specific wavelength bands, particularly in the infrared. The UV cut-off is dominated by ozone absorption. To ameliorate the effects of these molecular-absorptions bands, infrared observatories, and observatories in general, locate on mountain tops. But the rainbow of colors, red through blue, survives most of the absorption to reach our sensors: eyes and cameras—again, not a coincidence but an evolutionary adaptation.

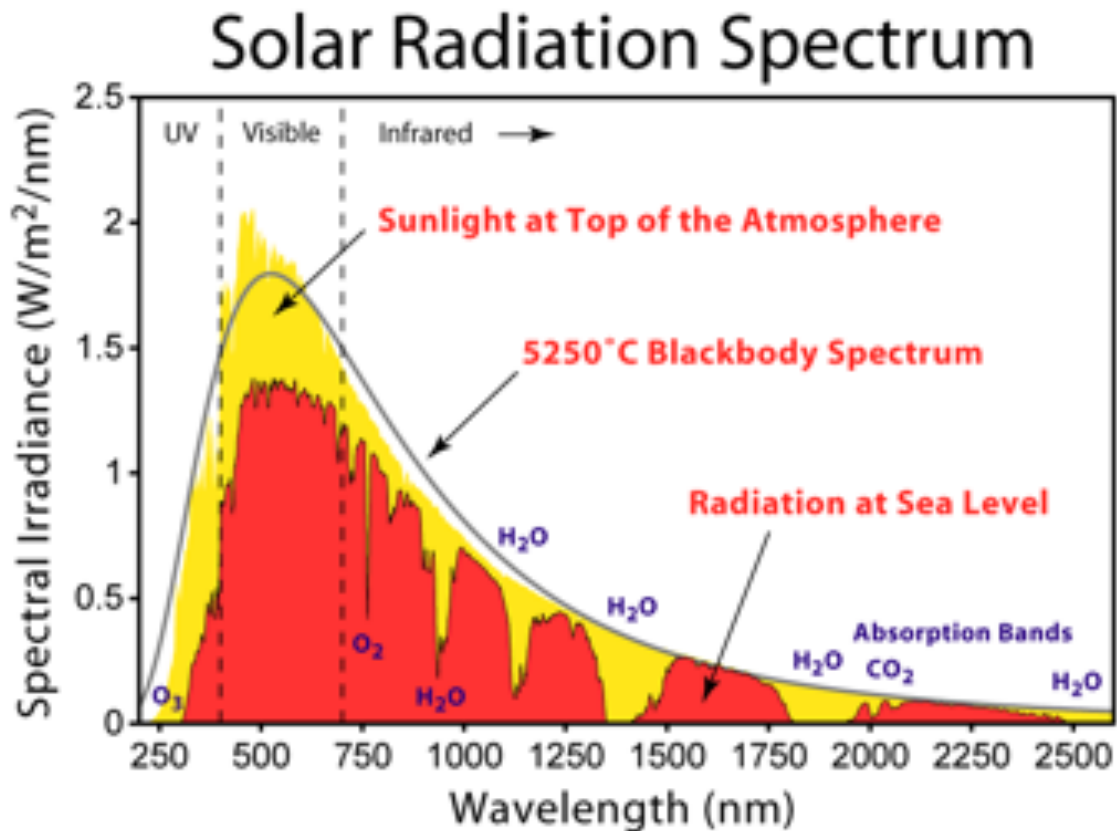


Figure 5: The flux of radiation from our sun plotted against wavelength. The 5250o C (5520o K) Black-Body curve approximately fits the observed solar output.

Some Final Notes:

- My illustrations' colors, as I see them, may not be the same as you see. As Juan Conejero, of PixInsight fame, said about the internet, "... a lot of people won't see your images as you expect, and a fraction of them will see your images horribly. We have to live with this, at least for now."
- I'm expecting that Part 3 of this series will move from this discussion of star colors to explanations of colors of nebulae.
- As usual, I'd be happy to try to answer any questions on this topic. You can ask them directly to me (alex@awkml.com) or, better, on our Yahoo group website.

* * * *

Total Lunar Eclipse – Sunday night – Jan. 20, 2109, More experience for you

Bill Nigg @ NMAV, AstroVIP – NPS – NPO, bill@ziptang.com

Many amateur astronomers have observed and photographed total lunar eclipses (TLE). It is a unique, leisurely event that allows even more experience to be collected. In my “many Moons” of telescope observing since I was 11 years old, I have developed and refined photographic experiences that are transferable to the more compressed window experienced when photographing a solar eclipse.

A cautionary word for beginners to avoid being a day late: Some calendars and some entertainment media people will state that “We have a total lunar eclipse coming on January 21st”. Their source is from astronomical information published in Universal Time (UT) – same as GMT London Time Zone. The TV weather person usually knows better and directs you to the adjusted window of time for viewing the lunar eclipse in your location.

New Mexico is in Mountain Time (MST) and that is 7 hours behind UT/GMT. So, 5 am on the 21st in London is 10 pm in New Mexico ON THE NIGHT OF THE 20th. Don’t go outside for the eclipse on the night of the 21st – you’ll be a day late! Hopefully you’ll avoid that mistake.

This four-hour eclipse takes place on the night of the 20th, Sunday, in various stages. The dark part lasts 2 hours centered at 10:15 pm – in PRIME TIME. This enables people on this half of the planet to see it, share it, photographing and experiencing a casual and long event; thereby providing amateur astronomers more “experience time” for observing and recording concurrent events.

For instance the full Moon normally washes out our view of the dim stars, but in totality the sky gets a lot darker. I have seen meteors, clusters, and aurora during these dark hours.

