SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

February 2020

"Fireworks Galaxy" NGC 6946 and Open Cluster NGC 6939 in Cepheus

Gary Miller

The cluster (mag. 8.85) is about 4,000 light years from Earth, while the magnitude 10.50 galaxy is 25.2 million light years distant, some 6,300 times farther away than the cluster from us. The brightest star, just below and right of center, is HD196085, magnitude 7.17, spectral class F2. Imaged in October 2019 at Ward Pound Ridge with ES 127mm triplet refractor on Losmandy GM811G Mount, auto-guided with PHD2, Canon T7i DSLR. Fifty 3-minute subs, darks subtracted, processed in PixInsight.

WAA February Meeting

Friday, February 7th at 7:30 pm

Wilcox Hall, main floor
Pace University, Pleasantville, NY

Methane on Mars

Br. Robert Novak, CFC, PhD
Iona College

February is Mars month at WAA. Brother Novak is a member of the team at the NASA Goddard Space Flight Center's Solar System Exploration Division, studying the Martian atmosphere using large terrestrial telescopes in Hawaii. He will bring us up to date on exciting recent findings from his group and from the Mars Curiosity rover that may suggest a biologic origin to atmospheric methane on the red planet.

Brother Novak is a member of the Congregation of Christian Brothers (Latin: *Congregatio Fratrum Christianorum*), an order within the Catholic Church dedicated to the education of youth, especially the poor. Iona College was founded by the Christian Brothers in 1940 specifically to provide higher education opportunities for the disadvantaged. Br. Novak recently retired from the Chairmanship of the Physics Department at Iona. He is also a member of WAA.

Pre-lecture socializing with fellow WAA members and guests begins at 7:00 pm!

Westchester Amateur Astronomers

Also In This Issue

WAA March Meeting

Friday, March 13th at 7:30 pm

Wilcox Hall, main floor
Pace University, Pleasantville, NY

Microquasars

Diana Hannikainen
Observing Editor, *Sky & Telescope*

Call: 1-877-456-5778 (toll free) for announcements, weather cancellations, or questions. Also, don't forget to visit the WAA website.

Starway to Heaven

Ward Pound Ridge Reservation,
Cross River, NY

The next star party will take place in March. We will ring in the equinox with a star party on March 21st, with a rain/cloud date of March 28th.

New Members

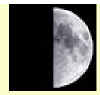
Patricia, Jon, and Frank Gelardo	Mamaroneck
Neil O'Connor	Yonkers
Tara Sharp	Scarsdale
Mohammad Asadullah Siddiqui	White Plains
Melissa Toole	Bedford
Charles Weicha	Hastings

Renewing Members

David Butler	Mohegan Lake
Daniel Cummings	Croton-On-Hudson
Eileen Fanfarillo	Irvington
Carlton Gebauer	Granite Springs
Jonathan Gold	Ossining
Penny Kelly	Wappingers Falls
Warren Lindholm	Cortlandt Manor
Barbara Matthews-Hancock	Greenwich
Mayan Moudgill	Chappaqua
Bob Quigley	Eastchester
Robert Rehrey	Yonkers
Anthony Sarro	Scarsdale
Robin Stuart	Valhalla
Michael H Tarlowe	New Rochelle

ALMANAC For February 2020

Bob Kelly, WAA VP for Field Events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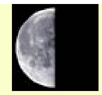
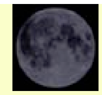
Feb 1


Full
Feb 9


3Q
Feb 15


New
Feb 23

The premier event for us is the Moon hiding Mars on the 11th. My question is whether we will be able to use the Moon, a thin crescent, to find Mars in the morning sunshine, as this event happens after sunrise for the eastern United States. Find Mars a few days in advance, so you'll know if you have an open horizon low in the southeast for this event. More on this later in the newsletter.

Mercury strays into the evening sky in one of its best appearances of the year. Brilliant Venus, at magnitude -4.1, sets an example, soaring higher, enticing magnitude -1 Mercury to show itself after sunset at the beginning of the month. Mercury will only go 18 degrees out from the Sun, as compared to Venus' 43 degrees. About 45 minutes after sunset, look toward the lower right of Venus, towards where the Sun had set, to spot the speedy messenger of the gods.

Mercury reaches greatest elongation from the Sun on the 11th. By then, at magnitude -0.3, it's already only half as bright as in early February. Starting on the 22nd, Mercury is only visible in the Solar and Heliospheric Observatory's C3 camera, shuttling well north of the Sun on its way to its next delivery in the morning sky in March. Venus is starting to look less round and more gibbous, 63%-lit by month's end. Mercury's phase decreases faster, half-lit by the 10th. Both Venus and Mercury appear larger than Mars; Venus about Saturn's size.

If you missed the Venus/Neptune conjunction in January, get a good star chart try for Neptune near 4th magnitude Phi in Aquarius on the 10th, between Venus and Mercury. Uranus is up in the star-poor area between Aries, Pisces and Cetus all evening, starved for attention.

How's Comet PANSTARRS C/2017 T2 doing? It's going to hang just above Cassiopeia this month. It's up all night, but highest after sunset. Try for it with binoculars and a dark sky as it brightens until May.

In the meantime, the morning sky is hopping with Jupiter and Saturn straining to join Mars just before sunrise. They are strung out low in the southeast, as if groggy from being awakened so early in the morning. Mars is 55 degrees out from the Sun, with Jupiter and Saturn trailing at 36 and 26 degrees elongation, respectively. Look for magnitude -1.9 Jupiter with Mars right ahead at magnitude +1.3 and Saturn left behind at magnitude +0.6.

Mars should be more colorful than the giants that trail it, but I haven't been impressed that it looks really red yet. Mars will gain about a half magnitude per month until October, when it will be brilliant . Barring dust storms, the red planet should live up to its colorful reputation as it gets brighter.

If you have a clear southeastern horizon, follow the waning Moon as it checks off visiting Jupiter and Saturn on the 19th and 20th. The Moon reaches perigee on the 10th, just 30 hours after Full Moon. Perigee near a New or Full Moon date makes for higher than normal tides for a few days following the dates of Full Moon. The Full Moons for the next three months will be even closer than February's.

