# **Morning Star** Spring 2020



# \*\*\* Club Info \*\*\*

# Announcements

Associate Members interested in becoming full members make your interest known to one of the board members. To become a Full Member one has to actively participate in club functions and events and be active in some other aspects of astronomy (more details are in our by-laws).

# Wanted - PR person

If interested in this position contact Jack St. Louis or Paul Walker.

Moving or Changing Email? Please send changes to Paul Walker, 53 Valley View, Middlebury, VT 05753, <u>paulwaav@together.net</u> (info@vtastro.org will also work)

# Hinesburg Observing Site

We have an observing site in Hinesburg, VT. (Located on town property). A locked gate (required by the town) limits access to the site.

Associate Members can request access to the gate lock. They have to a member for 3 months. This provides access to the Warming Hut, 115v AC power and port-a-potty.

Full Members can request access to the gate lock and the observatory locks.

Board approval is required in both cases. Some training is required. There is a training checklist and an access agreement that need to be filled out.

Contact the Secretary, Paul Walker or Jack St. Louis for more information at <u>info@vtast</u>ro.org

# **Observing List for HOS**

We have an email List for Member's interested in getting a heads-up when someone will be at the Hinesburg Observing Site (HOS).

If interested in getting on the list contact info@vtastro.org

# **Observing Certificates**

Several certificates (beginner to advanced) are available to members as encouragement to get out under the stars and hone their observing skills. Follow the link on our web site.

# Outreach Acknowledgment Letter

To help record our broad community involvement with public star gazing events, projects and classes, we have developed an Outreach Acknowledgment Letter with a Sample Form. It is posted on the website and can be found under **Members, VAS Club Materials for Members, Outreach Acknowledgement Letter**. **Direct Link:** http://vtastro.org/wpcontent/uploads/2018/03/VAS\_Outr each\_Ack\_Letter\_V3.pdf

# Dues

# Time to renew your membership Associate Members \$15 Full Members \$25

Send dues and any address or email updates to VAS, PO Box 782, Williston, VT 05495. Or bring to any monthly meeting or Contact Paul Walker, 802-388-4220, paulwaav@together.net.

# **Connect On-line**

www.vtastro.org Twitter@VTAstroSociety Facebook.com/Vermont-Astronomical-Society-113053818706458/ Email: info@vtastro.org (Goes to President and Secretary) webmaster@vtatro.org (Goes to Secretary and Webmaster)

# **Board Members**

Jack St. Louis	Pres	658-0184
Joe Comeau	VP	238-1664
Doug Williamson	Treas	388-3482
Paul Walker	Sec'y	388-4220
Bob Horton	-	879-7802
Keith Lawrence		453-5496
Jim Bosek		879-1697
Terri Zittritsch		
Scott Turnbull	Webmaster	

Editor and Publisher - Paul Walker Contributors: Joe Comeau, Lawrence Garrett, Maura Kelley, NASA Night Sky Network, Gary Nowak, Paul Walker, Charlie Warren, Terri Zittritsch. (My apologies if I missed anyone)



Venus & The Pleiades, 3/31/20 By Maura Kelley 20 sec X 20

All observing events -are weather

Permitting unless otherwise stated.

Bring extra clothes. Even a summer

evening can be chilly after standing

still for a couple hours in damp air.

We have an mail List for Member's

interesting in getting a heads up on

Observing Site (HOS).

impromptu events at the Hinesburg

Member & Invited Guest Star

Gazing at HOS & other events

Note: If you would like to be a

host, greeter/orienteer or want

some training on operating the

Members are welcome use the

Hinesburg Observing Site. Please

use precautions when more than 1

person is there. For those on the <u>observing@vtastro.org</u> email list, as

always it is at your discretion as to

whether or not to send a notice via

We will not send notices of im-

Contact info@vtastro.org

promptu events to the member

Public Star Gazing at Schools,

Libraries, and other groups.

If you know of a group or institution that would like to schedule a star gaz-

Corona Virus Note: We will likely

May 22 (Fri), 8:30-10:00 PM. Rain

date May 29 (Fri). At Underwood

Property (Park) in South Burlington

(near the intersection of Pinnacle Dr.

and Noland Farm Dr., S Burlington,

Sponsored by South Burlinton Recre-

ation & Parks (contact Ben McShane,

bmcshane@sburl.com (Office) 802-

846-4145 (Cell) 802-557-572) and by

VAS (Contact info@vtastro.org)

large field on South side of road).

ing session have them contact:

have not public events for the

scopes let Paul Walker know.

**Corona Virus Note:** 

that email list.

during this time.

info@vtastro.org

next few months.

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- Tadpole Nebula - M101, M81 - M42, M81 & 82 - Locator Maps of Objects Pg 17-18 For Sale / Wanted Pg 19 & 20	- Thor's Helmet		
- M101, M81 - M42, M81 & 82 - Locator Maps of Objects Pg 17-18 For Sale / Wanted Pg 19 & 20	- Tadpole Nebula		
- M42, M81 & 82 - Locator Maps of Objects Pg 17-18 For Sale / Wanted Pg 19 & 20	- M101, M81		
- Locator Maps of Objects Pg 17-18 For Sale / Wanted Pg 19 & 20	- M42, M81 & 82		
For Sale / Wanted Pg 19 & 20	- Locator Maps of Objects Pg 1/-18		
	For Sale / Wanted $Pg 19 \& 20$		

## Gary's Astronomical Events for the Month

can be viewed via WCAX at https://www.wcax.com/weather/astr onomy

# Jack on the Radio

Listen to Jack's astronomy update on radio station WJOY AM (AM 1230) on Ginny McGehee's 'Breakfast Table' morning show. Airs the first Wednesday of the month at 8:40 AM.

# Stargazing and other Events

If interested in being on this list contact info@vtastro.org

Events are listed on our website (vtastro.org) and Google Calendar (https://calendar.google.com/calend ar?cid=Nzc5dnQ1bnZrN2ljcDA2N G9vbXFnczI1M2NAZ3JvdXAuY2 FsZW5kYXIuZ29vZ2xlLmNvbQ)

# Green Mountain Astronomers <u>(GMA)</u>

All events start about sunset. Check before going as some events are not cast in stone or written in the stars yet.