A lunar eclipse is a good opportunity to share the telescope view with others AND take photos of people at the eyepiece. This is an exception to the usual telescope viewer “no flash” protocol because photographic flashes interfere with night vision of observers looking at dim objects.

Probing questions have caused mankind to ponder how the Moon goes dark. Imagine how the indigenous peoples wondered for centuries about what was occurring and how the early Greek science observers estimated the Earth’s shadow to be three times bigger than the physical size of the Moon.

Think of 3D reality: Your Sun is projecting the Earth’s shadow onto your Moon like a slide projector. Does this experience give you the understanding of our position IN SPACE?

Binoculars and small telescopes will show the unique lighting on the Moon’s surface. By contrast, there are no shadows like the usual phase terminator lighting. The phase shadows are caused by SIDE solar lighting. During a Full Moon/TLE, we see only OVERHEAD sunlight showing the reflective surface features. The observed reflective geology show us rays and splatters in between the craters.

The bright Full Moon slowly changes to very dim with some color. I have taken photos of each stage and had to adjust to different exposures until the DSLR view screen color to match the color I see with my eye. Getting the best color match requires practice and experimenting.

Because the TLE is much longer than a Total Solar Eclipse (TSE), so you have more time to adjust your camera exposure. This is good practice for the faster TSE event.

This wide range of brightness changes is similar to a Total Solar Eclipse (TSE). Full Moon bright for prominences at a TSE, partial stage dimness is like TSE inner corona, darkest TLE is similar to outer corona TSE photos. Capturing these stages is good practice for the next Total Solar Eclipse.

The Moon's image size in your camera is 0.009 X focal length. When I shoot with a 600mm lens, this gives me a 5.4 mm Moon image in the camera. My DSLR photo sensor is 15 mm X 23 mm and 5.4 mm image fits fine.

If I tried a C8 with 2000 mm focal length then the 0.009 X 2000 mm, then the image size would be 18 mm and would be too big for the 15 mm sensor side – if you wanted to get the whole thing in. Please see other photo ideas in the websites below.

This longer lunar eclipse allows you to optimize your scope and camera for practice in preparation for a quicker solar eclipse event.

The Moon rises at 5:22 pm in Deming/NMAV and its sky position is between Gemini and Cancer. This will rise up near 60 degrees above the horizon at mid totality. Umbra starts about 8:30 pm with the darkest at 10:15 pm. Umbra ends about 11:50 pm See additional tech info in websites.

www.eclipsewise.com/lunar/LEdisk/2001-2100/LE2019Jan21T.pdf
www.eclipsewise.com/lunar/LEprime/2001-2100/LE2019Jan21Tprime.html
www.twanight.org/newTWAN/gallery.asp?Gallery=Eclipses&page1

Lunar eclipses can be seen in the light polluted city and even around a campfire. You have plenty of time to log all this extra experience into your Observing Record Book. There is nothing better on TV, I already checked.

“Super Moon”: When the lunar orbit perigee(closest to Earth) is near Full Moon, the entertainment media announces it as a “Super Moon”. This calls attention to the general public and the more interested observers are rewarded with an impressive view. Photographers may compose the Moon among the city buildings for a dramatic shot. Sometimes “Super” implies size, but a more accurate statement would include explanation of elliptical orbits and that is always avoided by the entertainment media. It just looks bigger.

In 2019 we will have perigee close to a Full Moon for the eclipse – Jan 20, also Feb. 19, and March 21. The result is more people are observing the same event in space. We should do that more often!



Three photos taken during eclipse of Jan. 31, 2018, 450mm F4, Nikon D40, exposures to match visual color.



NGC 7000

NGC 7000 or more commonly called the North American Nebula. While the shape of NA is mostly imaged this image targets the internal parts of the nebula what is called “the Wall”. There is a lot of structure in this nebula beyond its geographical shape.

LRGB Ha OIII SII 10x5min each over two days 10-6/7-2018 at the Cosmic Campground;

SGP/PI/PS6

By John Kutney



Messier 33 The Triangulum Galaxy

Here is an image I just completed. I collected H-alpha data in November, then combined it with the LRGB data I collected about a year earlier. Here is the result.

M33 (plus H-alpha!) - NGC 598 (Triangulum Galaxy)