February 29th marks Leap Year Day, an extra day to keep the calendar aligned with celestial milestones during our annual trips around the Sun. The last year that was evenly divisible by four but was without a Leap Year Day was 1900. Years divisible by 100 aren't leap years, unless they are divisible by 400, like 2000 was. These exceptions built into the Gregorian Calendar rules keep us even more precisely in sync with the stars. ■

WAA Members: Contribute to the Newsletter!
Send articles, photos, or observations to
waa-newsletter@westchesterastronomers.org

Editor: Larry Faltz
Assistant Editor: Scott Levine
Editor Emeritus: Tom Boustead

A Daylight Occultation of Mars by the Moon **Bob Kelly**

Just after sunrise on Tuesday, February 18, the thin Moon will slide in front of reddish planet Mars. This will be a hide-and-seek event in more ways than one. The Moon will hide Mars, but both will be hard to find in daylight. Mars at magnitude +1.2 is nearly impossible to find by itself in daylight. While the Moon is usually findable during the day, it's only 24% sunlit, and so will not be very bright.

The best way to watch this event is to find the Moon and Mars before the 6:46 AM sunrise. At 6:00 AM EST, Mars and the Moon will be 0.8 degrees apart – just a bit more than the width of the Moon. They will be 19 degrees above the south-southeastern horizon, two fists high at arm's length.

Bring breakfast and follow the Moon or Mars with a telescope as the sky brightens. Mars will start to slip behind the Moon about 7:35 AM with the Sun eight degrees above the horizon, 64 degrees east of Team Mars & Moon.

Just before 9:04 AM, look for Mars peeking out from behind the dark limb of the Moon. Keep a lookout near the two o'clock position on the lunar disc (with 12 o'clock being north). Unlike most occultations of stars, Mars will take a noticeable, but short, amount of time to get all the way out from behind the Moon. Since the reappearance will be on the Moon's harder-to-see dark limb, it will be dramatic to see Mars "rising" over the dark (or Earth-lit) edge of the Moon. At this point, the Sun and Moon will both be 22 degrees above the horizon, 63 degrees apart.

To prepare for this event, look out for the (wider and brighter) Moon on a clear day before Tuesday. See how long you can track the Moon into daylight.

I'm hoping this day's observations will result in my first time seeing Mars in daytime. Haze, high clouds or fog will make picking out the Moon and Mars much harder. If I don't catch Mars on the 18th, I'll have to try nearer to opposition later this year, when Mars will top out at magnitude -2.6. ■

The occultation of July 17, 2003. Mars will be three times further away on February 18th than it was when this image was obtained. Andrew Chaikin/Sjy & Telescope.

Save the Date! NEAF 2020

Saturday, April 4th and Sunday April 5th
Rockland Community College, Suffern, NY
Sponsored by Rockland Astronomy Club

WAA will have a booth again this year. Please help staff it. Emails will be sent in February.

Some of the WAA crew at NEAF 2018

New Location for WAA Meetings and Lectures at Pace University

Beginning with the February meeting (Friday, February 7th at 7:30 pm), we are relocating to a lecture room in Wilcox Hall at Pace. Wilcox is much more convenient for attendees and guests. It is located just inside the main entrance to the campus. There is ample parking.

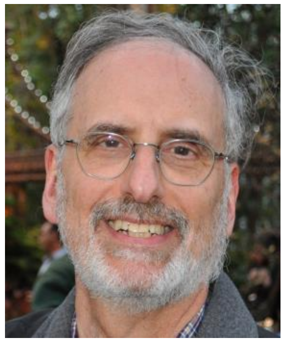
Go straight at the main entrance to the Pace campus off of Route 117 and park in the lot on your right. Wilcox is the large building in front of you to the right of the traffic circle. The lecture room is on the first floor, left of the entrance and down a short set of steps.

The lecture room is a more traditional academic lecture hall in terms of seating. It has complete audiovisual equipment for our presentations.

Westchester Amateur Astronomers is indebted to Pace University and Prof. Matt Ganis, who sponsors our use of the facility.

Our meetings and lectures are free and open to the public. As always, we encourage attendees to come at 7:00 pm to meet and greet club members and guests.

Member Profile: Art Linker



Hometown: Raised in Queens; have lived in Scarsdale for the last 35 years.

Family: Wife, Diane; children, Beth, Jenny, Michael, Annie; grandchildren, Jack, Abby, Lilah, Gabe, Ari.

How did you get interested in astronomy? As a 12-year old Boy Scout at the Ten Mile River boy scout summer camp in the Catskill Mountains, I canoed on a lake at night under a clear, black, moonless sky. As a kid who grew up in the city, I had never seen anything like it. That first impression has lasted my entire life.

Do you recall the first time you looked through a telescope? What did you see? As a teenager, an older cousin gave me a department store type (really, lesser quality than that) 3” Newtonian; all I really could see through it from my backyard in Queens was the Moon.

What’s your favorite object(s) to view? Galaxies, globular clusters, nebulae.

What kind of equipment do you have? Celestron Edge HD 8” SCT on Nexstar Evolution mount. Orion 10” Intelliscope Dob. Parks Optical 6” f/8 Newtonian (my first adult telescope, purchased in 1992) on home-made Dobsonian mount (one of my first woodworking projects, made from plans on the Stellafane website) with encoders and Nexus II DSC. Celestron Omni XLT 102ed f/9 refractor on Vixen Super Polaris mount (on which the 6” Newtonian originally was mounted). Stellarvue Nighthawk 80 mm f/6 refractor on Unistar light alt-az mount. Newest rig is a Stellarvue 80mm APO refractor on a Paramount MyT equatorial mount. I am just getting into astrophotography, using a DSLR.

What kind of equipment would you like to get that you don’t have? Eventually, a cooled CMOS or CCD camera, either OSC or mono with filters after I have had experience with the DSLR. Someday, perhaps, a 14” or 15” dob with Servocat tracking and DSC.

Have you taken any trips or vacations dedicated to astronomy? Tell us about them. In August 2017, we went to Glendo, Wyoming to view the solar eclipse. We then went to Flagstaff, where we visited the Lowell Observatory.

