CONSTELLATION *addendum . . .*

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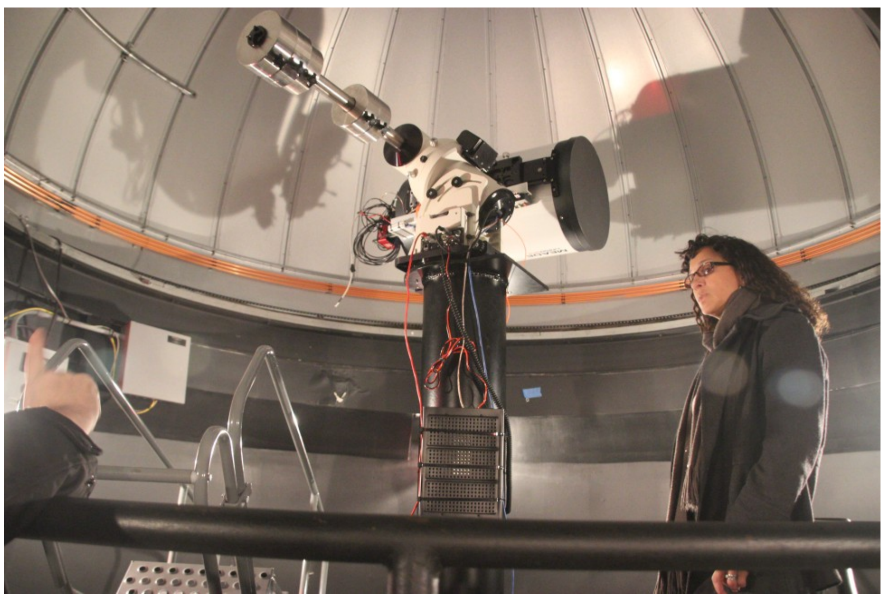
Report: Montgomery County Community College Observatory

- by Gary Sprague

Gary met with Kelli Spangler, Assistant Professor for Astronomy at Montgomery County Community College (MCCC) and her advisory committee on November 14, the same night as Astrofest was scheduled (but cancelled). The 16” Meade telescope in the MCCC observatory has been plagued with problems over the past few years, and has not been operational on a regular basis. Following a recommendation at the April meeting, the decision was made to replace the mount for the telescope, which was the main source of the problems.



Kelli Spangler in the MCCC observatory with the 16” Meade

The Meade mount has since been successfully replaced with an AstroPhysics 1600 mount and the mount and coordinated dome have been functioning well. Kelli and her students and consultant have been making good progress with their shake-down efforts. They now have a CCD camera in use with plans to add spectrographic capability. There has even been planning to join the exoplanet search.

It was nice to hear such good news from the MCCC astronomy program.

- Gary Sprague is BMAA co-president, and he provided this article with photo [-ed]

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Dimming Stars, Erupting Plasma, and Beautiful Nebulae

- by Marcus Woo

Boasting intricate patterns and translucent colors, planetary nebulae are among the most beautiful sights in the universe. How they got their shapes is complicated, but astronomers think they've solved part of the mystery—with giant blobs of plasma shooting through space at half a million miles per hour.

Planetary nebulae are shells of gas and dust blown off from a dying, giant star. Most nebulae aren't spherical, but can have multiple lobes extending from opposite sides—possibly generated by powerful jets erupting from the star.

Using the Hubble Space Telescope, astronomers discovered blobs of plasma that could form some of these lobes. "We're quite excited about this," says Raghvendra Sahai, an astronomer at NASA's Jet Propulsion Laboratory. "Nobody has really been able to come up with a good argument for why we have multipolar nebulae."

Sahai and his team discovered blobs launching from a red giant star 1,200 light years away, called V Hydrae. The plasma is 17,000 degrees Fahrenheit and spans 40 astronomical units—roughly the distance between the sun and Pluto. The blobs don't erupt continuously, but once every 8.5 years.

The launching pad of these blobs, the researchers propose, is a smaller, unseen star orbiting V Hydrae. The highly elliptical orbit brings the companion star through the outer layers of the red giant at closest approach. The companion's gravity pulls plasma from the red giant. The material settles into a disk as it spirals into the companion star, whose magnetic field channels the plasma out from its poles, hurling it into space. This happens once per orbit—every 8.5 years—at closest approach.