> Contact Ron Lewis for info 802-779-5913 (cell) 802-247-5913 (home) vtpoet@gmail.com

**Apr 25/26 (Sat/Sun)** Mini Messier Marathon (all-niter), Tracy Holden's, Wheeler Rd, Brandon

May 23 (Sat) GMA Members Only, Eyepiece Evaluation Night 1, Tracy Holden's, Wheeler Road, Brandon.

**Jul 20 (Mon)** Saturn at Opposition, GMA Members Only, Lovers Lane, Brandon.

**Jul 25 (Sat**) GMA Members Only, Hubbardton Battlefield.

**Aug 8 (Sat)** GMA Members Only, Hubbardton Battlefield.

**Aug 11 (Tue)** Public Outreach, Castleton University (Concert Series).

**Aug 21 (Fri)** Public Outreach, Bread Loaf Writers' Conference's Final Day/Barn Dance.

**Sept 26 (Sat)** GMA Members Only, Bristol Harvest Festival, Solar Event.

**Oct 10 (Sat)** GMA Members Only, Tracy Holden's, Wheeler Road, Brandon.

# **New Members**

**VAS welcomes** the following new member who joined us since the last newsletter:

Gary Moore

Nathan Ceffalo

# Meetings/Presentations

Meetings are held the first (non-holiday) Monday of the month, at 7:30 P.M. in the Kolvoord Community Room of the **Brownell Library**, 6 Lincoln St., Essex Jct (2nd building north of Essex 5 corners on the left on Rt. 2A). Extra parking is available in the Bank North parking lot across from the library. For inclement weather call Jack St. Louis (802-658-0184) or Paul Walker (802-388-4220) to confirm.

## April 6

Canceled as a precaution to limit the spread of the Coronavirus (COVID-19). All meetings may be canceled over the next few months.

### <u>May 4</u>

Annual Banquet & Business Meeting Probably will be moved or canceled stay tuned for updates

No Presentation. Members and invited guests only. **Contact any member to get an invite.** 

**Meal:** If you are having the meal, choices are Turkey with all the fixings or Veggie Lasagna. Paul will send out RSVP's in April.

The <u>meal is \$25 at the door</u>, no charge if not eating.

**Location**: St. John's Club, 9 Central Ave. Burlington (take Lakeside Ave from Pine St.).

**Time**: Social Hour 6-7. Dinner 7-8. Door prizes, awards, annual business meeting 8-9

# June 1 Might be done via Zoom on the web

### Imaging Processing Basics By Paul Walker

#### Page 3

Paul will cover some basic information about digital images that is useful for understanding why astsro-images are processed the way they are. He will include information about the difference between pictures taken using a camera's RAW format and the "normal" JPG format. Terminology and concepts will be introduced such as light frames, dark frames and flat fields. Typical steps taken during "stacking" of images will be covered. How to use specific stacking software will not be covered. This presentation will include a refresher on how cameras work from his earlier "Camera Basics (How cameras work) talk in February.



Go from camera to beautiful image







# Articles

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.

## Betelgeuse and the Crab Nebula: Stellar Death and Rebirth David Prosper

What happens when a star dies? Stargazers are paying close attention to the red giant star **Betelgeuse** since it recently dimmed in brightness, causing speculation that it may soon end in a brilliant supernova. While it likely won't explode quite yet, we can preview its fate by observing the nearby **Crab Neb**ula.

Betelgeuse, despite its recent dimming, is still easy to find as the redhued shoulder star of Orion. A known variable star, Betelgeuse usually competes for the position of the brightest star in Orion with brilliant blue-white Rigel, but recently its brightness has faded to below that of nearby Aldebaran, in Taurus. Betelgeuse is a young star, estimated to be a few million years old, but due to its giant size it leads a fast and furious life. This massive star, known as a supergiant, exhausted the hydrogen fuel in its core and began to fuse helium instead, which caused the outer layers of the star to cool and swell dramatically in size. Betelgeuse is one of the only stars for which we have any kind of detailed surface observations due to its huge size - somewhere between the diameter of the orbits of Mars and Jupiter - and relatively close distance of about 642 light-years. Betelgeuse is also a "runaway star," with its remarkable speed possibly triggered by merging with a smaller companion star. If that is the case, Betelgeuse may actually have millions of years left! So, Betelgeuse may not explode soon after all; or it might explode tomorrow! We have much more to learn about this intriguing star.

The **Crab Nebula** (M1) is relatively close to Betelgeuse in the sky, in the nearby constellation of Taurus. Its ghostly, spidery gas clouds result from a massive explosion; a supernova observed by astronomers in 1054! A backyard telescope allows you to see some details, but only advanced telescopes reveal the rapidly spinning neutron star found in its center: the last stellar remnant from that cataclysmic event. These gas clouds were created during the giant star's violent demise and expand ever outward to enrich the universe with heavy elements like silicon, iron, and nickel. These element-rich clouds are like a cosmic fertilizer, making rocky planets like our own Earth possible. Supernova also send out powerful shock waves that help trigger star formation. In fact, if it wasn't for a longago supernova, our solar system - along with all of us - wouldn't exist! You can learn much more about the Crab Nebula and its neutron star in a new video from NASA's Universe of Learning. created from observations by the Great Observatories of Hubble, Chandra, and Spitzer: bit.ly/CrabNebulaVisual

Our last three articles covered the life cycle of stars from observing two neighboring constellations: Orion and Taurus! Our stargazing took us to the "baby stars" found in the stellar nursery of the Orion Nebula, onwards to the teenage stars of the Pleiades and young adult stars of the Hyades, and ended with dying Betelgeuse and the stellar corpse of the Crab Nebula. Want to know more about the life cycle of stars? Explore stellar evolution with "The Lives of Stars" activity and handout: bit.ly/starlifeanddeath.

Check out NASA's most up to date observations of supernova and their remains at nasa.gov

NASA Night Sky Notes February



#### Page 4

This image of the Crab Nebula combines X-ray observations from Chandra, optical observations from Hubble, and infrared observations from Spitzer to reveal intricate detail. Notice how the violent energy radiates out from the rapidly spinning neutron star in the center of the nebula (also known as a pulsar) and heats up the surrounding gas. More about this incredible "pulsar wind nebula" can be found at bit.ly/Crab3D Credit: NASA, ESA, F. Summers, J. Olmsted, L. Hustak, J. De-Pasquale and G. Bacon (STScI), N. Wolk (CfA), and R. Hurt (Caltech/IPAC)



Spot Betelgeuse and the Crab Nebula after sunset! A telescope is needed to spot the ghostly Crab.