Are there areas of current astronomical research that particularly interest you? Gravitational wave observations, coupled with visual, gamma ray and x-ray observations of the same events

Do you have any favorite personal astronomical experiences you’d like to relate? In June 2018, I went to the Cherry Springs Star Party. I had never previously been to Cherry Springs State Park. It was phenomenal. I had never seen the Milky Way in its real, full splendor before then. I took my first Milky Way photo there (using just a DSLR on a tripod); it wasn’t very good, but it was mine. In September 2019, I went to the Almost Heaven Star Party, at Spruce Knob Mountain in West Virginia. It was almost as good as Cherry Springs.

What do you do (or did you do, if retired) in “real life”? In 2016, I retired after practicing law for 42 years at a large law firm in Manhattan, where I was a litigation partner specializing in financial litigation of all types (securities fraud, shareholder class actions, accounting malpractice, corporate investigations, real estate finance disputes, trusts and estates). I also handled lawsuits involving complex contractual and engineering issues relating to allegedly defective industrial machinery, because I was just about the only person there who had any technical background (a graduate degree in physics before going to law school).

Have you read any books about astronomy that you’d like to recommend? The books that got me started and that I return to often: *Turn Left at Orion*

(Guy Consolmagno) and *Nightwatch* (Terence Dickinson). The book that I have taken to every star observing event in the past few years and that is my constant "go-to" guide: *Objects in the Heavens, The Complete Mag-10 Northern Deep-Sky Viewing List and Fieldbook. The Year-Round Messier Marathon Field Guide* (Harvard Pennington). *Messier's Nebulae & Star Clusters* (Kenneth Glyn Jones). *The Norton History of Astronomy and Cosmology* (John North). Also, for beginners, *Astronomy Hacks* (Robert Bruce Johnson) is a great resource that helped me get started.

How did you get involved in WAA? I saw mentioned somewhere the WAA Friday night programs then at the Planetarium at the Hudson River Museum. I went to a few of them, where I heard about Ward Pound Ridge. I began going to the monthly Ward Pound Ridge star parties with my 6" Newtonian on the Super Polaris GEM (manual, no go-to and no tracking). I had some books about "star hopping," which probably pre-dated the increasingly awful light pollution, but I found them useless and had great difficulty locating anything in the sky. Club members (and especially former WAA President, the late Bob Davidson) were extremely helpful in giving advice about telescope setup and finding targets. I subsequently bought a used Orion Intelliscope Dob, with which I could find what I was looking for about 50% of the time. The truth is that I was only able to find desired targets with regularity on any given night when about 3-1/2 years ago I bought a Nexstar Evolution mount and used a Starsense auto-alignment camera. I control it from an iPad using Sky Safari.

What WAA activities do you participate in? I routinely attend the monthly meetings, and often attend the Saturday night star parties. I also sometimes observe at Ward Pound Ridge (with other WAA members) during clear night weekdays using the club's privileges there. I attend the annual picnic. I bring my scope (usually the Edge HD) to many of the WAA outreach events, and like to engage in discussions about amateur astronomy with people who come to look through the scopes.

If you have a position in WAA, what is it, what are your responsibilities and what do you want the club to accomplish? I have no position at WAA. I would like to see the club have more organized programs about observing techniques and astrophotography.

Provide any other information you think would be interesting to your fellow club members, and don't be bashful! I also am an active member of the Rockland Astronomy Club. I attend their annual dinner and lectures, and perform heavy-duty volunteering at NEAF every year. I also have participated in several of the RAC yearly 10-day Summer Star Parties in the mountains of northern Massachusetts and hope to continue doing so.

I am a member of the Adirondack Mountain Club, and enjoy hiking in parks in Westchester, Rockland and Putnam counties. I am also an amateur woodworker and woodturner and belong to the Northern Jersey Woodworking Association and the Hudson Valley Woodturners. I have a rather complete woodworking shop in a very small room in my basement.

Parks Optical 6" f/8 Newtonian on home-made mount with encoders and Nexus II DSC

I have always been interested in computers, starting with computer programming classes as an undergraduate at Columbia, programming a minicomputer in a Columbia physics lab, then buying a Radio Shack TRS 80 Model One and programming it in both Basic and assembly language at the beginning of the personal computer era. I have been dabbling with Linux programming at a beginner's level for many years and am currently working on adding a Raspberry Pi Model 4 to my telescope rig (using the Linux version of the SkyX and other Linux software to control the mount and the camera).

As a college undergraduate, I was the Chief Engineer of the Columbia University FM radio station, WKCR, and I have had a lasting interest in electronics and radio. I have a continuing interest in physics, and now (in my retirement) have resumed studying on my own classical and quantum mechanics, electrodynamics, and general relativity. ■.

Dew and How to Control It — Larry Faltz

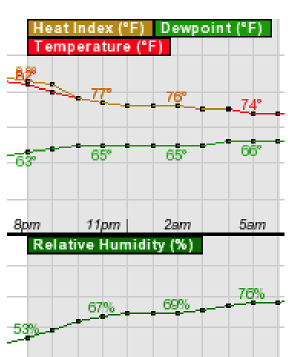
At the Medomak Astronomy Retreat and Seminar (MARS) in Maine this past July, Elyse was happily viewing through our Stellarvue Nighthawk 80 mm f/6 refractor. An 18 mm 60° FOV Meade Plossl eyepiece gave a nice 2.25 degree actual field of view. Open clusters and star fields in the Milky Way were spectacular in the dark Maine sky (the SQM rating was an outstanding 21.63), and she emitted a succession of “oohs” and “aahs” and “come look at this!” After a couple of hours, she called to me rather plaintively, “I think the seeing has deteriorated.” I didn’t notice that in my CPC800, and a glance at the Stellarvue’s objective revealed the obvious problem: the lens’s surface was covered with dew, in spite of the scope’s deep dew shield.

Unless you are viewing in the desert or on a mountaintop out west in low humidity, dew is a constant observing risk. It’s almost inevitable in the humid northeast where we live. Waiting until after the dew forms is the worst way to deal with it. It’s easy to prevent dew from forming in the first place with a little technology. “An ounce of prevention….”