TOA-130F, EM200, QSI690wsg

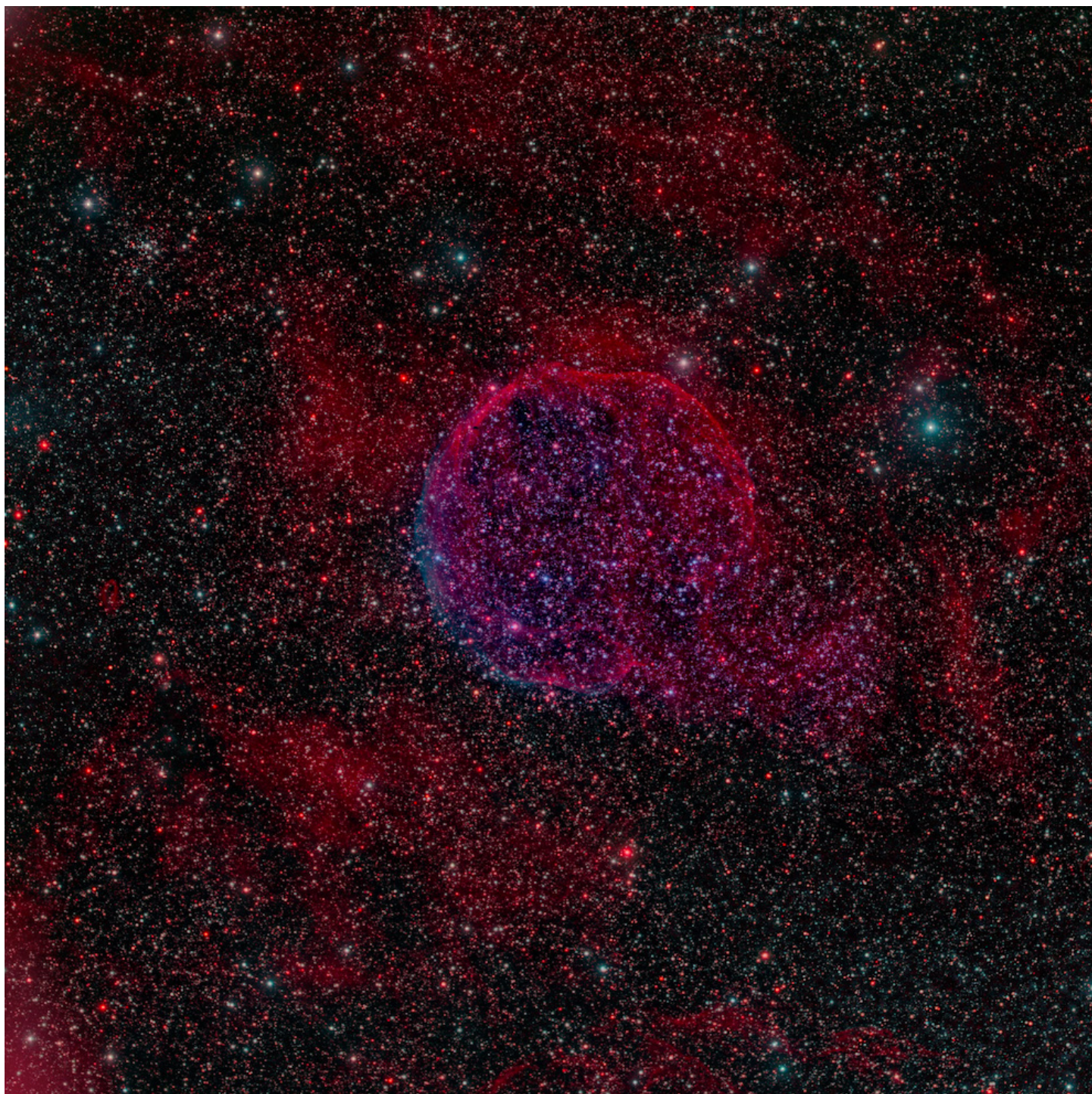
11x2min Ha, 9x10min L (bin1x1); 4x5min ea RGB (bin2x2); 10xdarks/flats/fdarks/bias

Imaged from my backyard in Las Cruces.

Credit: Jeffrey O. Johnson

Info at my site: http://jeffjastro.com/dso/M33Ha_7Nov18.htm

<http://jeffjastro.com>



Abell 85

OTA: RH-305 (12" f/3.5) Camera: SBIG STX-16803 Observatory: Deep Sky West
EXPOSURES: Red: 12 x 300sec Blue: 19 x 300 Green: 12 x 300
Hydrogen: 16 x 1800 Oxygen: 13 x 1800 Total exposure ~13 hours Image Width ~1.8 deg
Processed by Alex Woronow using PixInsight, Gimp, ON1 in 2018

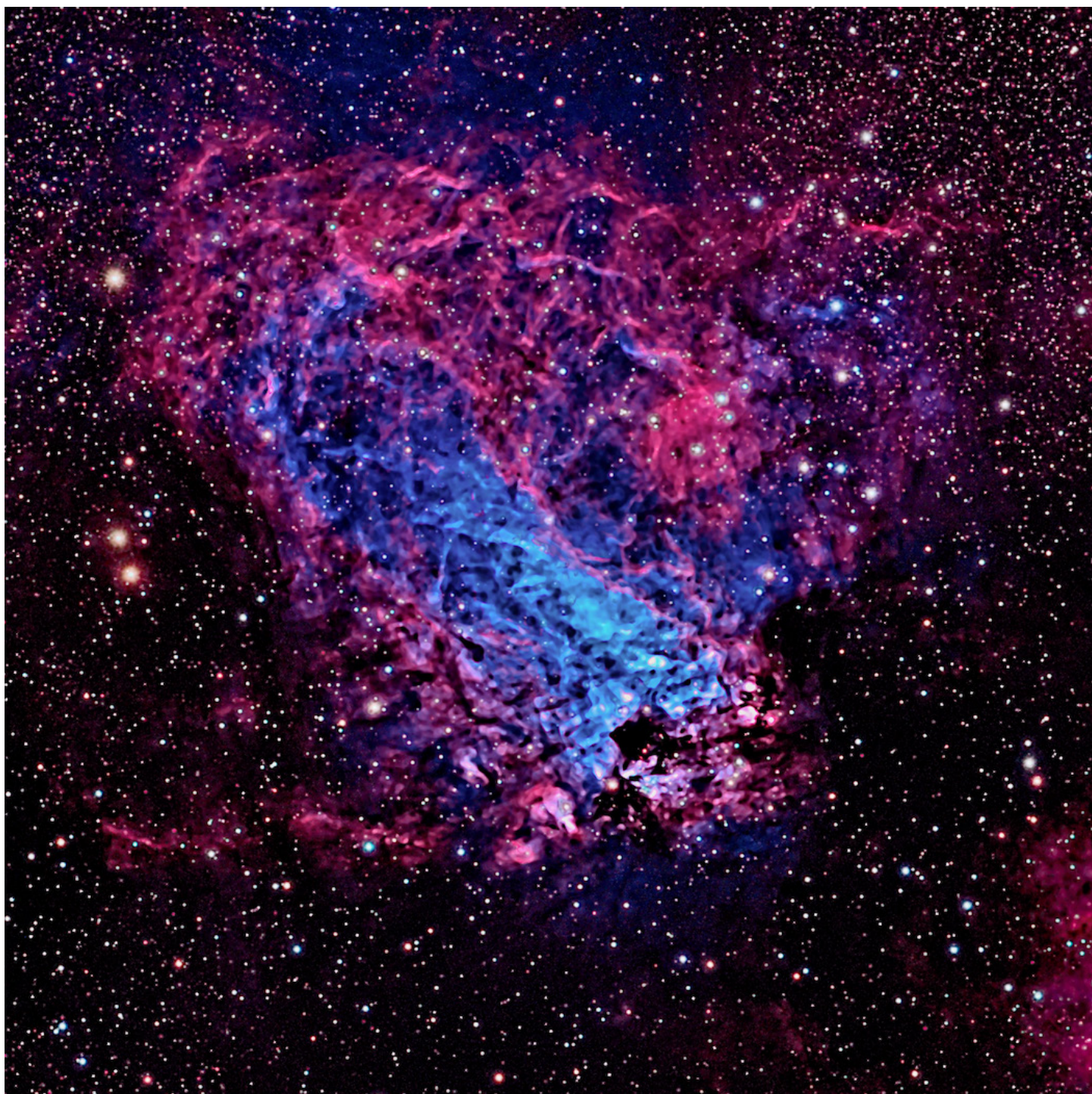
Abell 85 is a very faint supernova remnant (SNR) in the constellation Cassiopeia. It is difficult to image with any details due to its extremely low surface brightness. Abell 85 has a diameter of about half a degree; roughly the same diameter as the full Moon. Its physical diameter is about 98 light years. This SNR lies about 9800 light years from the Earth. Abell 85 was originally thought to be a planetary nebula, but confirmed to be a SNR by Willis & Dickel 1971." (astroanarchy.blogspot.com)

