The SPECTROGRAM

Newsletter for the Society of Telescopy, Astronomy, and Radio

April, 2002

April's Meeting

The next meeting of S*T*A*R will be Thursday, April 4th, at 8:00 PM. The meeting will be held at the King of Kings Lutheran Church, 250 Harmony Street, Middletown.

This month's meeting will feature a presentation by Dr. Edward Devinney, who will talk about "Mind over Matter: Journey to a Binary Star System". Dr. Devinney provides the following bio:

"BA, Physics from LaSalle U.
PhD, Astronomy & Astrophysics from U. Penn.
- was Assoc. Prof. at U. So. Florida, Dept of Astronomy;
-spent 2 years at Goddard Space Flight Center as Nat'l Acad. of Science as a Senior Postdoc researcher.
- worked at Siemens Res. Labs, Princeton, as Head, Artificial Intelligence Dept.
-now at Rutgers Center for Advanced Information Processing (research management).
--claim to astronomy fame: with Bob Wilson (U. Fla.) developed code to analyze data from eclipsing binary systems, and I will be talking about that work."

From the Editor

Thank you to this month's contributors. The Spectrogram is your newsletter and appreciates your support. Articles may be submitted to Greg Cantrell at monthly meetings or electronically at cantrell@optonline.net .

In this Issue

Calendar for Remaining Meetings

May 2, 2002
Dr. Licia Verde
Rutgers University & Princeton University

June 6, 2002
Dr. Tad Pryor
Rutgers University

Messier Marathon in April

March didn't cooperate with Marathoners, but April will offer yet another nightlong opportunity to observe every object on Messier's famous list. Attend this month's meeting to learn what other's are planning, or watch the club bulletin board for impromptu get-togethers. Take this opportunity to introduce a friend to our club and the wonders of the night sky!

Galaxies of Coma-Virgo Supercluster
by Ernie Rossi

As we continue our clusters of galaxy article from last month, probably the best constellation that holds the most observing clusters of galaxies is in the constellation of Virgo. Virgo is a special constellation astronomically as well as historically. Because it is well away from the obscuring dust of the Milky Way, Virgo should be expected to contain external galaxies. However, it not only contains an abundance of galaxies, it has a super abundance of galaxies, and many are very bright and contain eleven of the Messier numbers. The reason for this is that toward Virgo is the heart of the Coma-Virgo Supercluster, on the outer fringes, which orbits our small Local Galaxy Group. You will need your sky map and charts to find these galaxies in Virgo and don't be surprised if you run into so many other galaxies as you move your scope around this constellation. One evening observing in South Jersey near Lebanon State forest I counted over 50 galaxies within a period of 10 minutes.

The center of the Supercluster seems to be about 65 million light years distant toward M84, and M86, two of the Superclusters giant elliptical members. In the center of this patch of sky about 3,000 galaxies are within reach of amateur size telescopes under pristine sky conditions. Three-fourths of the Superclusters brightest galaxies are giant spirals similar to the Milky Way and Andromeda Galaxy, M31; but the aggregation also includes a large number of Lenticular's and giant ellipticals.

One of the most impressive clusters of galaxies, and within a .5 degree field of view are M84, M86, NGC4387, 4388, 4402, 4425, 4435, and 4438 and they can all be seen at one time with a scope around 10-12 inches under dark skies, and the brightest ones like M84 & M86 will show detail. Even scopes in the 4-6 inch range can see most of them under good conditions.M84 & M86 were both discovered by Charles Messier on March 18, 1781. M84 & M86 are magnitudes 9.1 & 8.9 respectively and a 6" scope shows both of these giant ellipticals as bright circular halos, see if you see a difference between the two. NGC4387 is the dimmest of the 8 galaxies at magnitude 12.1, and lies at the center of the triangle of M84 & M86. While NGC4387 can be seen in 6- inch scopes, you will need at least a 12 to 14 inch with a magnification of around 150 to 200 to see its defuse halo, or else you may think it's just another star. NGC4388 is an edge-on spiral galaxy at magnitude 11.0, and lies at the South corner of an equilateral triangle with M84 & M86. A 6 to 8 inch scope at 125 power will show it as a thin streak compared to the circular M84 and M86.