When the red giant exhausts its fuel, it will shrink and get very hot, producing ultraviolet radiation that will excite the shell of gas blown off from it in the past. This shell, with cavities carved in it by the cannon-balls that continue to be launched every 8.5 years, will thus become visible as a beautiful bipolar or multipolar planetary nebula.

The astronomers also discovered that the companion's disk appears to wobble, flinging the cannonballs in one direction during one orbit, and a slightly different one in the next. As a result, every other orbit, the flying blobs block starlight from the red giant, which explains why V Hydrae dims every 17 years. For decades, amateur astronomers have been monitoring this variability, making V Hydrae one of the most well-studied stars.

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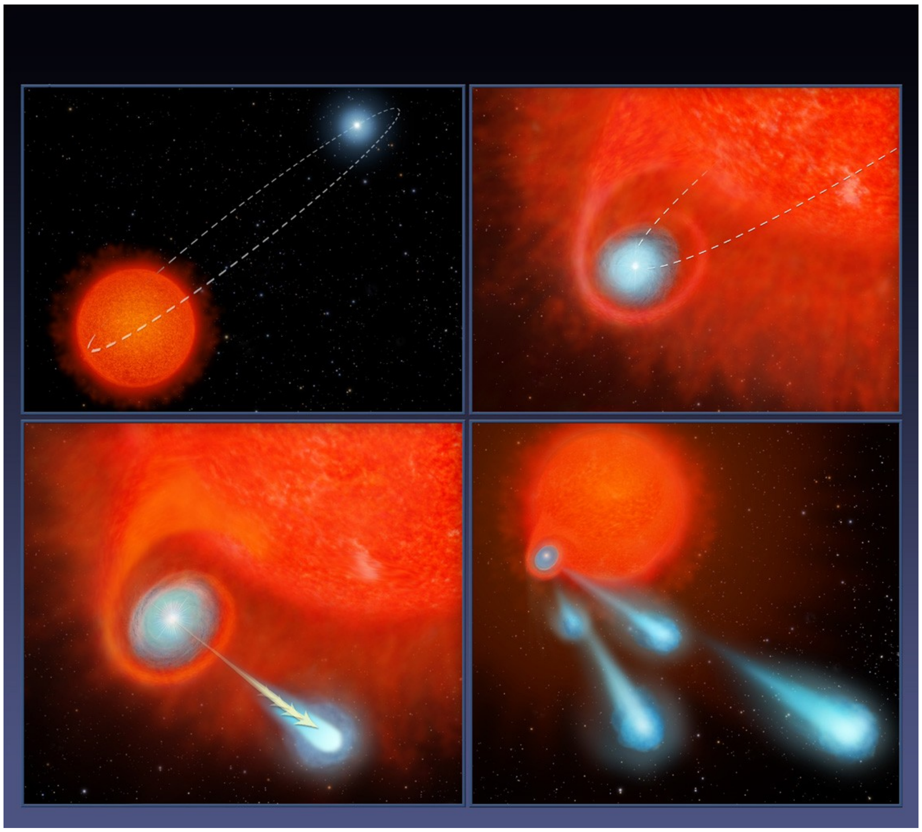
Because the star fires plasma in the same few directions repeatedly, the blobs would create multiple lobes in the nebula—and a pretty sight for future astronomers.

If you'd like to teach kids about how our sun compares to other stars, please visit the NASA Space Place: http://spaceplace.nasa.gov/sun-compare/en/



This four-panel graphic illustrates how the binary-star system V Hydrae is launching balls of plasma into space. Image credit: NASA/ESA/STScI

With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit **spaceplace.nasa.gov** to explore space and Earth science!

- Space Place is provided by NASA to local astronomy clubs [-ed]

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Space Place

December 2016

Big Science in Small Packages

- by Marcus Woo

About 250 miles overhead, a satellite the size of a loaf of bread flies in orbit. It's one of hundreds of so-called CubeSats—spacecraft that come in relatively inexpensive and compact packages—that have launched over the years. So far, most CubeSats have been commercial satellites, student projects, or technology demonstrations. But this one, dubbed MinXSS ("minks") is NASA's first CubeSat with a bona fide science mission.