#### \*\*\*\*\*\*

#### Dim Delights in Cancer David Prosper

Cancer the Crab is a dim constellation, yet it contains one of the most beautiful and easy-to-spot star clusters in our sky: the Beehive Cluster. Cancer also possesses one of the most studied exoplanets: the superhot super-Earth, 55 Cancri e.

Find Cancer's dim stars by looking in between the brighter neighboring constellations of Gemini and Leo. Don't get frustrated if you can't find it at first, since Cancer isn't easily visible from moderately light polluted areas. Once you find Cancer, look for its most famous deep-sky object: the Beehive

Cluster! It's a large open cluster of young stars, three times larger than our Moon in the sky. The Beehive is visible to unaided eyes under good sky conditions as a faint cloudy patch, but is stunning when viewed through binoculars or a wide-field telescope. It was one of the earliest deep-sky objects noticed by ancient astronomers, and so the Beehive has many other names, including Praesepe, Nubilum, M44, the Ghost, and Jishi qi. Take a look at it on a clear night through binoculars. Do these stars look like a hive of buzzing bees? Or do you see something else? There's no wrong answer, since this large star cluster has intrigued imaginative observers for thousands of years.

55 Cancri is a nearby binary star system, about 41 light years from us and faintly visible under excellent dark sky conditions. The larger star is orbited by at least five planets including 55 Cancri e, (a.k.a. Janssen, named after one of the first telescope makers). Janssen is a "super-earth," a large rocky world 8 times the mass of our Earth, and orbits its star every 18 hours, giving it one of the shortest years of all known planets! Janssen was the first exoplanet to have its atmosphere successfully analyzed. Both the Hubble and recentlyretired Spitzer space telescopes confirmed that the hot world is enveloped by an atmosphere of helium and hydrogen with traces of hydrogen cyanide: not a likely place to find life, especially since the surface is probably scorching hot rock. The NASA Exoplanet Catalog has more details about this and many other exoplanets at bit.ly/nasa55cancrie.

How do astronomers find planets around other star systems? The Night Sky Network's "How We Find Planets" activity helps demonstrate both the transit and wobble methods of exoplanet detection: bit.ly/findplanets. Notably, 55 Cancri e was discovered via the wobble method in 2004, and then the transit method confirmed the planet's orbital period in 2011!

Want to learn more about exoplanets? Get the latest NASA news about worlds beyond our solar system at nasa.gov.



NASA Night Sky Notes March 2020 Artist concept of 55 Cancri e orbiting its nearby host star. Find details from the Spitzer Space Telescope's close study of its atmosphere at: bit.ly/spitzer55cancrie and the Hubble Space Telescope's observations at bit.ly/hubble55cancrie Credit: NASA/JPL-Caltech



Look for Cancer in between the "Sickle" or "Question Mark" of Leo and the bright twin stars of Gemini. You can't see the planets around 55 Cancri, but if skies are dark enough you can see the star itself. Can you see the Beehive Cluster?

\*\*\*\*\*\*

#### **Brunch with the President** By Michelle Spaulding

As the four of us meandered our way through the tables and booths at Athens Diner in Colchester, VT his boots jingled with every step. With his Santa hat and his salt and pepper beard, the patrons in the crowded diner all turned to see who was making all that festive noise. His e-mail said, "If you don't remember who I am, I will be wearing the Santa hat and bells on my boots".

Jack St. Louis is President of the Vermont Astronomical Society (VAS). An avid and extremely knowledgeable lover of all things space-related, he invites member of the VAS for a Presidential Brunch on a monthly basis and this month, my son was lucky enough to be chosen.

We had never met Jack face-to-face in the daylight, as all our prior interactions with him took place in the dark of night at the Observatory in Hinesburg, VT, but I recognized his voice right away. In Hinesburg, it always felt like whenever Jack arrived at the Observatory the party really got started. His energy and openness to everything was palpable even in the pitch black. No matter how many times he peered through the telescope to view Saturn and her rings, he always seemed blown away, his excitement and awe never wavered. His appreciation always strong and raw.

Once seated, Jack proceeded to talk all things Astronomy, which both my son and I soaked up. While my son is much more knowledgeable about the topic than I am, I do still find it so interesting. I ask amateur questions like "do you think life exists other than us?" while my son asks, "How many times has the sun revolved within our galaxy?". Of course, Jack has an immediate answer for him, as I sit there trying to wrap my head around the fact that not only are we here on earth spinning on our axis, but we are also revolving around the sun, which itself is also spinning on its own axis, while also revolving around our galaxy.

All the spinning literally makes my own head spin, but apparently the two of them can conceive of it more readily.

We ordered, we ate, Jack showed us myriad pictures of his telescopes, pictures he's taken of the Andromeda Galaxy and The Sun and showed us new things to buy for my son's telescope. He got the astronomy bug in his midto-late teenage years and has never looked back, having taught at UVM and a plethora of other places to boot. By the end of our brunch, he was telling us jokes and funny stories about his diagnosis of cancer 6 years ago (he's in full remission), and how he lost half his thumb to a table saw. I was charmed to no end by his light-heartedness and humorous take on life. If only we could all be a little more light-hearted.

Maybe his life-long passion of peering through a telescope at things that dwarf our inflated sense of importance has somehow eased him of any Existential angst. I know when I myself look through that hole and see Saturn and its rings in person, it oddly gives me comfort and makes my seemingly important problems just a little less acute.

Next to him, his more quiet and lovely partner Sharon showed us a picture she had recently drawn of Jack himself, and our entire table erupted in laughter at the hilarious accuracy of it. She's allowed me to share it publicly and I honestly think it captures him perfectly.

Thank you to both Sharon and Jack for spending some time with us this morning and letting us get to know you. As my son and I drove out of the parking lot of Athens Diner, he turned to me and said, "I want to have lunch with them again sometime".

If you or anyone you know might be interested in learning more about the Vermont Astronomical Society, please click the link below. My son and I are having a blast.

\*

#### First Telescope Program

With the support of the VAS Board, I am developing a First Telescope Program for new members of the club. For now I am seeking a few of the old 4 <sup>1</sup>/<sub>2</sub>" f8 Newtonian telescopes that I can renovate, fit with 1 <sup>1</sup>/<sub>4</sub>" rack and pinions and eyepieces then outfit with Dobsonian mounts. My target is to sell these to club members for \$100 or non-members for \$125. For the first year the new owners can return it for full refund in case of non-use or to upgrade, etc. After a year the refund will depend on condition. Sales will depend on availability of telescopes and components, so if you have old telescopes, eyepieces or parts you want to sell or donate please contact me.