NGC4402 is another spiral galaxy but fainter at 11.8 and 8-10 inch scopes at magnifications of over 125 are needed to show its elongated structure. NGC4402 lies just north of M86, and larger scopes are needed to see any additional detail. NGC4425 is located SE of M86, at magnitude 11.8, and to make out this spirals shape 8-10 inch scopes with magnification over 125 is needed. NGC4435 and 4438 are two more spirals but large and bright magnitude 10.2 and 10.4 respectively. 8-10 inch scopes show them well at around 100 power, and they lie very near each other, ENE of Messier 86. Both galaxies contain a stellar nucleus, but NGC4438 is a little larger, see if you can see the difference.

The next cluster of galaxies in Virgo are M59, M60, NGC4638, and NGC4647. M59 is located WNW of M60 and is magnitude 9.6 and was discovered in April of 1779. M59 is a giant compact Elliptical and in a 6 inch scope shows a bright center that fades to a diffuse at the edges. M60 was discovered the same day as M59 and it is brighter at magnitude 8.8, and appears twice as large. In a 6-inch scope at 75 power it shows a bright, smooth, circular halo with NGC4647 almost touching just below it. NGC4647 is much dimmer at magnitude 11.3, with a uniform low surface brightness. NGC4638 is at magnitude 11.2, and is in the southern corner of the triangle between M59, and M60. To see any detail a 10-12 inch scope is needed. However, a 6-inch scope will show it as a faint halo.

NGC5846 is the center of a small cluster of galaxies and shines at 10.0 magnitude. The other groups of galaxies around NGC5846 are NGC5846A which is directly next to it, and shines at magnitude 12.8, NGC5839 is a faint galaxy Magnitude 12.7 west of NGC5846, NGC5845 lies between NGC5846 and NGC5839 and is at magnitude 12.5, while NGC5850 is SE

of NGC5846 at magnitude 10.8. To see all these galaxies an 8-10 inch scope is needed, but to see some of the dimmer ones defuse structures you will need a larger scope in the range of 16-18 inches.

There are many other clusters of galaxies within a 1/2 of a degree field but some are dimmer and the ones I listed are some of the brightest and most impressive. Besides bright clusters in Virgo, you have some other very bright galaxies that should not be forgotten. To name but a few M104 the Sombrero, which is one of the brightest galaxies we can see at magnitude 8.0. M104 is a Giant galaxy which is 16 times brighter than our own and probably contains over 1 trillion suns. It has one of the most prominent dust lanes which run across its entire disk. Instead of describing all the other brighter galaxies, I will list them under objects that can be seen with large binoculars on a steady mount, or with a small scope between 3 to 6 inches in aperture. M49, M58, M59, M60, M61, M84, M86, M87, M89, M90, M104, NGC4216, NGC4526, NGC4535, NGC4536, and NGC4666. All these galaxies are brighter than 11th magnitude, most are 9 to 10 magnitude and some even brighter and are in range of small binoculars. During the week of April 15, I will be in Cloudcroft, New Mexico, at the New Mexico skies inn. I will be there with my friend Steve Fedor and we have rented telescopes as large as 30 inches. New Mexico Skies Inn is located at 7300 feet with some of the darkest skies in the United States. The Coma-Virgo group of galaxies will probably be our main observational goals. Hopefully if the weather is good I will be able to write some great articles about our up coming trip.

I Want to Do Astrophotography. What do I Need?

by David Segelstein

One of the most frequently expressed interests in amateur astronomy is the desire to take photographs with a telescope. Consequently, many beginners (and others) ask what equipment they would need for astrophotography. Almost everyone underestimates the equipment needed, how difficult it is, and especially how much they would need to spend for this capability. The typical question is ``what telescope should I get to be able to do astrophotography?" The answer is it almost doesn't matter what kind of telescope you start with. Except in special cases, the single most important piece of equipment is the mount, and most mounts that are adequate for astrophotography are more expensive than most telescopes.