Dew forms when the ambient temperature drops below the point at which the air is saturated with water vapor, known as the *dew point*. It can be estimated from the equation

$$T_d = T - \frac{100 - RH}{5}$$

where T_d is the dew point, T is the air temperature (both in degrees Celsius) and RH is the relative humidity. This gives a reasonable approximation; there are more detailed formulas that model the somewhat complicated relationship between temperature and vapor pressure. As the night progresses, the air cools from lack of sunlight energy. At any level of absolute humidity, cooler air has less capacity to carry water vapor, so the relative humidity increases. Once the temperature on a surface drops below the dew point (100% saturation of the air’s water vapor carrying capacity) water in the atmosphere becomes dew.



A typical summer evening in Westchester (adapated from weather.gov)

Dew can form even when the temperature in the air is still above the dew point because the temperature of a particular surface can drop below the dew point. How is that possible?

The Second Law of Thermodynamics tells us that heat always flows from a warmer to a cooler body. Heat transfer occurs by three mechanisms: conduction, convection, and radiation. In conduction, the energy is transferred by direct contact. Consider boiling water for tea. When you heat the bottom of a kettle, the heat is transferred from the hot metal bottom to the water above it by conduction. In convection, the movement of matter redistributes the heat. Water comes to a boil as the hot water from the bottom of the kettle rises and mixes by convection with colder water above. The warm kettle radiates electromagnetic waves in the infrared that you can detect if you put your hand near it, not touching it. If you stupidly touch it, the burn you get is from conduction.

The refractive index of air varies with temperature. Convection of the air inside the telescope disrupts the wave front like so many tiny lenses. It takes some time for the air inside and the tube to equilibrate. But the telescope tube and its optics can cool below ambient temperature by radiation. The equipment is exposed to the entire universe, not just the surrounding air, and the universe is a very cold place. The telescope “sees” the cold universe and transfers heat to it via radiation, courtesy of the Second Law. When the scope cools below the air temperature, the warmer air will provide heat to the cooler scope by conduction, balancing heat loss by radiation. The scope will be brought into a new equilibrium, albeit at a temperature lower than the surrounding air (but at least the scope doesn’t cool all the way down to the temperature of deep space!). If the equilibrium temperature is below the dew point, dew will form. The reason is our roads don’t dew up at night that the Earth absorbs solar radiation during the day and the loss of surface heat through radiation is compensated by the conduction of heat from below. Much less heat is transferred from the ground to the blades of grass in your lawn, so they can dew up. Unless you provide a source of heat, your scope is going cool below ambient temperature at night.

Radiative heat transfer occurs by the emission of infrared radiation, described by this equation:

$$q = \varepsilon \sigma (T_h^4 - T_c^4) A_h$$

where q = the rate of heat transfer (W), ε = emissivity (1 for a black body, 0 for perfect insulator, everything in the real world somewhere in between), σ = 5.6703 x 10^{-8} (the Stefan-Boltzmann constant, in units of $Wm^{-2}K^4$), T_h = warm body absolute temperature (K), T_c = cool surroundings absolute temperature (K) and A_h = area of the hot object (in square meters).

A black body is a perfect transmitter or absorber of heat energy. Glass is fairly close to a black body, with an emissivity between 0.85 and 0.95, differing with the exact type of glass. Telescope tubes, depending on their composition, have lower emissivity. It's not surprising, then, that the glass will radiate its heat and cool below the dew point before the tube. That's especially true for thin SCT corrector plates.

The best way to remove dew on a lens or corrector planet is to evaporate it. The amount of heat needed is substantial, and the best way to deliver it is with a hair dryer. If you are observing in a location that has 110 volt power, you can use a regular hair dryer, but if you are in the field, you will need one of those smaller 12-volt units. As small as they are, they consume a lot of power, some as much as 18 amps, and you will need to power them from your car battery (run the engine!) If you use a portable power supply, the dryer either won't run or it will drain and possibly damage the battery. Once you heat up the optics and remove the dew, the glass will cool and dew will re-form, but you might get 5 minutes of dew-free viewing between air blasts. It's not a good idea to wipe the lens or corrector plate with a towel or microfiber cloth, no matter how soft they might be. Grit on the surface can scratch the glass.

A dew shield is mandatory for SCT's. The large corrector place "sees" a lot of the sky and loses heat rapidly. The dew shield reduces the amount of sky that the plate is exposed to, so the rate of dewing is lessened, but it's almost inevitable that an SCT corrector plate will dew unless the humidity, and thus the dew point, is unseasonably low. Refractors are usually made with a reasonable dew shield, but if it is retractable, make sure to extend it. For reflectors, dewing of the secondary is more of a problem than the primary. You can make a dew shield that extends beyond the front of the telescope by at least one tube diameter, although this can sometimes be hard to mount on certain telescopes.

The best way to prevent dew is to keep the optics just above the dew point by warming the tube and, by conduction, the optics. If you have those chemical heater packs that skiers use, you can slap one into activity and tie it to the top of the telescope tube. Sloppy, but it works. It's much better to use a dew heater strip. These are bands containing resistance elements that heat up when power is applied. They are designed to get warm but not hot, transferring heat to the telescope tube, which in turn transfers it to the optics. For refractors and SCT's, the dew heater strip should be placed just behind the front optic. For reflectors, the secondary might need to be heated with a very small heater strip on its reverse side, with wiring attached to the secondary struts. Primary mirrors in reflectors generally don't get heated, but laminar air flow across their surfaces using small vibration-free fans can reduce the likelihood of dewing.

You can make your own heater strip using either nichrome wire or resistors in series and some duct tape to hold it together, but the look can be rather ugly. There are a number of YouTube videos demonstrating how to make these devices. Commercial heater strips, made by Dew-Not and Astrozap, are not terribly expensive, are good values (value=quality/cost) and look much better. They wrap around the tube and are held firmly in place with Velcro on an elastic band. They operate at 12 volts and consume about 39 milliamps per inch. A Dew-Not strip for an 8" SCT is 30 inches long and draws 1.18 amps when fully on (which it doesn't need to be, see below). It costs $45 and is very long-lasting. There are also dew heater strips for eyepieces, binoviewers, hand controls (to keep their LCD screens from failing in the cold) and camera lenses. The only peculiarity in the dew strip universe is that the power connectors are male RCA plugs, familiar to any stereo owner, rather than the more typical type M coaxial power connector. You can easily buy or make an adaptor if you need one.