#### Keith Lawrence

sleepingbearwoodworking@yahoo.com 802-453-5496

# Board & Committee Meetings

#### **Board Meetings**

#### January

Jack opened the meeting. Announced all the board members are invited to Brownell Library's 26th Annual Ground Hog Day Volunteer Dinner and Yankee Swap on February 4th. He has scheduled a Telescope Clinic for February 22 for members and the general public. Jim Bosek has agreed to fill one of the Board at Large positions for the remainder of the fiscal year. The Board has approved this appointment (see Motions).

Doug updated us on the financials. Insurance premiums have gone up partly do to additional coverage such as coverage for malicious cyber activity directed at us. Reminded us that Astronomical League membership dues are due for those who are or want to be members of the AL.

Bob dropped of 2 eyepieces from 14 Irene (the club's portable 14" telescope) at the HOS for use on the Chmela and Patterson scopes.

Keith brought up items discussed at the recent Membership Committee Meeting: There was discussion at the meeting of setting up a library of astronomy books (started by Angele a few months ago). It will take some work to make this happen. For now we plan to set a table up at the monthly meeting where folks can bring books to share (actually give away). The deal will be anyone can bring astronomy books they are willing to part with. Anyone can take any book they want from the table. A big caveat you have to take home any books you brought that are not taken by someone else when you leave for the night.

Paul is in the planning stages for an astro-imaging workshop in the Spring. We are working on having a discussion forum on the website, Scott has installed the software, he and Terri are the primary people working on this. There is no go live date scheduled as yet.

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Duane Waller has requested gate access to the HOS. The board has approved his request (see Motions). He will have access after he goes through the training.

MOTIONS:

Doug moved that we appoint Jim Bosek as a Board of Large board member. Seconded by Bob. The vote was in favor.

Paul moved that we honor Duane's request for gate access at the Hinesburg Observing Site. The vote was in favor with one abstain.

ACTION ITEMS: None.

#### February

Jack opened the meeting. He reminded us about the Telescope Clinic for February 22 for members and the general public. Now that we are holding board meetings at Jack's place of residence, the plan it to schedule them every 3rd Tuesday of the month as long as the room is available.

Terri Zittritsch has been approved to the last open Board at Large position for the remainder of this year's term.

Doug has paid the liability insurance for the year.

Keith asked if we planned to hold an auction at the Annual Banquet this year. We do. We will need to collect items for the auction.

Paul – We are set for monthly presentations through June. July is open. Gary will do his 2 part presentation on Mars and observing Mars in August and September to help us prepare for the Mars apparition this Fall. The Annual Banquet/Business Meeting is booked for May 4th at St. Johns Club. The meal choices will be the same, turkey with all the fixings or a veggie surprise. We will charge \$25 for the meal.

> MOTIONS: None

#### ACTION ITEMS:

Paul will inquire as to whether people can request dark or white turkey meat.

#### March

No Meeting.

\*\*\*\*\*

**VAS Membership Committee** No meetings.

**Observatory Site Committee** No meetings

#### Site Survey Analysis

The results were reported in the Winter 2020 newsletter. The full 2018 Site Survey results are available as a PDF file on request (contact Paul Walker)

## **Observers Page**

#### It's Time to View Venus

[Feb. 19] Putting Gary's Observing Venus talk to work, I have been out seeking the "twilight sweet spot" with Venus and lunar observations on the 17th and tonight.

Seeing in my Orion XT6 telescope was surprisingly good, perhaps holding briefly at 7/10 for at time on both nights. Observations just after 5:00 PM local time.

I used my new Kokusai Kohki 1.25" Fujiyama HD-OR Orthoscopic Eyepiece - 9mm, 133x for the first time with very good results. In comparison to observations of the 17th, the southern cusp of Venus appeared darker this evening, the darkest part of the disk.

Filters of 80a and 82a used, with 80a the best.

#### Lawrence Garrett

I was looking at it in the twilight a couple of nights, which is really the best time and down here in the Keys it's quite high up! Once it gets fully dark you really need some serious dimming capability!~!! This baby is bright.

The yellow filter doesn't do a thing for the brightness in my 5.5" refractor.. I have a generic blue filter and that will tone it down, and not sure what Wratten number it is. Tonight I'll try a bit more critical viewing at twilight.

Terri Zittritsch

I have been observing Venus in my 4.7" F/7.5 APO refractor. My seeing hasn't been as good as Larry Garrett's, approx. 4.0 - 5.0 / 10. I've been using my Baader 495 nm filter (Yellow) as the main filter. I've found that the Baader 570 nm Orange really will reduce the planet's brightness and does a nice job on showing the terminator... The Baader 610 nm Red gives a bit too dark image of Venus in the 4.7" APO. The Baader 610 nm is similar to the W25 Red. (I think a red or orange filter (W21) will work better for Terri on dimming down the planet in a 5.5" refractor.) I plan to try the W23a Light Red filter to see how that will work in my 4.7" APO on Venus.

On the 17th and 18th [Feb.]I was observing Venus at 22:30 UT (05:30 PM) with my 4.7 F/7.5 APO refractor at 128X. I was using the Baader 495 nm Yellow filter along with the Baader 570 nm Orange. The Southern Polar Area was a bit brighter than the Northern Polar Area. I could see a bright light section in the Southern Polar Area near the limb. It looks like there was some type of bright white limb cloud in that area... I wished my seeing was better so I could get to use the blue filters. Unless the seeing is really good, the blue filter images get kicked around badly by the seeing conditions. However, the Baader 495 nm Yellow did show the bright white limb cloud a bit better than the Baader 570nm Orange.

It will be interesting to see if any dark clouds will be seen on Venus. We are now entering into the prime Venus observing window with Dichotomy (half phase) coming up on 26 March 2020. Venus will gain some more altitude and brightness as we approach Dichotomy.

#### Gary Nowak

[2/20/2020] Tonight held the worse seeing of my 3 day series, but good enough to record the southern

cusp now equal to the north. When I tried moving up my observing to about 5:30 PM local, was the seeing bad!!!

Sweet spot here from about 4:45 to 5:10 PM, 133x XT6 telescope.

Hope it is clear on the 23rd, as perhaps the southern cusp may darken again with the clouds rotation.