What do you want to photograph, and how?

There are a couple of questions you need to answer before you decide what equipment you need:

1. What do you want to photograph - star trails? Constellations? The Milky Way? The moon? Diffuse nebulae? Planetary nebulae? Planets? Galaxies? (These are in increasing order of difficulty).

2. What medium are you interested in - film? CCD? Video?

What objects?

Let's take the first question - what objects do you want to photograph? There is a wide range of object sizes, and this will affect how you can photograph them. Galaxies, planetary nebulae, and some diffuse nebulae are all fairly small objects (in angular dimension) - usually less than a degree or so. (Planets are even smaller, and are discussed below). These require some magnification in order to yield a large enough image scale to be reproducible in print, slide, web image, or other format. This means you will probably be imaging faint objects through the telescope as a prime focus instrument. This kind of photography through the telescope is one of the most difficult forms of astrophotography. It requires the most precise tracking and stable mounting.

The moon is a special case because it is about the same angular size as these other objects (about 1/2 degree across) but is very bright. That means it does not require a long exposure, and precise tracking is not required (except for lunar eclipse photographs, in which the moon is very dim). Planets are another special case, being very bright but very small (less than 1 arc-minute in diameter). They also are most affected by "seeing" (turbulence in the earth's atmosphere). They

require short exposures, high magnification, and most likely the aggregation of multiple images to produce an acceptable result. This means you will be using the telescope objective and probably an eyepiece to project and magnify the image. If you intend to use a CCD camera, which may have a very small but high-resolution detector, planetary images may be feasible without eyepiece projection. This area of astrophotography is very specialized, and even those using CCD cameras will typically not use the same CCD cameras that others might use for "deep sky" objects (galaxies, nebulae, and star clusters).

Large, diffuse nebulae, constellations, and the Milky Way are good candidates for a camera and lens. The focal length lens you want to use will depend on the size of the field you want to capture. A typical 35mm camera and 90-100 mm lens will provide approximately a 30 degree field of view. Constellations are sometimes larger, so you would need a shorter focal-length, such as a 50mm or 35mm (or even wider) lens. For some nebulae and star clusters that are only a little more than a degree in angular size, it will be necessary to use a camera lens that is much longer, perhaps approaching the focal length of a typical telescope. In any case, many of these objects may be captured through a camera lens, and the camera and lens will be riding "piggy-back" on a telescope and mount for tracking the objects. Thus, the mount and drive are important, but require less precision than for prime focus photography. As a special case of piggy-back photography, one can use a camera on a "barn-door" platform - one that tracks well enough to handle short focus lenses. This will not be discussed here, but is a good place to start for photography that involves some tracking.

Star trails are the simplest astrophotographs to take. They require only a stationary mount, such as a tripod. A dark sky will help, but is not absolutely necessary. Just open the shutter and wait a while.

How much precision do you need?

It is usually very clear after just a moment's thought why the telescope needs to have a drive for most photography. If the exposure is long enough (and the length of time depends on the magnification), the telescope must follow the object as it appears to move across the sky (as the earth turns). It is often less clear why the scope must be "guided" in addition to simply being automatically driven. The fact is that any "clock drive" will have errors. There will be errors in the surfaces of the gears, in the rigidity of the mount (flexure), and in the bearings. These errors will cause the objects to move (only slightly if the drive is very high quality, but always some amount) in the field of view. Another source of error, which is correctable to some extent, is misaligning the mount with the pole. This can cause field rotation even in a photograph that is precisely guided. Polar alignment is the subject of another article. Atmospheric refraction can cause additional errors, as can turbulence ("seeing").