Launched in December 2015, MinXSS has been observing the sun in X-rays with unprecedented detail. Its goal is to better understand the physics behind phenomena like solar flares – eruptions on the sun that produce dramatic bursts of energy and radiation.

Much of the newly-released radiation from solar flares is concentrated in X-rays, and, in particular, the lower energy range called soft X-rays. But other spacecraft don't have the capability to measure this part of the sun's spectrum at high resolution—which is where MinXSS, short for Miniature Solar X-ray Spectrometer, comes in.

Using MinXSS to monitor how the soft X-ray spectrum changes over time, scientists can track changes in the composition in the sun's corona, the hot outermost layer of the sun. While the sun's visible surface, the photosphere, is about 6000 Kelvin (10,000 degrees Fahrenheit), areas of the corona reach tens of millions of degrees during a solar flare. But even without a flare, the corona smolders at a million degrees—and no one knows why.

One possibility is that many small nanoflares constantly heat the corona. Or, the heat may come from certain kinds of waves that propagate through the solar plasma. By looking at how the corona's composition changes, researchers can determine which mechanism is more important, says Tom Woods, a solar scientist at the University of Colorado at Boulder and principal investigator of MinXSS: "It's helping address this very long-term problem that's been around for 50 years: how is the corona heated to be so hot."

The $1 million original mission has been gathering observations since June.

The satellite will likely burn up in Earth's atmosphere in March. But the researchers have built a second one slated for launch in 2017. MinXSS-2 will watch long-term solar activity—related to the sun's 11-year sunspot cycle—and how variability in the soft X-ray spectrum affects space weather, which can be a hazard for satellites. So the little-mission-that-could will continue—this time, flying at a higher, polar orbit for about five years.

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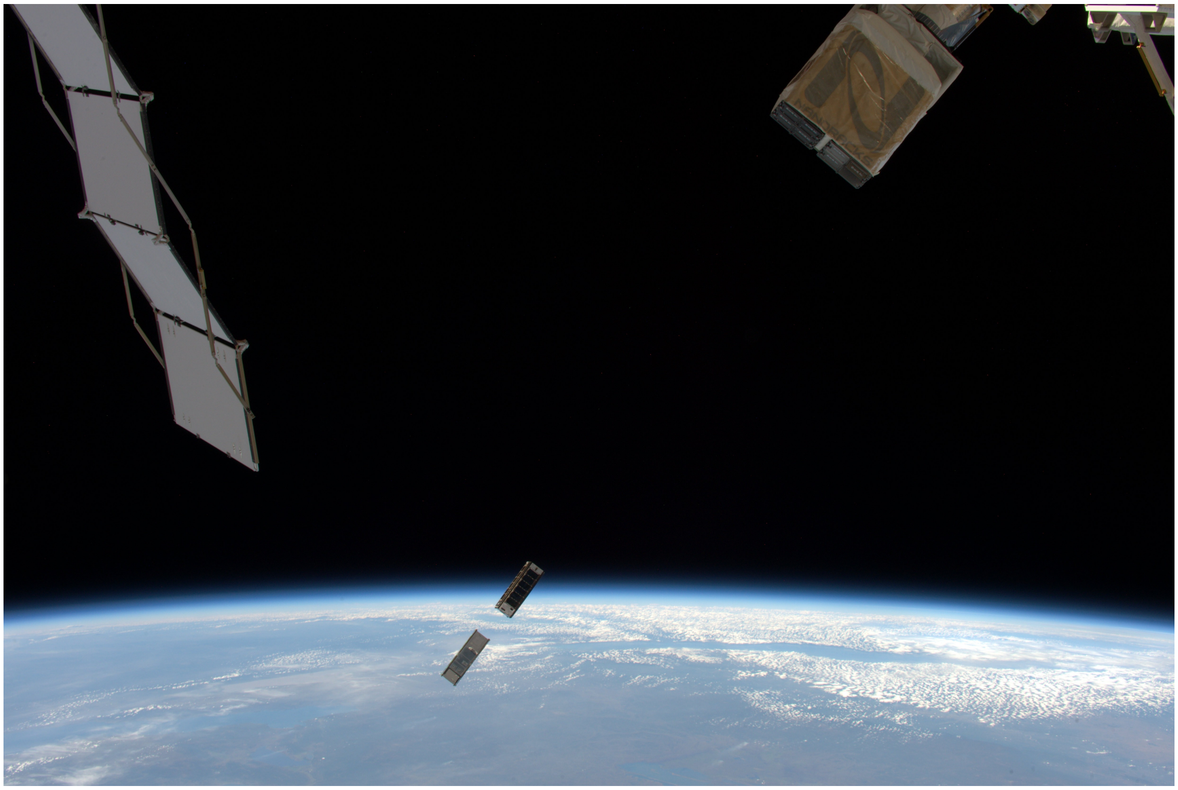
If you'd like to teach kids about where the sun's energy comes from, please visit the NASA Space Place: http://spaceplace.nasa.gov/sun-heat/