Lawrence Garrett

[3/3/20] I took some time to review images of Venus from the A.L.P.O Venus section to see if any were posted that were taken on any on my February dates of observation, one was.

On February 17, my first daylight observations since reading Gary's Venus presentation, I observed on the first of 4 times thru February 24.

This date did have an image posted at the ALPO site and confirmed my sightings.



This image, a UV 325-375 band pass image did include features observed visually marked with arrows, the bright limbs were seen. But the dark clouds were nothing but just less bright uniform featureless white surface clouds. The observation was two whites, limbs brighter. I had never seen this before.

This was not hard to see in my 6" f/8 reflector. But at the time, I considered it perhaps too easy, maybe just the normal appearance. I had noticed in the following nights this was not present. 133x and W80a filter, seeing about 6/10. These bright limb arcs did not extend right to the terminator on the Venus disk, you could really see where they started and ended on the limb.

After seeing this image, it seems this first night time [view] was the real deal in these features, the darker bands below and above them, would really be bright if seen alone. On the 19th, I observed the southern cusp to be darker than the north, but have found no follow up image.

In the past I have seen drawings of Venus with numbers to measure the brightness of the parts of the surface, talk about difficult. I can just image the seeing and time you would need to compose such a detailed drawing. Look for the brightest spot on the surface and branch out from there, perhaps such success will fall for one of us who takes the time and effort to push this planet to the max. I can't believe this can be done after dark, even in my 6", the filter cut the brightness in daylight, 80%!!! *Lawrence Garrett* 

[3/3/20] I took a look at Venus this past Sunday, March 1st. The seeing was surprisingly good. I started about 5:45, 15 minutes before sunset. I maybe saw a slight brightening on the Southern cusp or a slight darkening just inside the Southern cusp. I couldn't tell for sure, it was very subtle and came and went, could have been just a contrast thing. I used my 10" f/5.6, Atmospheric Dispersion Corrector (ADC), 2x Barlow (needed for reaching focus using the ADC), and 24-8mm zoom eyepiece (the combo gives 160-480x range). Image wasn't too bad even at over 300x. Tried red (25A) and blue (80A) filters. Didn't provide any more details. Venus was high enough that there was very little atmospheric color dispersion but the ADC allowed my to "tune" it out for a pure white image with no blue and red fringe. Had a lot of glass though (Barlow, ADC and zoom eyepiece) between Venus and my eye, can't say whether all that was problematic. Of course I could reduce the glass by using standard eyepieces but I sure do like being able to just dial in the magnification that works best.

I also imaged Venus using the same setup with the exception of replacing the zoom for a 16mm Konig eyepiece (~240x). The camera used was a Nikon AW-110 point & shoot with 5x zoom at 5x (28-140mm equiv.) for a total eff. mag. of ~680x. Venus was still so bright that I had to use a Moon filter to dim it. This one has a greenish tint. Stack of 70 frames from a 1 minute video (color image, you can see the green-

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#### ish tint from the Moon filter. I cropped



the video frames by 50% before stacking so Venus is twice size as in the original video. Couldn't detect any shadings. I extracted the blue and red channels and enhanced them to see if I could pull out and details. Knowing that the orientation of an image can affect visual perception I rotated the image. Below is the blue channel.



Applied a contour tool to see whether that would show and subtle brightness variations.



Here's the red channel.



And with contours.



Paul Walker

I got back Wednesday night [from Porto Rico] and got into the observatory tonight [3/14/2020]. I took a 2000 frame video using a Sentech camera at prime focus with the C14. I processed the video in Registax 6. Here is the RGB image and the split color channels. *Joe Comean* 



15-16 March 2020 UT, Seeing 6.0, Transparency 5.1, Temperature +16°F, Humidity 50%, Wind NW at 2 mph, Barometric Pressure: 30.07". Observing in my back yard.

00:00 UT Venus, Size 21.0", Illumination Phase 56%. 4.7" (120mm) F/7.5 APO Refractor, 128X, Filters: W23a Light Red, Baader 570nm Long Pass Filter (Orange) and Baader 494 nm Long Pass Filter (Yellow). Venus features: Terminator near South Polar Region seem to be irregular and sticks out a bit into the dark side. Rest of the Terminator looked smooth. North Polar Region had a bright spot or small bright white area. Dusky, "darkish" Terminator Clouds were visible along the Terminator with a partial dusky extension of the Terminator Band Clouds. No illumination seen on the dark area of Venus. *Gary T. Nowak* 

#### **Double Star Observations:**

The seeing was pretty good so I decided to do some double stars. One of the double stars which I always check is Sirius to see if I could split it. Sirius is a binary double star with an orbital period of 50.1 years. Sirius A is the primary star at -1.46 magnitude while Sirius B ("The Pup") is the orbiting secondary star at +8.4 magnitude. Right now, we are at the start of the prime observing window for Sirius B. The observing window is from 2020 to 2026. This primary observing window is when Sirius B is at maximum separation (over 11.0"). The 2020 separation is 11.1". The maximum separation will occur in 2023 at 11.3". After maximum separation occurs, Sirius B will slowly close in on Sirius A. If you miss this prime observing window; you will have to wait another 50 years to see Sirius B so far separated. The splitting of Sirius A / B looks easy according to the Dawes Limit with its wide separation of 11.1". Yet there are 3 factors that will work against you and prevent an easy split of Sirius A / B.

1. Sirius doesn't get that high in our skies; maximum altitude of Sirius is 28°high.

2. Seeing conditions must be very good to do the split.

3. This next factor is probably the hardest factor to overcome to see Sirius B; the brilliant, overpowering glare of Sirius A.

To compensate for the glare of Sirius A; I use the Baader 495 nm Long Pass Filter (Yellow). This filter helps cut down on the glare and helps steady the image.

At 01:00 UT, I turned the 4.7" F/7.5 APO Refractor onto Sirius using a 150X eyepiece with the Baader 495 nm filter. I could see the Airy Disk of Sirius A along with its Airy Rings. The Airy Disk and Rings kept scintillating in and out. I thought I was catching a glimpse of Sirius B between the movement of the 1st Airy Ring. I checked the view by removing the filter; the Baader 495 nm filter helped to sharpen the Airy Disk and help steady the image. I was watching the scintillation of the Airy Rings when suddenly the seeing steadied, everything settled down and Sirius A Airy Disk shrunk in size. I looked and I could clearly see The Pup. How tiny and dim The Pup looked as compared to Sirius A. The Pup was clearly separated from Sirius A disk but seemed rather close to it... No wonder it's so hard to see The Pup. The seeing held steady for about 30 seconds or so then degraded downward. I was very fortunate to get a good look at Sirius B; a secondary star which had alluded me many times before. The seeing never returned back to that previous superb moment. I will try again on some other clear steady night to split Sirius again. Now I know that I can see Sirius B in a 4.7" (120mm) telescope and the Baader 495 nm Filter (Yellow).