Typical, high-quality, "astrophotography-capable" mounts and drives provide tracking with accuracy in the range of 5 to 20 arc seconds. That means that, without "guiding," the drive by itself will keep the telescope pointed within 5 to 20 arc seconds of a given target. With a drive like that, and adequate guiding, you can do the most demanding of astrophotographs - long exposure, prime-focus photography. A good quality auto-guider (such as the SBIG ST-4 or the new SBIG ST-V) can yield better than 1 arc second guiding with a drive of that quality, and that is usually better than the "error" produced by atmospheric turbulence ("seeing" effects) on a star image. If the field of view of an image is 1 degree, and it is recorded on 35mm film, this error will be as small as, or smaller than, a film grain. The result is that any error will not be detectable. Good situation!

For "piggy-back" photography, if you are using a 50mm lens on a 35mm camera for example, the field of view is approximately 50-60 degrees. To get the same kind of undetectable error on the film (less than the size of a film grain), you need about an arc minute accuracy. Some mounts will give that accuracy without guiding. Many mounts that are optimistically called "photographic quality" by their manufacturers give between 1/2 and 3 arc minutes (note - not arc seconds) tracking accuracy. To be sure of good quality piggy-back images with those mounts, you'll need to guide. But the guiding require-

ments will be less stringent than for prime-focus work.

You want names? I don't get advertising dollars, and I don't work for any of these companies, so I will give you the brand names of mounts that in my experience fit into these categories. If you want 5-20 arc second drive accuracy (of course, this also depends on the load on the mount), you want to look at AstroPhysics (900, 1200), Mountain Instruments (MI-250 or MI-500), or Losmandy (G-11 or larger), or any well-made mount that uses Byers gears. Common drives and mounts that are offered by Meade and Celestron, for example, will only provide 1/2 to 3 arc minute accuracy. Other things being equal, the heavier the mount, the more likely it is to provide enough stability, and the larger the drive gear, the more capable it is of precise enough tracking. An alternative is to make your own mount. There are examples of home-made, or custom-made mounts, that are quite good. Whatever you do, you'll want the kind of drive accuracy I've described.

Lunar and planetary photography will require smooth drives, but they need not be as precise, because exposures are much shorter than for deep-sky objects. Stability is important, because the motion of the camera shutter should not disturb the image during the short exposure. This is not a problem for CCD cameras without mechanical shutters (although stability never hurt a photograph). Frankly, I don't know the quantitative accuracy requirements for lunar and planetary photography since I've never done it, but I'm sure it's harder than most people think it is. Note that there are far fewer photographers producing good planetary images than those producing good deep-sky images.

Film or CCD?

Do you want to use a 35mm (or medium format) camera? Or do you want to use an electronic, digital camera that is based on a Charge Coupled Device, or CCD (an array of detectors which essentially convert photons to electrons, and can then count them)? Each has advantages, but the primary advantages are:

1. Film can inexpensively record a large field of view with a single exposure (the size of 35mm film is 24mm by 36mm, medium format film is 6cm by 6, 7 or 9cm). The cost of a comparable CCD would be astronomical (as in Hubble range).

2. CCDs are linear detectors (they don't suffer from "reciprocity failure" as film does), and are typically more sensitive than film. They also have the capability to provide better resolution than film, since pixels can be smaller than most film grain sizes.

If you could find a CCD chip the size of a 35mm film frame, you would not be likely to be able to afford it. CCDs typically have better resolution than the film (for most pixel sizes), and you don't need chemistry to process it. On the other hand, for a 35mm size chip, you'd be talking about a 10 mega-pixel camera (or thereabouts), which will yield pretty large files for your images. And you'd have to do 3 images (or more) to produce a color image (except for one-shot color cameras). And you'd need filters, and a computer, and ... Oh, and there's the cost factor. The largest commercial chip in common use today by amateurs is the SBIG ST-8, which is 9.2mm by 13.8mm and costs around $8,000 (without filters, computer, etc.). It would take a mosaic of several images by such a chip to provide the equivalent field of a single 35mm frame. And if (when?) a CCD chip that size becomes readily available and cheap, the film photographer could go to medium format (up to 6cm by 9cm), leaving the field of view of the CCD in the dust again (assuming the optics of the telescope provide that large a field without aberrations - not an insignificant requirement). Note that the CCD chips used in common "daylight" cameras have insufficient sensitivity to capture astronomical images. The CCDs that are adequate for astrophotography are somewhat specialized, and their prices do not seem to reflect the trends in mass market, consumer electronics. Astrophotographers comprise a small market, unfortunately.