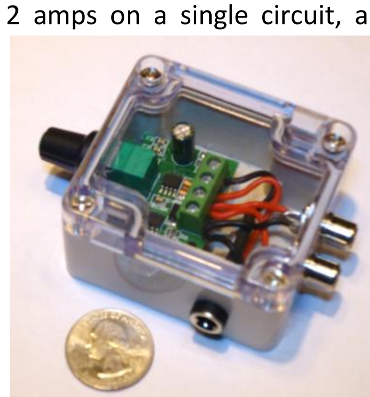
You don't need or want to operate the heater strips at full power. Too much heat will re-form thermals inside the tube. You just want the tube to be just above ambient temperature. A heater strip's heat output is attenuated by reducing the current flowing through it. Dew-Not, Kendrick, Thousand Oaks and others make solid-state dew controllers that offer individual control of multiple dew heater strips. They are $80 and up. I have a fancy Dew-Not controller from a decade ago (now out of production) that even has a temperature sensor that regulates the output current. It has 8 outputs, 2 of which are coupled to the sensor, but I can't think of eight devices that I'd want to protect. If I fully trick out my scope, I could put five heaters on it: scope, eyepiece, RACI finder, Telrad, and hand control. I suppose I could make a pad for my observing chair to warm my butt and connect it to a sixth output. But for most purposes, like for Elyse's small refractor, only the scope needs to be warmed, and perhaps the finder.

You don't need to spend $100 to control your dew heaters. A simple potentiometer (adding resistance) in series with the dew heater strip will work, but that's not the best solution. It gets warm and it wastes power, draining your battery faster than you'd like. What you really want is to provide a constant voltage with lower current and minimal power drain. To achieve this, you can make a dew controller using a pulse-width modulation (PWM) motor controller or LED lamp controller, which are really the same thing (and what the commercial controllers use). They work by chopping up the current into rapid on-off cycles. The longer the "on" cycle is compared with the "off" cycle, the higher the power, up to the maximum current draw of the device. Dew heater strips have no problem getting their power in short bursts. These controllers are protected from over-current situations, which might be a problem with motors but shouldn't be with dew heaters since they have a known maximum current capacity, unlike motors that draw more current if they are loaded excessively. These devices are very inexpensive.

I ordered the "Onyehn Low Voltage DC Motor Speed Controller PWM 1803BK Adjustable Driver Switch 2 Pack" for $9.49 from Amazon (you can now get 3 for $10.28). These tiny units are just 32x32x15 mm and can handle a current of 2 amps, meaning that only the largest power strips overdrive them. They have a power-on light and overheating protection fuse that automatically reconnects when it cools. To house the controller, I wanted a very small plastic project box. I found "Uxcell ABS Junction Box Universal Electric Project Enclosure Clear" for $6.35 each. These are 63x58x35 mm and were the smallest ones that would fit the controller and still have room for connectors. I already had female RCA phono panel jacks and female type M panel jacks, but in any case these are very inexpensive. As usual for Amazon, the parts arrived in a day or two.

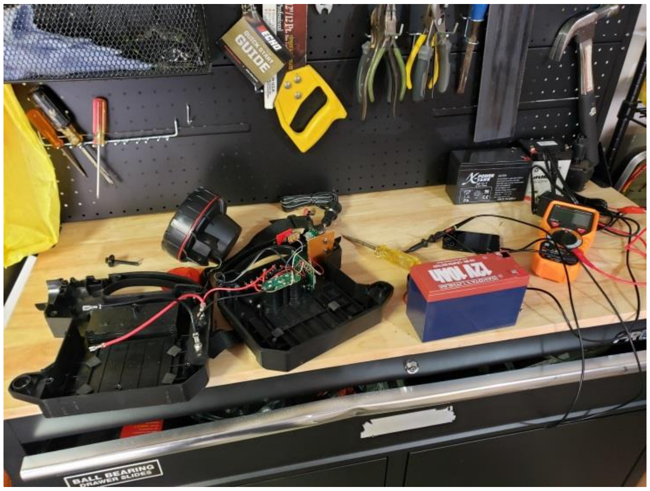
Construction involved first fitting the controller into the project box to determine exactly where to drill the hole for the potentiometer shaft. I cut off the front corners of the circuit board diagonally about 2 mm to fit the box's inner contour so the front of the board would be flush with the inside of the box. There are no circuit components in those corners of the board. The board is held in place by the nut under the knob. I drilled another hole for the input (12 volts through type M panel jack) and two more for the outputs, RCA phono jacks wired in parallel. I used short pieces of flexible 20 gauge wire to make the connections (the usual color coding: red=hot, black=ground). I soldered the connectors, but the circuit board uses screw terminals. To be extra safe, I put some shrink wrap tubing over the ground connector on the power jack so no wire or solder would be exposed. Electrical tape would also work.

So, for about $11 I now have a proper dew heater controller in a neat little housing that I can attach to Elyse's scope. If you want to make a more flexible multi-channel controller, use separate PWM controllers for each circuit and mount everything in a larger project box. You can wire a 12-volt LED across the outputs as a signal lamp for each circuit. It's still vastly cheaper than commercial products. For people who need more than 2 amps on a single circuit, a small 30-amp PWM controller can be had for less than $15. Obviously, you will need sufficient battery power to supply the dew heaters. I use a separate 17 ampere-hour power tank rather than the same power supply that runs my mount. ■



Upgrading an Old Celestron Powertank **Mike Lomsky**

Replacing the battery in your old power supply is a great deal for a small investment of time



The old PowerTank opened, with the replacement battery on the right.