The Eastern Coyotes were howling away in the SW when I went after another double star, Eta Orionis. This double star was split at 150x with the Baader 495 nm filter. This double star whitish components have a 1.7" separation. The primary star is +3.6 magnitude and the secondary star is +4.9 magnitude. There is no problem here with the primary star overpowering the secondary star. This is the best (smallest) separation of a double star from my back yard. Usually my average seeing in my backyard is about 2.2" ... This limit in separation capacity is solely due to the poor seeing conditions. I know that some of the double star observers are probably not happy about using a yellow colored filter because it contaminates the true colors of double stars. Yet for me; the benefit gain in steadiness and sharpness of the Baader 495 nm (yellow) filter far outweighs the loss of the true color of binary stars.

Gary T. Nowak

#### More Venus

Once again I tired my 12.5" reflector on Venus, and from 22h00-20mm found the seeing sweet spot,

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and perhaps the Venus viewing sweet spot as well. That would be the daylight, filter (80a) and seeing combining just right to produce this season's best view for me yet. Conditions for Venus are so demanding.

While I reported a serrated look to the terminator the day before, seeing was even better, to produce a dusky look at 156x, and graduated albedo across the whole disk like never before. Very much like images you see online.

In the 6" telescope side by side, only a smooth terminator was visible. Seeing was 6-7/10 at the time.

Panstarrs C/2017 T2 was an easy object too.

Lawrence Garrett

Venus. White light shot. Stack of 1000 video frames. Notice that there is no red and blue fringes on the edge of Venus. Seeing how wavery the image in the video was, it is amazing this came out looking as good as it dose.

In this case I did not use Photo-Shop magic of re-aligning the red and blue color channels to correct for atmospheric diffraction. I used my Atmospheric Dispersion Corrector (ADC) to correct the diffraction before I took the video.



Below is the same image with contours to see if there is any subtle gradients. There may a very subtle brightening near the north (lower) and south (upper) ends. I kept the wavelet sharping in Registax 6 to a minimum in an effort to not introduce processing



artifacts. The contours were added while the image was still in 16 bit TIFF format.

This a stack of 750 video frames from a video taken through a blue filter (485nm with a 20nm half bandwidth)



Same image is below with contour lines. On this one the contours show a subtle brightening on the edge, however, this could very well be an artifact of the image processing. I stacked the frames using Registax 6 and used the software's wavelet sharping function to try to bring out subtle details. However, wavelet sharping will also produce a contrast enhancement along edges, that is, it will make the dark side of the edge darker and the light side of the edge lighter. I see this on the edge of Moon images I enhance with wavelets, only there I don't care so much.



Paul Walker

**Deep Sky in Auriga** By Maura Kelley

"For myself, I really enjoy imaging a wide field. It really puts things in perspective! It helps me to mentally mapout objects. I can use just my camera, a modified Olympus micro-four thirds DSLR on my telescope mount. In this wide field image (top of next page), in the constellation Auriga at 150-164mm focal length, you can spot several beautiful deep sky objects in a single image. This photo is comprised of (325) 20-sec. sub exposures (1.8 hrs.) and I'm finally ready to switch over and learn to use an auto-guiding system.

Below I photographed 2 of the main deep-sky objects, the Flaming Star (IC 405) and Tadpole (IC 410) nebulae. The Flaming Star comprises 2.12 hours over 3 nights, and the Tadpole Nebula comprises 1.34 hours, over 2 nights. Another project will be to capture just the Starfish Cluster (M38) as seen in the wide-field image.

Equipment used: Explore Scientific 80mm f/6 air-spaced triplet ED apochromatic refractor in carbon fiber and Explore Scientific EXOS2-GT equatorial mount with PMC-Eight Go-To System."





Spring is the Time for Watching the Moon By Paul Walker

If you are an evening person, Spring is a great time to view the Moon. It rides high in the sky and the weather is warming up. This image shows the Lunar X on the terminator near the bottom and I think the Lunar Y (tipped on



it's side) toward the top. Though with the lighting at the time, it looks more like the symbol for Aries the Ram (North is down).

Below are close-up shots of the 2 features.



The Moon was 7.4 days old. The images were taken with a Nikon AW-110 point & shoot through a 10" f/5.6 Newtonian telescope. Each are stacks of 200 to 500 frames from High Definition video clips.





#### More images by Maura Kelley

"A quick wide-field look into Monoceros... and then focusing in on the Rosette Nebula (NGC 2244) and the Christmas Tree Cluster (NGC 2264) which includes the Cone & Fox Fur Nebulae."





Image Credit: Charlie Warren Editor: Amateur Astronomy Magazine

#### Terri Zittritsch at the Winter Star Party in the Florida Keys

You can see I'm taking images with the Stowaway while the TEC140 is setup a little behind me for visual. It was a great event for both!

Paul will be surprised at just how many people commented, and were in 'awe' of how long the phosphorescent tape worked. It basically worked all night long. You can see it flowing bright here. I shared that it was not an original idea of mine, but came from a club member.



# The Veil Nebula Taken by Terri Zittritsch

A very deep and detailed image. Terri used a ZWO ASI071MC Pro Color Camera (1 shot color astro-camera) and her Skywatcher Refractor (400mm f.l.).



# Thor's Helmet (NGC 2359) Taken by Joe Comeau

Joe's latest version of Thor's Helmet cropped from a series with a 6" F9 Ritchey–Chrétien telescope (74 minutes) in 2018 and with a 6" F4 Newtonian (120 minutes) taken on 2/29/20. Canon XT modified at ISO1600. 2 min subs on the RC and 1 min subs on the Newtonian. Processed with darks, bad pixel map and flats and demosaiced in Nebulosity. Combined (2 star align with sigma clip in Maxim DL). Finished in Photoshop CS2



# Tadpole Nebula (IC 410)By Joe Comeau2 hours total exposure using his 6" F/4 scope. All 1 minute exposures.





Approximate visual appearance in my 10" f/5.6 Newtonian telescope. This is an image created from the same file as the image on the left.