However, the story is not quite so simple as to rule out CCD cameras definitively. As mentioned, many objects people want to photograph are very small. A "typical" galaxy can be, say, 5 by 15 arc minutes in size. The ST-8 chip on a 1500 mm focal length telescope (60" focal length, like a 10" f/6), will cover about half a degree diagonally across the chip. That's plenty

of space for imaging a 1/10th degree by 1/4th degree galaxy. And you'll be able to do it in a few minutes, instead of an hour. Then you can obtain lots of images through various color filters (to be aggregated later in software), and produce a color image in about the same or less time it takes to image the object on color film.

Because CCDs are linear, they yield greater image density for longer exposures. But also, they yield some density for very short exposures. Film has non-linear properties at the short and long end of the time dimension. So a short exposure (say, less than a minute or so) will record less than 1/10th the density that a 10-times longer exposure will. At the other end of the scale, a very long exposure (say, 100 minutes) will record less than 10 times the density of a 1/10th shorter (10-minute) exposure. You can take lots of short exposures with a CCD, and aggregate them later into a composite image using digital image processing. That, consequently, requires less precision in the telescope drive. Therefore, the mount need not be as substantial as for film photography.

Whether you choose film or CCD photography, you will get good results with proper equipment and with an adequate amount of time to learn your system. This point cannot be overstated. You can find countless examples of astrophotographers who have the best equipment, but cannot produce good results because they do not have the patience and experience with their equipment that is necessary for consistently obtaining what the equipment can provide. (This, by the way, is true for most of us, only differing in degree).

Refractors, Newtonians, SCTs, etc., etc.

What type of telescope should you get (back to the first question)? Great images have been obtained with refractors, Newtonian reflectors, Schmidt-Cassegrains, Maksutovs, Ritchie-Cretiens, Dall-Kirkhams, hyperbolic astrographs, etc., etc., etc. This question only becomes important when you've decided what objects you want to photograph. Remember that focal length determines image scale, and focal ratio determines image brightness (and exposure times). Looking to photograph the Rosette Nebula (about 2.5 degrees across)? Want to do it on 35mm film? You'll need a telescope with around a 30" focal length. A 4" f/7 refractor, a 6" f/5 Newtonian, an 8" f/3.3 astrograph - these would all be suitable, but would require different exposure times. You can't get that object in an 8" f/10 SCT with either film or a typical sized CCD. Or you could use a 10" f/6 telescope with a camera and 400mm lens riding piggy-back. You'll need a good drive (you need long exposures for film, and even for CCD cameras for this object) and a good stable mount.

Want to photograph galaxies? Don't bother with a 6" f/4 Newtonian, and it won't be easy with a small aperture, f/6 megabucks APO refractor. That 8" f/10 would be OK, except that f/10 is slow for film. But if you use a CCD camera, it would work. You'll need a really good mount and drive.

Want to take panoramas of the Milky Way? Put a camera and wide lens on top of any decent scope and mount, and guide the image.

Get the idea? Pick the objects you're interested in, pick the medium (film or CCD), pick your scope and mount. Then spend a lot of time.