Planetary nebulae result from the death of stars of about the same mass as our Sun. However, if a star is at least 8 times more massive than our sun, when it dies it explodes as a Supernova. Stars balance the inward force of gravity, attempting to compact them, and the outward forces caused by fuel burning. Balance between these forces is lost when the star uses up its nuclear fuels, causing the outward pressure to abate. The star's core suddenly collapses, in as little as 15 seconds. This violent, supersonic collapse compresses the core and raises the inner core's temperature to 100 billion degrees K. These catastrophic events send an enormous shock wave outward that blows off the outer part of the star at a velocity of ~30,000 kilometers per second (70 million miles per hour). That ejected gas is dominantly hydrogen (red) and oxygen (aqua) radiation, as captured in this image. The remnant of the star becomes a neutron star or black hole. (Wikipedia)

Processing:

This target lies in the plane of the Milky Way, amidst a dense array of stars. Dealing with the stars, keeping them from overwhelming the image while enhancing the nebula, poses a significant challenge! I approached this challenge by masking then removing the stars--making a mask to do that was a challenge of its own! But having the mask, I used Gimp with the G'MIC plugin to 'heal' the star out of the picture. Subsequently, PixelMath generated a stars-only image from my now star-free image. The star-free image also provided a luminosity image. Color and saturation were adjusted in the star-free image. The luminosity image was sharpened and recombined with the star-free image and with the stars-only image (after adjusting star colors and sharpness).

That's my life, now! Alex



M 17- The Horseshoe Nebula or The Omega Nebula

Hi all, Just to make things more fun, this images is H-S-O-R-G-B where SHO is from one scope and RGB from another. Hope you enjoy. Alex Woronow

OTA: RCOS (14.5" f/8) & AP175 (f/8) Camera: SBIG STX-16803 & PL16070
Observatory: Deep Sky West

EXPOSURES: **AP175:** Red: 17 x 600 sec Blue 6 x 600 Green: 9 x 600 Lum: 11 x 600
: **RCOS:** Hydrogen 8 X 1800 sec Sulfur: 4 x 1800 Oxygen: 4 x 1800

Total exposure ~15 hours Image Width: ~1/2 deg Processed by Alex Woronow using PixInsight in 2018

M17 lies between 5,000 and 6,000 light-years away and it spans some 15 light-years in diameter. It is one of the most massive star-forming regions of our galaxy. An embedded open cluster of young, hot stars with abundant ultra-violet radiation, causes the gas in the nebula to ionize and radiate. The radiation of three gases are recorded in this image: hydrogen (red), oxygen (teal), and sulfur (red). Although several thousand young stars occur in this nebula, most are hidden within the nebula.

(Source: largely Wikipedia & messier-objects.com)

Processing: Images from the two scopes were separately processed and stacked. The stacks were aligned to the RCOS frames, which had the narrowest fov. The RGB were constructed using my Pixel-Math process for combining narrowband and broadband images according to...

R = {Ha(RCOS) w/ S(RCOS) w/ R(AP175)}

G = O(RCOS) w/ G(AP175)

B = O(RCOS) w/ B(AP175).

L was extracted from the LGB constructed above and blended with the L from the AP175. The stars were removed from this L and from the RGB image. The starless-L image was process for detail, the stars for color and size, and the RGB for color attributes. Then the 3 were recombined.

Adjustments ensued.



Comet P46 Wirtanen

Mike Nuss captured the green Christmas comet with his new DSLR. The green Xmas comet is near the center of the field: Pleiades at upper center and Orion's sword and upper left.