When I first got a Celestron AV-X mount I also bought a 7-Ampere-hour (Ah) Celestron PowerTank, a power supply that many club members will recognize. It served me well but as the years went by it began to run out of power before the night was over. Typical of lead-acid batteries, it didn't like to run down below 50% charge, and repeated charging cycles reduced its capacity over time. It began to lose voltage too quickly to support an evening's viewing. At that point, I bought Celestron's new lithium PowerTank. It's small and hangs on the AV-X or on my 14" Dobsonian without causing any problems. That power supply is doing well, but it doesn't have enough capacity to run everything I need for a night's observing: the scope, the fans that cool the mirror and some new lights I put on. I thought I would have to buy a new power supply. But the rest of the original PowerTank was perfectly good, so instead of buying a new power supply, I decided to replace its battery. I swapped the lead acid battery for a more powerful lithium iron phosphate battery that is the same size. It was not hard to replace the battery and it was less expensive than buying a new Powertank. I believe this is something that anyone can easily do, and I would be happy to help anyone in the club do it.

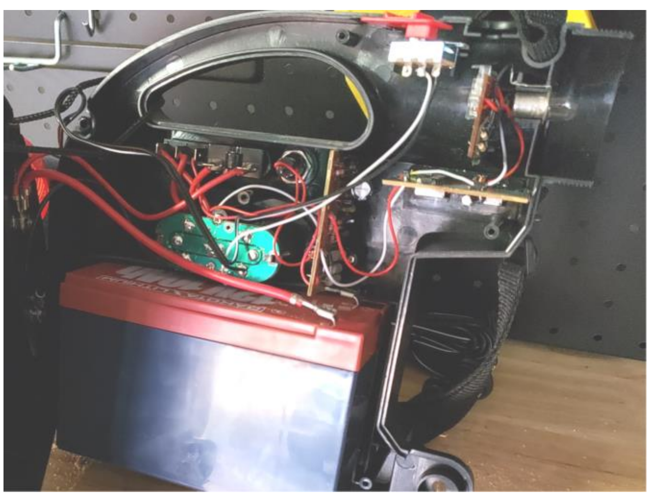
Although there are many US and foreign companies that sell lithium batteries, I did some research and I selected US-based Dakota Lithium. They offer a 12-volt/7-Ah battery and a 12-volt/10-Ah battery that have the same dimensions as the standard 12-volt/7-Ah lead acid battery that the old PowerTank uses. Their 7-Ah battery costs $69, and the 10-Ah battery costs $99. You need to buy a battery charger that is designed for lithium iron phosphate batteries, which they also sell. Chargers for lead-acid batteries are not compatible. Lithium iron phosphate is the exact same battery chemistry used by Celestron lithium batteries. Chargers for lead-acid batteries are not compatible with lithium batteries. The charger I got from Dakota Lithium has alligator clips, which I had to replace with the familiar type M coaxial power connector (5.5 x 2.1 mm). I had bought a 10-pack of male and female connectors with screw terminals for my lighting projects on my telescope, and I had one left over. The male form of the connector is what you need.

The charger with its alligator clips and the replacement male connector ready to installation.

The whole process was neither difficult nor very time consuming. All I had to do was to disassemble the Celestron PowerTank's case, which is held together with 10 screws. I then took out the old lead acid battery, and put the new lithium battery in its place. The last step was to cut off the alligator clips from the new battery charger strip a bit of insulator from the wires, and then attach them to a standard 12 volt DC adapter, being careful to maintain proper polarity. Add a little electrical tape, and you're all set.

If you look at the guts of the PowerTank, you will see a lot of wires and circuits. There are two important things to be aware of. The charging smarts are in the actual charger itself, both for charger that came with the PowerTank and for the new one I purchased with my lithium battery. The battery indicator LEDs on the PowerTank are also not going to work without adjustments. For me, I don't need to use them. Putting a standard volt meter to the 12-volt power output port will tell me the status of the battery. You could take the LED battery indicator circuit board out, and modify the circuit to show the correct light for the correct voltage. You would have to do some math, and swap out a few resistors based on that math.

There are standard voltage/capacity charts for different battery chemistries that you can use to calibrate the LEDs. That's a bit more effort, and I don't see the need for that. Another option would be to spend $10 to $15 on Amazon for a battery gauge tuned for Lithium Iron Phosphate batteries. To use that, you would need to drill one hole into the side of the case through which you would thread two wires for the battery gauge to connect to test the voltage. Those two wires would be attached to the battery or the leads coming from the battery to the case. Then mount the gauge on the side of the PowerTank, using two pieces of Velcro, or even just some superglue. It would be a bit kludgy, but it would absolutely work just fine.



The new battery inside the PowerTank

Now I prefer this option because it's all a bit safer to use. The fuse will still work. The 5 volt USB chargers will still work; I tested the voltage there. I also tested the voltage at the 12-volt DC output, and that too shows the correct voltage; about 13.5 volts at full capacity. The power on/off/charge switch is also nice to use.

If you don't have one of these, or just don't want to reuse a PowerTank, then you can still make your own DIY lithium battery. You could use simple alligator clips to link to the connector your equipment needs, although coaxial power connectors are safer. You can find clips that are covered with insulation for safety. I would highly recommend that you connect a standard automobile 12-volt DC fuse between your battery and your telescope connector to protect. The fuse and fuse holder can be found on Amazon for a few dollars. I saw a five-pack of fuses and fuse holders with 12-gauge wire for $9. I would put one on both the positive and the negative leads. You would want to come up with some ways to prevent accidental touching of the battery terminals, as that can be lethal.

A third option would be to build a basic battery case for your new battery. This is a simple project that again I would be happy to assist anyone with. For about $10, you can buy a battery case intended for a motorcycle. Alternatively, you can spend a few dollars more to get a larger case that is intended for car batteries if you have a bigger battery in mind. On this case, you can mount that battery gauge that I mentioned earlier. Of course you can cut a proper mounting hole in the nylon battery case, or just glue it to the side with a hole to send the wires to the battery. You can then mount any kind of power port your telescope needs onto this battery box, and connect that to the battery in the box.