*Alternative Advice for Beginn*ers

What is the cheapest, easiest set-up that would enable you to do astrophotography of several different kinds of object? A small, high quality refractor or reflector of relatively short focal length, and a Losmandy G-11 mount. Cost? Around $2000 for the mount and drives, and whatever you can afford for the scope, as long as it weighs less than 40 lbs or so together with camera and other equipment. Want something better? A Mountain Instruments MI-250 (around $4000) and a larger or better scope, but less than 80 lbs or so. Want more? An Astrophysics 1200 (around $7000) and any scope you can afford up to about 120 lbs weight. Know a good machinist and want to design your own mount? Unlimited possibilities (and cost). All this is exclusive of the extra equipment like camera (film body or CCD), autoguider, guide scope or off-axis guider, etc.

The vast majority of beginners who express an interest in astrophotography will change their minds within a short time. This is not really be-

cause it is a difficult and expensive aspect of astronomy. It is mostly because, beginners don't yet know what they like, and what they really want.

If you are feeling the need to get a telescope, unless you have unlimited funds, it is best not to try to start out getting everything needed to do photography. Get a telescope you will use visually, with good optics, and that is portable enough to take to dark sites. Learn the sky, and learn what objects look like and what gets you excited about the activity. You will naturally evolve toward doing the kind of photography you want to do after some informed experience in the activity. Then, start thinking about what it would take to photograph the objects you like, and with the medium you find most interesting. In the meantime, start saving your money. You'll need it.

Astronomical Folklore

Ed. Note: The following article is taken from NASA's Earth Observatory web site, found at http://earthobservatory.nasa.gov/masthead.html, and is used with their permission

Stars, Clouds, Crops
by Melissa Robertson

For more than 400 years, Andean mountain people in Peru and Bolivia have forecasted the most auspicious time to plant potatoes by stargazing. Aymara- and Quechua-speaking farmers watch the skies for a week before the Catholic festival celebrating San Juan (Saint John), June 24. At midnight of the feast day, villagers climb the mountains, arriving at the peaks a few hours before dawn to drink and sing. Looking toward the northeast, where the Pleiades, a cluster of stars in the constellation Taurus, shine not far above the horizon, the farmers gauge the stars' brightness, note the stars' apparent sizes and the positions of the brightest stars.

The dimmer the Pleiades, as determined by their apparent size and brilliance, the less rain the area will get six months later, said Benjamin Orlove, an anthropology professor from the University of California at Davis. If the stars are dim, skywatchers anticipate dry weather and delay planting to reduce crop damage. Scientists have known that El Niño reduces rainfall in the Andes. But until recently, no one had made a connection among El Niño events, shifts in the apparent brightness of the Pleiades stars in June, and drought in the following rainy season from October through March.

Orlove, Mark Cane, atmospheric scientist from Lamont-Doherty Earth Observatory of Columbia University, and John Chiang, graduate student at Lamont-Doherty, believe high, thin cirrus clouds obscure the Pleiades, the way thick low clouds sometimes make the sun look like a small disk. The researchers found that when these clouds appeared in June, an El Niño event would begin several months later, resulting in less rainfall to the Andes.

The research team correlated ritual observation reports from 12 villages and crop yield information with NASA satellite data, including precipitation data from the TIROS Operational Vertical Sounder (TOVS) distributed by the Goddard Space Flight Center DAAC, cloud data from the International Satellite Cloud Climatology Project (ISCCP) from the Goddard Institute for Space Studies distributed by the Langley Research Center DAAC, and cloud data from the Stratospheric Aerosol and Gas Experiment II (SAGE II) maintained at the Langley Research Center DAAC.

"Climate scientists heretofore had not looked for these correlations of El Niño and cloud cover. This study generates hypotheses for contemporary western modern atmospheric scientists to evaluate," Orlove said. Cane heard about the Andean forecasting practice while on vacation in Peru. He had already studied ways to predict El Niño and thought the practice might have merit. Orlove, the UC-Davis anthropologist, had seen some of the rituals associated with the Pleiades-watching while working on his dissertation. Mutual friends put them in contact. It was the first time Orlove had worked with an atmospheric scientist, and the first time Cane had collaborated with an anthropologist, Orlove said. "On the face of it, it's slightly odd to look at stars to see whether they're dim, and decide what rainfall is going to be like a number of months down the road on that basis," Orlove said. "So we just

wanted to see what kind of foundation there might be to that."