From Mike's yard in Deming, NM on Dec 10, 2018

Photo of the Month

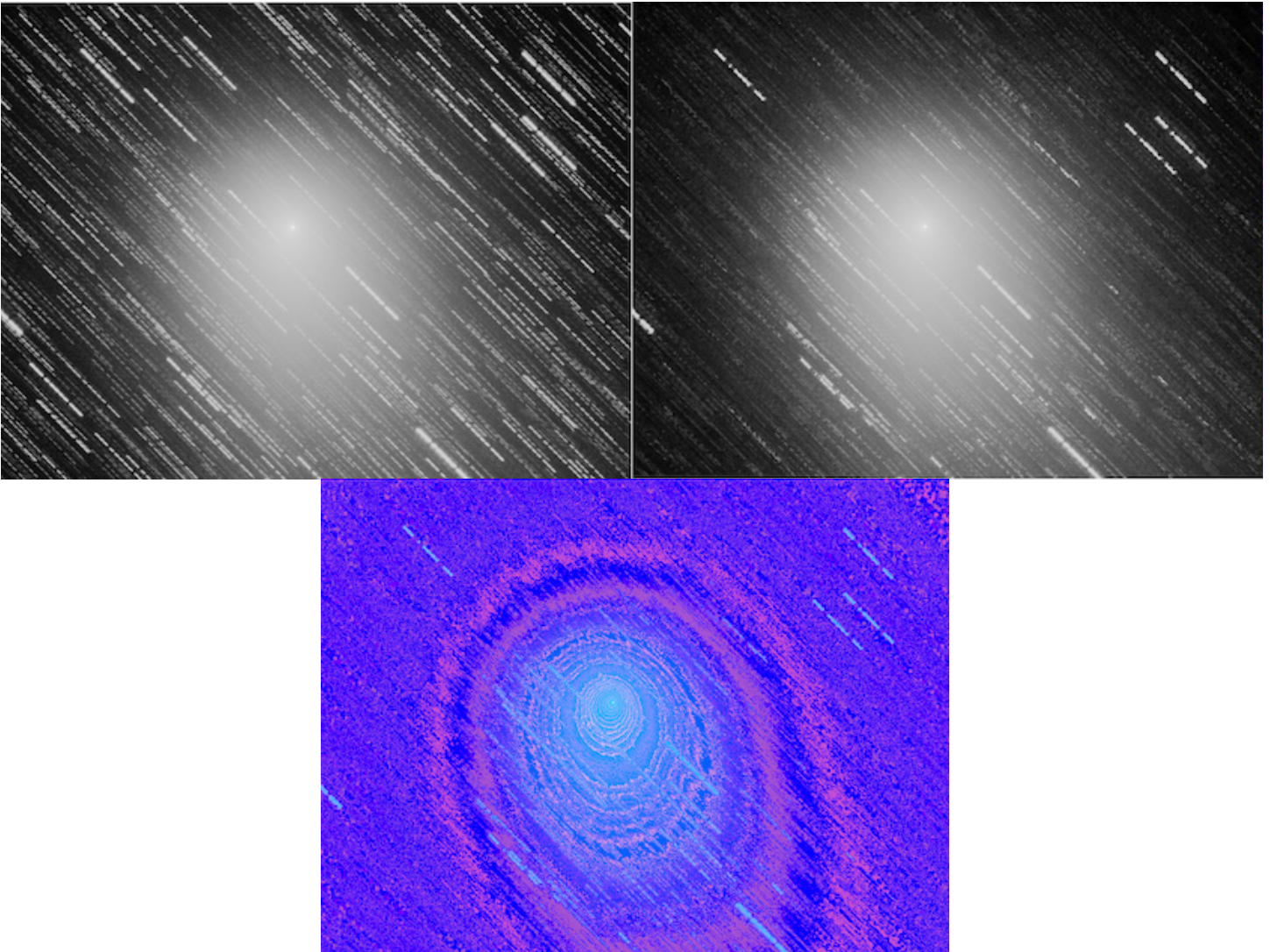


Comet P46 Wirtanen

Took this on December 24th, 30 seconds, ISO 1600, at F/2. Samyang 85 mm Lens.