## Thor's Helmet (NGC 2359) By Paul Walker

Not an easy object to image as it is quite faint and rather small (this is a 40% crop). Joe's recent image prompted me to give it a try. A week or so after taking the image I decided to find it visually with my 10" f/5.6 Newtonian. It was low in the South and faintly visible. An Orion Ultra Block light helped with the visibility. **Image details:** 2020-03-15, in Canis Major, 10" f/4, 5min X 20 (1hr 40min total time), ISO 800, camera- Canon T7i modified, North is down



Pinwheel Galaxy (M101) in Ursa Major By Paul Walker

The common name "Pinwheel Galaxy" is "pinned" to both M101 and M33. M101 is about 21 Mly away and 170,000 ly across. **.Image details:** Taken 2020-03-27, 5 min X 37 (3hr 5min) Meade LXD55 10 inch f/4.0 Schmidt-Newt. Reflector, Canon T7i camera, ISO 400



## Bodes Galaxy (M81) in Ursa Major By Joe Comeau

Friday (2020-03-27) was clear in South Alburgh. The dew point was 27F and the temperature was 43F so I took the opportunity to take a look at M81 without worrying about corrector plate fogging. M81 is 12 Mly away and 90,000 ly across. **Image details:** 1 minute subs X 114 (1hr 54min), autoguided. ISO 1600 Canon XT modified, LXD55 10" F/4 Schmidt-Newt., with flat, darks and bad pixel map in Nebulosity, Sigma Clip aligning in Maxim DL. Stretching, cropping and color balancing in Photoshop CS2.



The Great Orion Nebula (M42) By Paul Walker

It is difficult to do M42 justice due to the large range of brightness. I took the subs at the camera's lowest ISO setting and relatively short exposures. I shot twenty 1 minute and twenty 2 minute exposures, not knowing which would be better for not "blowing out" the bright core. The 2 minute exposures were fine, especially as I worked with the RAW files. I processed the stack of 2 min. exposures to enhanced the fainter parts without completely blowing out the core. I then processed the stack again, focusing on retaining the core and enhancing the detail there. I then carefully cloned the enhanced core into the other image (this took some trial and error). The outer regions really need 2 or 3 hours total exposure time. **Image details:** Taken 2020-02-22, 2 min X 20 (40 minutes total), ISO 100, Meade LXD55 10 inch f/4.0 Schmidt-Newt., Canon T7i camera.



The Cigar Galaxy (M82) and Bode's Galaxy (M81) By Paul Walker

M81 and M82 passed close to each other a few hundred million years ago disturbing the smaller galaxy so much that a lot of the gas and dust in M82 (the Cigar Galaxy) (on the left) is rapidly collapsing and forming thousands of new stars. We call such galaxies "starburst" galaxies. The red areas are where the new stars are being born. Notice how much red there is in M82 compared to M81. The star birth regions in M81 are the tiny red spots. **Image details:** Taken 2020-02-20, Exp 5 min X 25 (2hr 5min), ISO 800 Meade LXD55 10 inch f/4.0 Schmidt-Newt. Reflector, Canon T7i camera. **Seems we like to image the same stuff**.

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Location Charts for the deep sky object images in this issue. Created using Starry Night Pro 8 & Picture Window Pro 7. Auriga



INGC 2483

NGC 2527

Page 20

Location Charts for the deep sky object images in this issue. Created using Starry Night Pro 8 & Picture Window Pro 7.



# Wanted

**Wanted -** old 4 <sup>1</sup>/<sub>2</sub>" Newtonian telescopes with or without mount. Also 1 <sup>1</sup>/<sub>4</sub>" rack and pinions and eyepieces for my VAS First Telescope Program. I will renovate and sell to new club members for a starter telescope.

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

**Wanted-** Old medium duty tripods and or legs that I can use to manufacture binocular parallelogram mounts.

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

# For Sale

For sale - Binocular parallelogram mounts. Work well for use with lounge chair for looking at higher elevations or for multiple observers of different heights. I will fit your binoculars to the mount for optimum performance. **\$195** 

Contact Keith Lawrence, 802-453-5496, sleepingbearwoodworking @yahoo.com

**Celestron SLT mount** w/handset and Talentcell Lithium-Ion battery pack--**\$100** 

ETX-125 OTA only--This one has the USA made optics. Just too heavy for my needs. Needs some TLC but gives the images you expect out of this model. Contact me for more details if interested. \$125 Orion Tri-mag 3x Barlow in very good condition - \$30

Celtstron Omni 2x Barlow in excellent condition - \$25 Contact Paul Marino,

paulmarino@gmavt.net or call (802) 482-5128 Meade 6" LXD55 telescope with

the following: 26mm eyepiece, Finder

40mm; 32mm; and 20mm. Solar filter,

Dew cap, Autostar Instruction Manu-

Asking \$350 with the accessories list-

Contact Bruce Harmon, 802-876-

Scope, Anniversary eve piece kit with

15mm; 6.4mm; 9.7mm; 12.4mm;

al, Martin Preston users guide

7535 or bdhinvt@yahoo.com.

Meade model 4500 OTA only 4.5 inch F/8 newtonian reflector

1.25 inch rack and pinion focuser

MA 25mm and MA 9mm eyepieces

Contact Bob Peacock (802) 658-2131

Telescope mirrors and a couple

mounting cells

8", probably f/8, in nice cast alumi-

10" f/9, 1/10 wave (measured by Bob

several years ago), Beral coating that is

in good condition though the edge has

several chips (edge not beveled) and a

note from the coater says there are a

few scratches and it is not fully pol-

ished (may be saying that because of

(Sold to Jack for \$50)12", probably

f/8, plate glass mirror in nice 18

point mirror cell. The cell is worth

St. Michael, s College, from the old

scope they had in their observatory.

Other than the 10" f/9 I cannot

vouch for the figure of the mirrors.

cell and look again. The rest have a

Make an offer on any of the items.

Paul Walker 802-388-4220 or

slight greenish-yellow tint.

paulwaav@together.net

The only one that may be Pyrex is the

8" mirror, I'd have to pull it out of the

more than the mirror. This came from

the scratches). From St. Michael, s Col-

Meade 2X telenegative barlow

**3.5" f/10** with 3/4" diagonal.

6", probably f/8.

num cell.

lege.

bcpeacock@outlook.com

2- 4.5 inch tube rings

ed.