Astronaut Tim Peake on board the International Space Station captured this image of a CubeSat deployment on May 16, 2016. The bottom-most CubeSat is the NASA-funded MinXSS CubeSat, which observes soft X-rays from the sun—such X-rays can disturb the ionosphere and thereby hamper radio and GPS signals. (The second CubeSat is CADRE — short for CubeSat investigating Atmospheric Density Response to Extreme driving - built by the University of Michigan and funded by the National Science Foundation.) Credit: ESA/NASA

With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.
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*- This article is provided by **NASA Space Place** to local astronomy clubs [-ed]*

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How to Take a Non-Crappy Picture of the Moon

- by Kristin Wong

On November 14th, we'll get the closest full moon since 1948, and it won't happen again for 18 years. If you want to snap a photo of the moon in all its glory, be prepared. Here's how to take a picture of next week's supermoon that will do it some justice, and may even be wallpaper-worthy.

Entire lifetimes have come and gone without the moon looking quite as large as it will this month.…

Start With the Right Camera and Lens

The moon looks beautiful, big, and bright. You snap a pic with your phone and take a look. Wow. You might as well have photographed a speck of dust because that's what it looks like. If you've ever taken a photo of the moon with your phone, you know this feeling. It's pointless.

The biggest and most obvious reason your moon photos suck is that the moon is just so far away. It's hard enough to take a decent smartphone picture of your cat across the room, much less something that's 238,900 miles away. Granted, the moon is much, much bigger than your cat, but still, it's a long way from your camera.

You can't take a great photo of anything *that* far away with your smartphone because, despite all its other cool settings, your phone's zoom and focal length just aren't designed for it. In basic terms, focal length is the distance between a lens and its focal point. Most decent photos of the moon are taken with telephoto lenses with focal lengths of at least 300mm. The capture in the video above, for example, was taken with a 500mm lens. By comparison, your phone's focal length is probably about 20mm. Smartphone cameras and point and shoots are designed to be compact and convenient enough to fit in your pocket. They're just not built to handle the same functions as a DLSR, mirrorless camera, or any other camera with interchangeable lenses.

However, there are detachable smartphone lenses available that come with optical zoom. As you can imagine, those aren't that powerful either, but you can get slightly better shots with them. They won't be amazing, but they'll be better than what you would get otherwise.

No, I've seen brilliant iPhone pics of the moon*,* you might say. Yes, those photos are amazing, but keep in mind, iPhone astrophotographers like astronomer Andrew Symes use telescopes to get those detailed, close-up shots. It's called afocal photography and it involves taking a photo of the telescope's eyepiece (you can try it with a pair of binoculars to see what happens).

You'll have better luck getting a decent picture of the moon with a DSLR, or EVIL (electronic viewfinder with interchangeable lenses) camera, like a mirrorless. These cameras are equipped to handle better lenses. For lunar photography, you'll need to rent or buy one of those 300mm or higher lenses we mentioned. Prices can range from about a hundred bucks to a couple thousand bucks.

On the other hand, some cameras have pretty good built-in optical zoom that can get great shots even without a lens. For example, the Nikon P900 takes impressive pictures of the moon.

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Adjust Your Camera's Exposure Settings

Basic, boring photos of the moon also look crappy because the moon is so bright. That's why it looks like a big blurry light bulb in your photos, lacking definition, or those clear features on the surface you're probably trying to capture.