John Gilkison
NPO President

Photo of the Month



Comet P46 Wirtanen

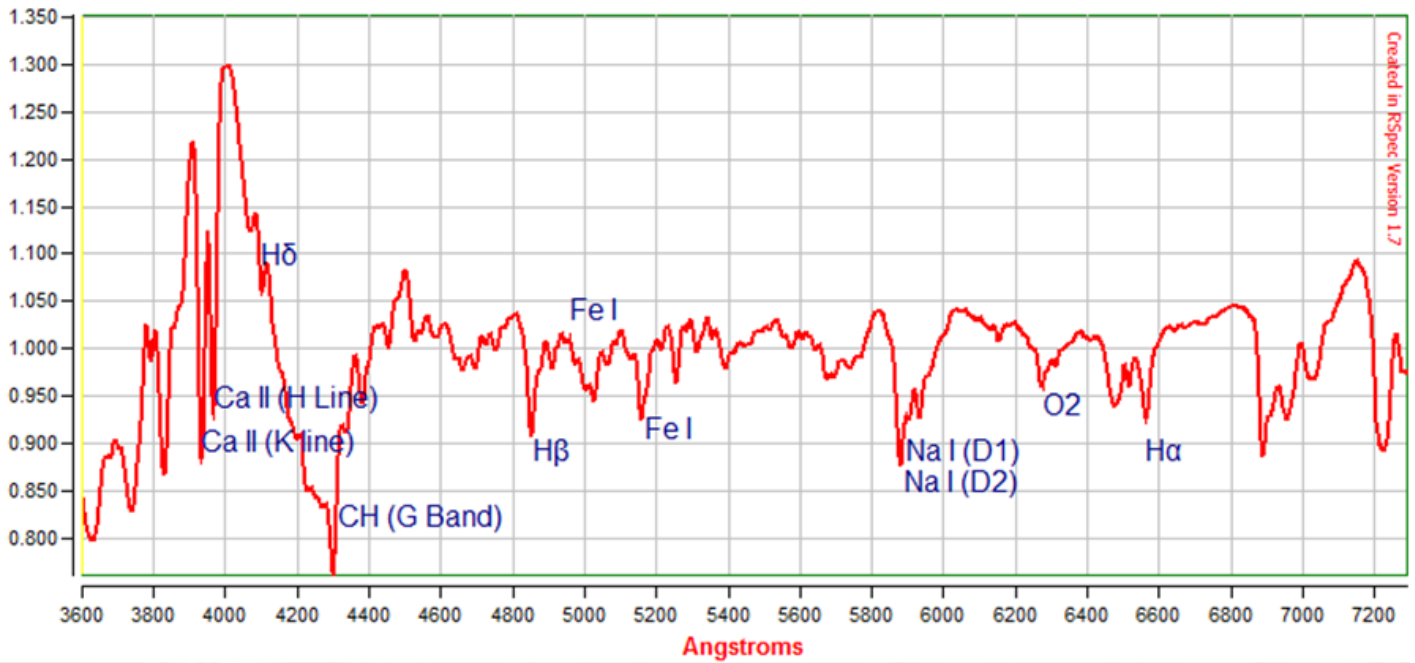
I've attached a three-image panel of 46P Wirtanen taken on Christmas eve 2018 remotely from Phoenix. It shows different views of a 22 minute stack of 2 minute exposures taken over a 30 minute time span. A monochrome R filter was used to show the dust rather than gas that might be associated with the comet. Dithering was done between exposures, thus causing the gaps in the star trails. SGP was used to acquire the sub-images and guiding was done on the comet using PHD2 with comet rates derived from the planetarium program C2A.

In the panel, the normal view is at the left and was stacked in Maxim DL. That image was then processed in GIMP (middle view) to remove most of the stars and provide cleaner input for coma analysis. The view at the lower center was then produced using Michael Vinther's Image Analyzer to show a false-color qualitative view of dust contours in the coma of the comet. The relative brightness of the rings does not relate to actual relative brightness of the object, but does show the structure. As can be seen, there is a distortion of the coma with no definable dust tail, at least at this scale. The comet is moving to the upper left in the images.

Regards, Kent DeGross

Spectrum of the Month

SUN: Fully Calbrated Alpy600



Spectrum of the Sun:

A few words about my Solar Spectra.

spectragraph: Alpy 600
telescope: 80mm refractor
camera: ZWO ASI

exposures: 40x0.7"

Image calibration via standard (Dark, Bias, Flat frames)
wavelength calibration against standard lamp emission spectra