OTA,

Asking \$70

Celestron NexGuide Autoguider

I purchased used at the Stellafane Swap Tables as a backup to the on I am using, however, I forgot had already purchased a back at the Swap Tables the previous year. I don't really need 2.

## \$140 OBO.

Paul Walker 802-388-4220 or paulwaav@together.net

#### 4 inch, 550mm f.l. brass Televue Renaissance scope with carrying case

Equatorial mount with oak tripod

- 2", 20mm Nagler type 2
- 2" 45deg. righting prism
- 2" Big Barlow
- 2", 4.8mm Nagler
- 1-1/4", 26mm Plossl
- 2", 45deg. Prism camera adapter

# New Price \$1850 - will negotiate.

Contact Richard Cummings at Rick@vsbmetal.com Or you can contact Ron Anstey anstyer@myfairpoint.net

## Books

The Night Sky Observer's Guide, Volumes 1-3, like new, **\$100** Burnham's Celestial Handbook, Volumes 1-3, used but very good condition, **\$50** 

Abell's Exploration of the Universe seventh edition, textbook in used condition, **\$10** 

Celestial Objects for Common Telescopes, Volumes 1-2, used but good condition, **\$10** Cheryl Rayner

cheryll.rayner@gmail.com

**Copies of "Mirror Mirror" - A History of the Human Love Affair with Reflection** by Mark Pendergrast of Colchester, Vt. available for **\$25**. Mark will split the profits with VAS. Contact Mark at <u>markp508@gmail.com</u> or see Jack St. Louis at any monthly meeting.

	6" Telescope Kit
	Parts for a 6" Newtonian Telescope
10" Telescope Kit	(unused), these were purchased new a
Parts for a 10" Newtonian Tele-	number of years ago. The previous
scope (used), these were in a home-	owner never made them into a tele-
made Dobsonian scope that was build	scope
many years ago. The tube assbly and	Includes:
base were in bad shape so we discarded	6  inch  f/5, full thickness (1") mirror,
them.	Pyrex glass.
Includes:	3 point cast aluminum mirror mount
10 inch $f/5.5$ , lightweight (1") mirror,	Diagonal mirror (1 7/8" minor axis)
Pyrex glass.	Diagonal mirror mount
Heavy duty 9 point floatation Mirror	1.25 inch rack and pinion focuser
mount (Kenneth Novak & Co.)	Mirror coating are in like new condi-
Diagonal mirror (2.5" minor axis)	tion.
Diagonal mirror mount	Equatorial head (1" shafts)
1.25 inch rack and pinion focuser	115vac synchronous RA motor
Mirrors are usable as-is though could	Astring \$60 for everything or \$40 for
use re-coating.	the telescope parts \$30 for the equa
The minute mount was sugar from	torial head and motor or best offers
Ouglity Optical Support Systems	This was given to the club and is being
Quality Optical Support Systems	sold by the club. It is located at Paul
Astring <b>C75</b> on bost offen	Walker's house
This was given to the club and is being	Contact info@vtastro org
sold by the club. It is located at Daul	Contact infold vtastro.org
Walker's house	
warker's nouse.	

Contact info@vtastro.org

for VAS members.

material and my time.

stock).

Light duty machining and custom

hardware for astronomy. Simple

adapter plates and other custom

made or custom modified hardware

I have a moderate amount of scrap alu-

minum, mostly flat stock. For a nomi-

nal fee (~\$10 - \$50 depending on

size and complexity) I will consider

adapters. I can also do some custom

I have a 2-way cross vise on a heavy

a light duty mini-lathe (for round

Paul Walker 802-388-4220 or

paulwaav@together.net

duty drill press (allows for light milling

and precision drilling, +/-0.005"). And

modifications to existing brackets and

hardware. Dependant on availability of

making custom mounting brackets and

Modified Orion XT10 10 Inch Dobsonian Telescope

For Sale: One Orion XT10 Dobsonian telescope with accessories. This scope has been flocked and sits on a mount I modified. Four adjustable legs attach to the bottom plate to keep the 'scope out of dewy grass or snow. The bottom plate is hexagonal and has a 360 degree compass rose attached. The rocker box has a cutout so you can read the azimuth. I lost the little paper clip pointer. You'll have to make your own.

This sale is in two packages.

## The first package is the telescope and mount, \$450 :

(1) Modified, flocked Orion XT10 Dobsonian Telescope (1) Orion padded zippered carry bag with shoulder strap (1) Tube cap (1) Rocker box (1) Hexagonal base with compass rose (4) Adjustable legs (1) Orion 2" Crayford style focuser (1) Set Orion Crayford Focuser hex kevs

CONTINUED IN NEXT COLUMN

## CONTINUED FROM PREVIOUS **COLUMN**

## The second package is the telescope accessories, \$250:

(1) Large plastic toolbox with sliding trav

(1) Orion stock rack and pinion 2" focuser

(6) Homebrew foamcore Hartmann Masks and (3) blanks

(1) Plastic engineer's magnetic compass

- (1) Zhumell 26mm wide field lens
- (1) Olympus CLA-10 Lens Adapter
- (1) Sirius Plossl 10mm lens
- (1) Sirius Plossl 25mm lens
- (1) Orion Shorty 2x Barlow lens
- (1) Large to small lens diameter adapter
- (1) Orion 13% moon filter

(1) Camera adapter

- (1) 9 in 1 Hex key set
- (1) 7 in 1 Hex Key set (metric)

(1) Crescent wrench

(7) Various bubble levels

(2) Spare lens caps

- (14) Small round magnets
- (1) 2 in 1 pocket screwdriver

(1) Bag milk jug spacers

- (2) Mirror end dust covers
- (1) Orion 9x50 90 degree finder scope
- (1) Orion 9x50 straight thru finder scope
- (1) Magnetic base inclinometer
- (1) 12v hair dryer
- (1) Tie down strap
- (1) 360 degree protractor

(6) Orion rocker box screws with hex keys

- (3) Collimation screws
- (1) Orion LaserMate Deluxe collimator
- (1) Telrad reflex sight

This sale is AS IS. I've homebrewed some features but I also cared for it. The mirror is clean and was collimated the last time I put it away. I added the nice smooth Orion Crayford focuser. Gene Harriman Middleboro, Massachusetts Bigwingboy@verizondot.net

For selling & buying also check out: www.marketplace.skyandtelescope.com