All the ports on the PowerTank can be found on Amazon, or an electronics supply site like Jameco.com for $0.50 to $10. I would add the safety fuse for the equipment that I described above. In short, a simple, but very useful battery case can be made for about $35. This gets you close to the cost of what Celestron is selling you, but this would be customized to your needs. Also, for folks who wanted a larger battery capacity, the $35 of additional parts is basically fixed cost even as you use larger batteries. [Editor’s note: If you also need lower voltages for other devices, buck step-down power supplies are very inexpensive and small. Some come with digital readouts as well. Just verify the polarity and use the right connectors.]

Regardless of what you do, you don't want loose wires floating around. There is a lot of power in these batteries, and that needs to be respected. You don't want bare metal in a place you might accidentally touch it, and you don't want loose wires or connectors, as any of that can lead to a terrible shock or even a fire. Don't be fooled just because it's only 12 volts.

A new Celestron PowerTank with a 7-Ah lead-acid battery lists for $70 on their website. The lithium PowerTank lists for $149. There is a 15% off sale on their website as of this writing (January). Celestron also makes a larger 17-Ah power supply, which will cost you $132 for the lead-acid version or $179 for the lithium version.

For a total cost of about $120 and about 30 minutes of my time, I got a rejuvenated and more energetic Celestron PowerTank. Lithium batteries are preferable to lead-acid ones. They can be recharged more times and have a better discharge curve. The voltage does not drop off as quickly so devices run better for longer periods. They are also a bit lighter.

If you do a one-to-one comparison, the 7 Ah lithium upgrade would cost about $80, versus a new Celestron for $134, effectively a $50 savings over the sale price. My option only saves $15, but you get an extra 3- Ah of power which equates to about 40% more energy stored. This puts us in the middle of the two Celestron lithium options.

This really was an easy upgrade, and I have spent more time writing this article and doing the work. I am convinced that other devices can be upgraded in this way, and I would be happy to help anyone in the club do the same.

It looks just like the original!

Some Other Choices for Power on the Observing Field

While you're observing, you are continually drawing current. Most of us have had the experience of a long observing session that ended when the drive died. Do that a few times and a lead-acid battery will stop being reliable. As Mike Lomsky mentions, lithium batteries can be drawn down much further while still giving decent voltage and avoiding damage. There are some other options, however.

What if you want more than 10-Ah? You may have a laptop that won't last long enough on its internal batteries, for example, or perhaps you use enough dew heaters to challenge the 7- and 17-Ah PowerTanks. If you can calculate that you might need, say, 15 Ampere-hours of current, you should get a battery that has at least twice that capacity. My solution was a 35-Ah sealed lead-acid deep-cycle battery, which I got from Northeast Batteries on Saw Mill River Road in Hawthorne. This is a "deep cycle" battery, which means it can be discharged more than an automobile ("cranking") battery without damage. It is "U1" size, often used in wheelchairs and scooters, smaller and much lighter than a typical car battery, but still 27 pounds. I put binding posts on the terminals so I can just plug in a connector cord. Between uses I keep it "trickle charging" with a Noco "Genius" smart charger. These batteries run in the $50-$100 range. A lithium battery with the same capacity will cost well over $400, but it weighs only 11 pounds.

I also have a small 9-Ah Starizona Power Pack II+ lithium polymer power supply that works well with my CPC800 when I don't need dew control. Sometimes I use it to power a video screen when I'm using the Mallincam.

While it's convenient to have the features of the PowerTank (two 12-volt car-plug outputs, lower voltage outputs for other equipment, a light), you can easily make inexpensive DC/DC converters, power cable splitters and even voltage and current meters to plug into a battery that just sits, perfectly happily, in the open under your scope. Making your own cables and power supplies with inexpensive screw-terminal power plugs and jacks is easy and you don't need a soldering iron. Just watch the polarity!

Larry Faltz

Images

Karen Seiter was in the passenger seat returning from LaGuardia Airport and snapped this cell phone picture of the Moon and Venus in conjunction on November 28th. Not super terrible traffic considering it was the Grand Central Parkway.

Carl Gebauer just sent in this superb lunar image which he captured on March 26, 2018 from his backyard in Granite Springs. Celestron Nexstar SLT 102 and Lumix G7 SLR.

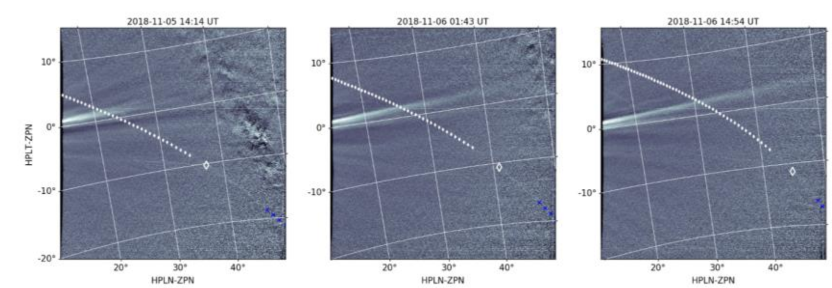
Research Highlight

Parker Solar Probe Observations of a Dust Trail in the Orbit of (3200) Phaethon

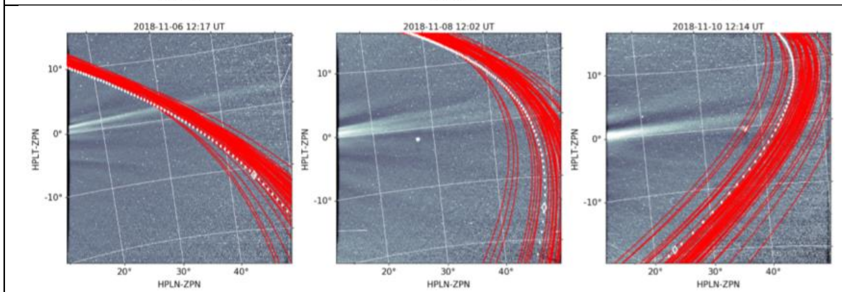
Karl Battams, Matthew M. Knight, Michael S.P. Kelley, Brendan M. Gallagher, Russell A. Howard, and Guillermo Stenborg, US Naval Research Laboratory and University of Maryland. https://arxiv.org/pdf/1912.08838.pdf. Posted December 20, 2019.