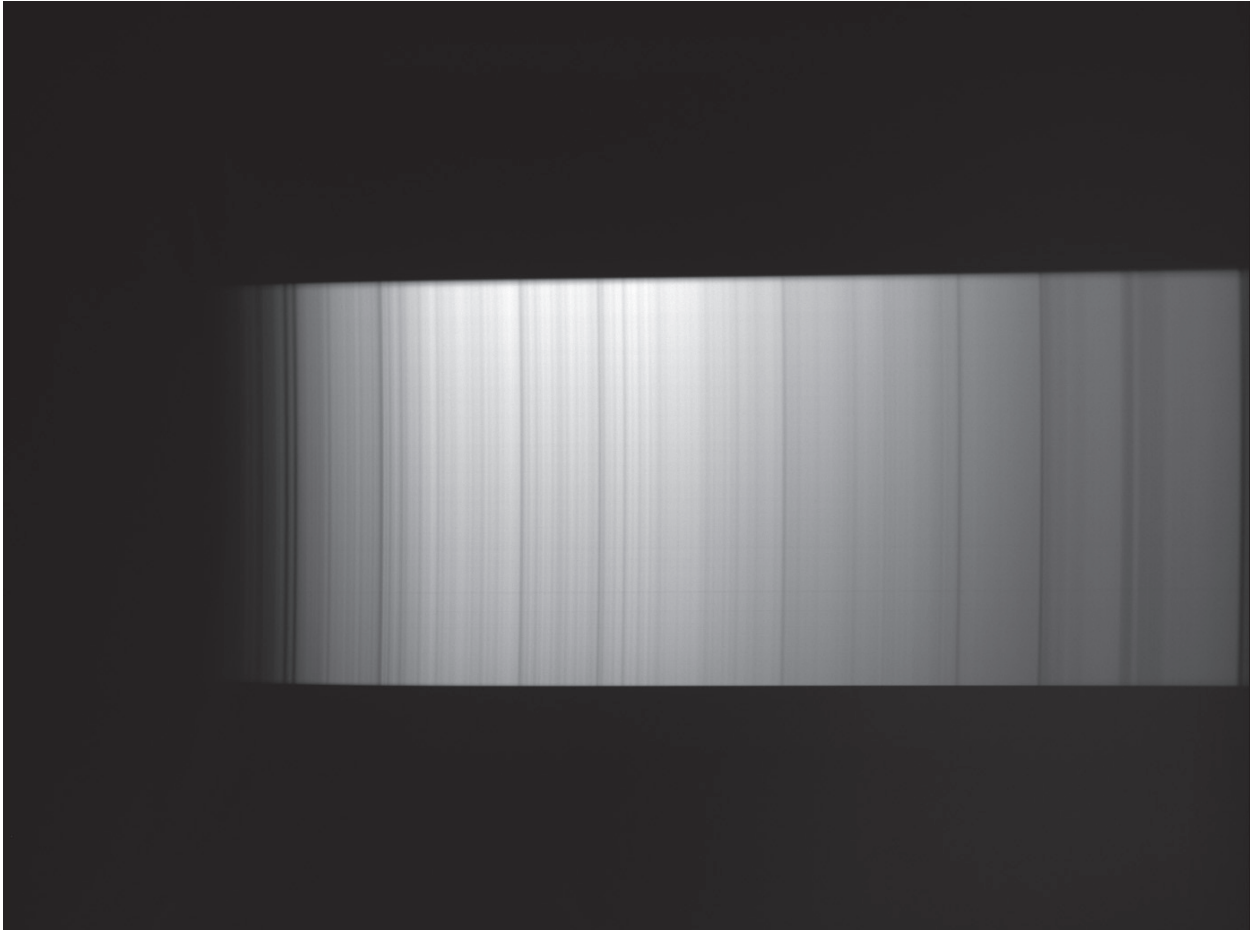
Most processing in RSpec

By Alex Woronow

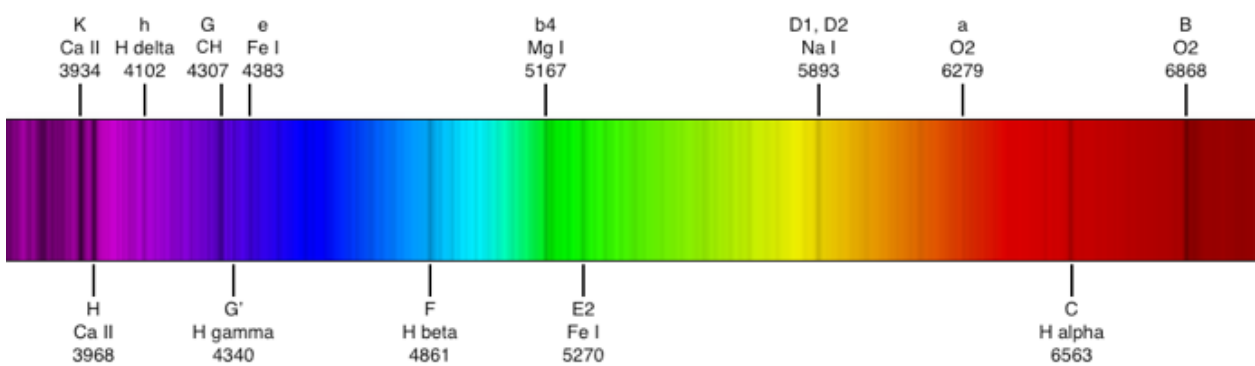
Spectrum of the Month

Steve Barkes graduated from the First Spectroscopy Workshop last year. Unlike some of us, who went home and read some more books, Steve actually started using his spectroscope. Here are some of his efforts at capturing and producing a spectrum. His spectrum of Vega was actually voted the winner of the annual ASLC astrophoto contest.

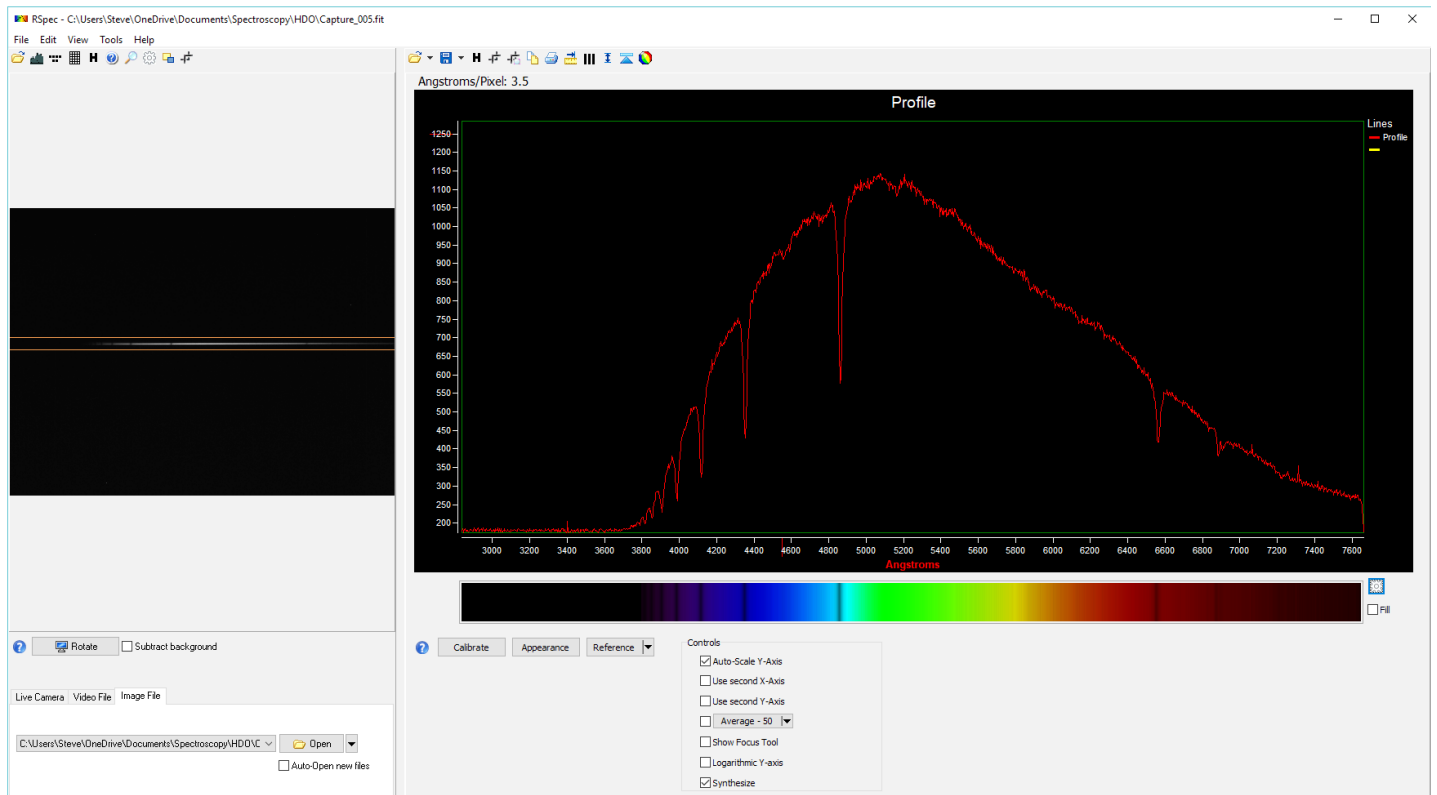
Raw spectra of the Sun, captured with the Alpy600 off of the telescope and pointed at an open window on a cloudy day.