If you want to get even a hint of the moon's craters and shadows, you have to adjust your camera's exposure settings. You could use your camera's metering mode for this. This function is usually found in your exposure settings and it measures and analyzes the light of particular area to adjust your settings so that the area is properly exposed. With spot metering, you choose a smaller area. Instead of the night sky, your camera will focus on a specific spot (the moon) and adjust its exposure accordingly. It's easy to adjust these exposure settings yourself, though.

Your camera's exposure depends on three factors: aperture, shutter speed, and ISO speed, also called the "exposure triangle." Here's what each of those three settings mean and how you should adjust them to get your moon photo.

Aperture

Aperture is the amount of light your lens lets in and it's measured in f-stops. The wider the aperture, the lower the f-stop (f/1.0 is pretty wide). Narrower apertures will have a higher number, like f/11. In fact, f11 is the ideal aperture for moon pictures. There's even a name for it in lunar photography: the Looney 11 Rule. This narrow aperture doesn't let too much light in, which is ideal, since the moon is super bright. According to Wired, you'll at least want to stay in the range of f8 to f16. You'll be able to pick up more detail, like craters and shadows. The downside is, if you want to get the surrounding landscape in your photo, you probably won't be able to see it because your aperture is so narrow. We'll tell you how to fudge this later, though.

Shutter Speed

Your camera's shutter speed determines how long your camera's sensor will be open to let in the light. The faster the shutter opens and closes, the less light it allows. When you have a long shutter speed, you let in a lot of light. Shutter speeds are measured in fractions of a second. For the moon, you want a speed around 1/125 to 1/250 second. The moon is already bright, so you don't need to keep your shutter open that long.

ISO Speed

ISO determines how sensitive your camera's sensor is to incoming light. The higher the ISO, the more sensitive it'll be to light. If it's dark, you can take a brighter picture without a flash by adjusting the ISO upward. The problem is, this typically makes your photo really grainy, too. When shooting the moon, you usually want a lower ISO (about 100-250) since the moon is super bright.

The Looney 11 Rule falls within the above ranges, but here's what it calls for specifically:

- **Full moon**: Shutter speed at 1/125, aperture at f/11, and ISO 250
- **Quarter moon**: Shutter speed at 1/60, aperture at f/11, and ISO 250
- **Thin crescent moon**: Shutter speed at 1/15, aperture at f/2.8, and ISO 250

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Of course, you'll want to play around with the settings a bit to see what yields the best results. These ranges should get you in the ballpark, though. Also, make sure your camera is in manual focus so you can the clearest shot possible. Focus on the moon, then shoot. You also want to use a tripod to make sure the image is stable and not blurry.

Choose the Right Environment

Barring a bunch of Photoshop tricks, your picture of the moon can only be as good as it looks in real life. If it's obscured by a bunch of clouds, you're not going to get as good of a shot. For a truly striking photo, you might even want to drive a little out of the city so there's less light pollution.

You may want to wait until it's pitch black so you can get a really bright and clear shot, too. On the other hand, as Wired points out, the moon looks bigger when it's near the horizon, so you might also want to try within an hour of sunset or sunrise.

Finally, keep in mind: a decent image of the moon often means a terrible image of your surroundings. The moon is very bright, after all, so when you underexpose for that brightness, anything around you will be dark, since these surroundings aren't as bright as the moon. You've probably seen images where both the moon and its surroundings are exposed beautifully, though. That's usually because photographers take two separate photos and merge them.

First, you take a picture of the moon with the proper exposure settings, then adjust to expose the rest of the scene. In the second picture, the moon will look terrible, but you can layer and blend the two images in Photoshop (here's a good tutorial). If that's too much work, just try to add some basic composition where you keep the focus on the moon and minimize the background in the shot. Photograph it with the silhouette of some trees in the foreground, for example.

With the right kind of camera and lens, you can get beautiful pictures of the moon, even if you're not a professional photographer. If you don't have access the right camera or lens, renting might be a better option, especially if you're just interested in photographing specific events.

Kristin Wong, contributing writer

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- Originally published at lifehacker.com, 11/10/16. Thanks to Dwight Dulsky for providing this. [-ed]

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