The Geminid meteor shower each December has been identified with the asteroid (3200) Phaethon, the named asteroid with the closest known perihelion (0.13998 AU). The Geminids are the only shower not associated with a comet. How does Phaethon provide matter for the meteor shower?

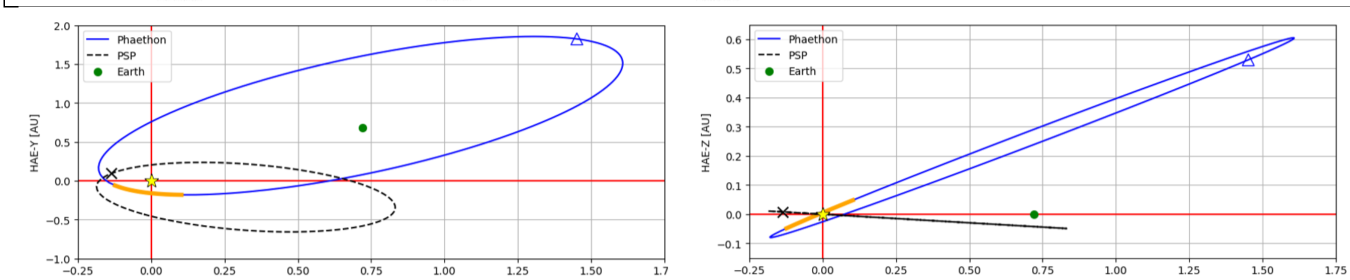
The Parker Solar Probe, was launched in 2018 to study the Sun and the solar corona. It will make 34 close perihelion passes over 7 years. The final one will be less than 10 solar radii (0.046 AU) from the Sun's surface. PSP carries the Wide-field Imager for Parker Solar Probe (WISPR), a 28-mm focal length camera with an aperture of just 42 square millimeters. Among its initial observations was detection of a dust trail along the orbit of Phaethon near the asteroid's perihelion point (the actual position of Phaethon was close to aphelion at that time). The authors estimated the total mass of the dust stream to be between 0.4 and 1.3×10^{12} kg, consistent with though below the assumed mass of the Geminid stream, but greater than could be produced by activity of Phaethon at perihelion. Subsequent orbits of the Parker Solar Probe will permit further study of (3200) Phaethon.



PSP images of the orbit of Phaethon. Marks show its position at 60-minute intervals pre (white) and post (blue) perihelion. The symbols are excluded in the region where the trail is most easily visible as a thin white line (enlarge the page for clarity). The white diamond indicates the perihelion position of the orbit.



Visualization of the orbits of 51 Geminids (red) observed December 13–15, 2011 by the Canary Island Long-Baseline Observatory. Superimposed is the orbital path of Phaethon (white dashes) and its perihelion point (white diamond).



Schematic of the orbit of Phaethon (blue) and PSP (dashed black) as seen from above the solar system (L) and from the side (R) on November 6, 2018 at 1:43UT, corresponding to the top row of images, above. The blue triangle indicates the actual location of Phaethon at the time of the PSP observations, the green circle the location of Earth, the yellow star the Sun's location and the black X the location of PSP. The thick orange arc along the Phaethon orbit indicates the portion of the orbit crossing the WISPR field of view during the observations.

Member & Club Equipment for Sale

Item	Description	Asking price	Name/Email
Celestron 8" SCT on Advanced VX mount	Purchased in 2016. Equatorial mount, portable power supply, polar scope, AC adapter, manual, new condition.	$1200	Santian Vataj spvataj@hotmail.com
Celestron CPC800 8" SCT (alt-az mount)	Like-new condition, perfect optics. Starizona Hyperstar-ready secondary (allows interchangeable conversion to 8" f/2 astrograph if you get a Hyperstar and wedge). Additional accessories: see August 2018 newsletter for details. Donated to WAA.	$1000	WAA ads@westchesterastronomers.org
Explore Scientific Twilight I Mount	Manual Alt/Az, capacity 18 lb. Steel tripod. Excellent condition. Used fewer than 10 times. Great for grab-and-go viewing. Owner upgrading to an EQ mount.	$100	Eugene Lewis genelew1@gmail.com
Celestron StarSense autoalign	Brand-new condition in original packaging. Accurate auto-alignment. Works with all recent Celestron telescopes (fork mount or GEM). See info on Celestron web site. Complete with hand control, cable, both mount brackets. Printed documentation. List $359. Donated to WAA.	$175	WAA ads@westchesterastronomers.org
Meade LX-70 Equatorial Mount	Dual Axis Drive and Polar Scope - Brand New. Bought during the closeout sale of these mounts. Owner thought he might like to have a light GEM, but decided to stick with alt-az mounts. Set up once in the garage to be sure it all works, and it does, but never saw first light in the field. Price paid: $365.	$240	Eugene Lewis genelew1@gmail.com
Celestron 6-inch f/5 reflector OTA	Same optical tube as the famous Orion 6" StarBlast. 1¼" rack-and-pinion focuser, Celestron 25 mm eyepiece, tube rings and dovetail plate. 5x30 straight through finder. Heavy-duty dark canvas carrying case with compartments and plenty of room for accessories. Excellent condition, unblemished optics. These scopes are hard to find without a mount. An Orion StarBlast 6 with 1¼" focuser and table-top Dobsonian mount lists for $379. Meade's 6" f/5 scope, admittedly with a 2" Crayford focuser but no case, lists for $339. Donated to WAA.	$175	WAA ads@westchesterastronomer.org

Want to list something for sale in the next issue of the WAA newsletter? Send the description and asking price to ads@westchesterastronomers.org. Member submissions only. Please submit only serious and useful astronomy equipment. WAA reserves the right not to list items we think are not of value to members.

Buying and selling items is at your own risk. WAA is not responsible for the satisfaction of the buyer or seller. Commercial listings are not accepted. Items must be the property of the member or WAA. WAA takes no responsibility for the condition or value of the item or accuracy of any description. We expect, but cannot guarantee, that descriptions are accurate. Items are subject to prior sale. WAA is not a party to any sale unless the equipment belongs to WAA (and will be so identified). Sales of WAA equipment are final. Caveat emptor!