Identification of some of the solar spectrum lines



Raw spectra of Vega captured with Alpy600:



Vega image roughly processed in RSpec. Raw spectrum from the captured image in the left-hand pane and the top pane. Graph of the emission/absorption lines in the upper-right pane. Below the graph is a synthetic color spectrum generated from the calibrated data.



**February 22,23, & 24
Hotel Encanto de Las Cruces
Las Cruces, New Mexico**

SMSW-2 will be held at the beautiful Hotel Encanto de Las Cruces in Las Cruces, New Mexico. The Hotel Encanto is Southern New Mexico's Premier resort hotel.

Single and double rooms are available for \$95/night for workshop attendees.

The closest airport to Las Cruces is El Paso, Texas.

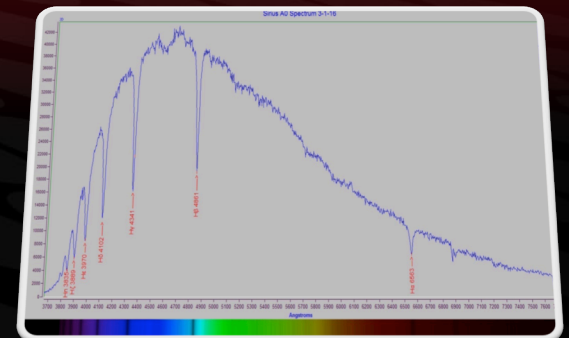
The average high temperature in Las Cruces in February is 64° F.



Our in-depth three-day program is intended to help newbies get started with astronomical spectroscopy and we want to help experienced amateurs learn more and get better. As far as we know, our workshop is unique. You won't find a boot camp like this anywhere else in the world.

SMSW-2

SACRAMENTO
MOUNTAIN
SPECTROSCOPY
WORKSHOP

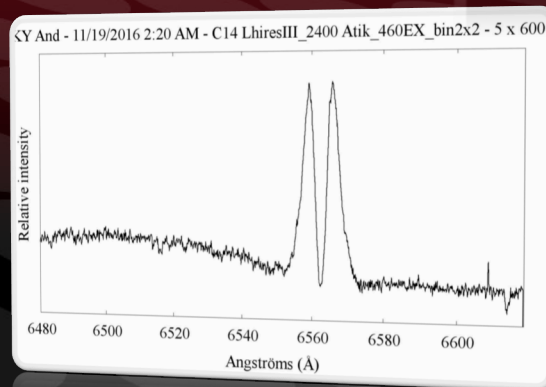
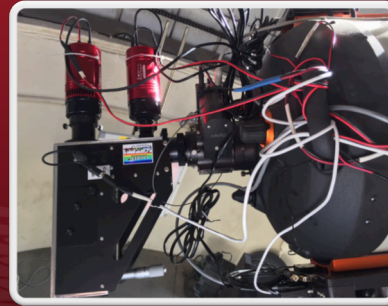
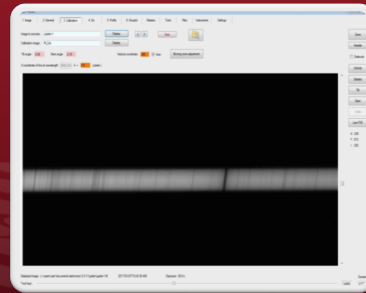


smswweb.com

The second Sacramento Mountains Spectroscopy Workshop (SMSW-2) will be held in Las Cruces, New Mexico on February 22, 23 and 24, 2019.

Spectra of Jupiter (right)

Be star emission spectra
with central absorption
(below)



Please go to website smswwb.com for all program and registration information.

Our work shop speakers are a mixture of amateurs and professionals who will provide a foundation for understanding the underlying principles of spectroscopy and the practical aspects such as what equipment to use, how to process spectra with the software ISIS, VSpec, and Demetra, the possible projects that amateurs may undertake, how to be involved in Pro-Am projects, and how to submit to the new AAVSO spectroscopy database and the BeSS database.

The goal of the workshop is that attendees will be able to take raw data and calibrate it and process it to produce a finished spectra that can be accepted by the BeSS database validators.