When they began their research, clouds were one of many possible explanations for the Pleiades' dimness. Other possibilities included the presence of atmospheric turbulence and dust, Orlove said. But the researchers realized it would take an enormous amount of atmospheric turbulence to change the brightness of the stars: more than what existed. They also rejected the likelihood that dust storms which occur in that area, caused the stars to appear dimmer, because, first, dust storms don't usually occur at that time of year, and second, because obtaining data about dust would be difficult, Chiang said. One of Cane's colleagues suggested they examine satellite data on high clouds. Thin cirrus clouds are invisible from the ground and form above other clouds, near the top of the troposphere, the layer of Earth's atmosphere where weather occurs.

The ISCCP cloud cover data, planned for 1983 through 2005 with data currently from 1983 through 1994, show global cloud cover and cloud types over month-long intervals, allowing the researchers to determine that high clouds were present, dimming the Pleiades, and to verify that El Niño events correlated with high cloud appearances.

They needed more information about the high clouds, including the clouds' thickness and composition, available in the SAGE II data collection. To make these observations, a satellite is lined up so the Earth's atmosphere is between the satellite sensor and the sun. Then the sensor measures differences in the way the light gets through the atmosphere, Chiang said. The data allowed Chiang and the other researchers to compare high-cloud thickness at different times.

They found that when the high clouds were thicker, obscuring the Pleiades, the El Niño that occurred a few months later was more severe and less rain fell, thus confirming the farmer's observations. Orlove and Chiang said they could not have performed the study without the ISCCP and SAGE II data. "Neither of us are primarily NASA people and we're putting the NASA data to use." Orlove said. "It goes to show that the environmental issues that can be addressed through data collected by NASA are of great significance to people around the world. I and my co-researchers feel very fortunate that these data exist and are publicly available so that we're able to make use of them."

Orlove hopes the connection between high clouds and El Niño, discovered through examining an ancient ritual, will encourage climate scientists to look more at indigenous practices all over the world to develop better forecasts.

New Jersey's Disappearing Dark Skies
by Ernie Rossi

I have observed all over New Jersey since I moved here almost 30 years ago, and I have seen our skies slowly and, at times, rapidly becoming light polluted in areas you would never think possible. It has not just been my observation, but also many other avid observers I have talked with throughout the years. I hear observers mention that at one time in the not-so-distant past they could see the Milky Way from Cranford, NJ, and now when I look up at the sky from Sperry Observatory it's hard to see stars down to 3.5 magnitude on a good night. At my home in Sayreville, I remember on a good night less than 10 years ago I could see stars down to 4.5 magnitude, but now a good night is 3.5 magnitude. "Okay" you may say, but what about our dark areas like the Pine Barrens, Jenny Jump, Stokes Forest, or NJAA in Voorhees State Park?

Before we can talk about these sites we need to know some history and geography about our beloved state. NJ ranks as the 46th state out of 50 states in size, with a total area of 7,419 sq. miles which makes it extremely small. NJ has a population of over 8,100,000 people -- over 1 million more people than 10 years ago, which makes it the most densely populated state in the union. In contrast the state of Wyoming has 97,105 sq. miles and less than 500,000 people. If you broke this down people Vs area, New Jersey has 1092 people for every sq. mile, and Wyoming has 5 people for every sq. mile. The median age of the population is 34 years, which means lots of families and children. Many grandparents now stay in NJ after they retire because of the beaches, night life, Atlantic City, and their children and grandchildren who still live here. Because of this NJ has become the

second largest retirement state in the United States after Florida. Retirement homes have sprung up all along our southern coast as well as inland. Retirement homes are now being built at the western part of the state as well as thousand in many rural areas throughout the state. Due to New Jersey's proximity to New York and Philadelphia, where many lucrative jobs exist, many new homes are being built and are spreading out to all parts of New Jersey that were once forests, farms, and open preserves. The economy has been booming, and many people now are making very good salaries and are building many new larger homes, and moving further out in the suburbs. To support these homes many new shopping centers, gas stations, hospitals, and schools are being built around all these new developments. We are now having problems supporting the additional homes and facilities with the extra energy that is needed. Home now have very powerful security lights, not just one, but several, and they are not shielded properly or set to turn on at the recommended distance. Automobiles now have stronger lights, and no matter what we do, light pollution is growing faster than we can control it. Just take a ride down any major road just about anywhere in this state and you will see new construction of all types where open fields and woods once stood. More cars, SUVs and trucks have added a lot more smog and air pollution particles into the atmosphere which reflects additional light? And don't forget concrete is a much better reflector of light than Earth and forest.

You may say, "How about proper shielding?" That is a good idea -- educate the public. All of us should make a supreme effort in fighting light pollution when we see lights that aren't shielded properly, or not working effectively while energy is being wasted. We should talk to our neighbors, town officials, and merchants who may not realize that their lighting practices are not efficient and costing them more money, produces glare that cause driving accidents, besides wasting scarce energy, and creating unnecessary light pollution. My own example has been my neighbor across my street who had his security lights going on every time a car passed on his side of the street instead of going on when someone was on his property. We can all do our share in trying to hold back this unnecessary light pollution that is destroying our skies and wasting precious energy and causing sky rocketing prices. This will have some effect, but not enough to alter all the additional lighting that is used now unless the government steps in. I hate to say this, but I am a realist and believe unless we all act now and our government steps in, our dark skies will be a thing of the past unless we take immediate action. If we want to find truly dark skies we must now go to other states like New York or Pennsylvania -- just ask any deep sky observer. There have been proposals to protect our forests and wetlands, but our once many farms are now but a few. Farmers over the years have sold out sometimes thousands of acres to builders who have built thousands of dwellings, many on top of each other. A friend of mine doesn't go out to observe anymore because a new neighbor wants to keep an unshielded bright light on outside next to his house because of security reasons. Many of us don't like to say anything to our neighbors because we may upset them. You need to tell them in a nice way and explain to them that shielding will even give you more light on the ground. When I go up to NJAA in High Bridge, our discussion usually is, "Wow! Look at all that light pollution!" At one time no one really mentioned it, but it is so obvious now. There are so many lights now, that they come right through the trees from the valley below. Skyglow has grown from the horizons, almost right up to the zenith. NJAA has taken action and hopes to stop or slow down the advance of light polluters. They have gone to city counsel meeting and have been informing officials who have imposed stricter guidelines on lighting. Jenny Jump is the same way, just look off to the South and see all the lights in the distance. Hackettstown and other once-rural areas around Jenny Jump State forest have been building many new homes, and more facilities will be needed to support them. UACNJ has been trying to find ways to curb some of the light pollution by speaking to some merchants whose lights are destroying our dark site at Jenny Jump. In South Jersey, the Pine Barrens lie between all the new adult communities, Atlantic City and Philadelphia. New larger casinos are being built and more hotels keep springing up. You can see the glow all along the horizons and it is slowly creeping higher each month. We can try doing the best we can to keep the public and New Jersey political groups informed and involved about good lighting practice and controls.

Most astronomy clubs have some members, or a group involved with light pollution. Speak to them to learn what proper light shielding is, and what they are doing to halt light pollution. Try getting involved. It's inevitable what New Jersey's future will be if we don't make an effort now. But the things we do now may at least preserve our skies for years to come.

Searching for Dark Skies – Spruce Knob WV vs. Cherry Springs PA
by Greg Cantrell

Last year was not a very productive observing year for me. Several family and work related events filled each month and it seemed that, inevitably, a "must attend" function would land squarely on the dark cycle weekend.

I've decided that this year will be different, so I'm scheduling vacation days well in advance for each dark cycle weekend and reserving time on the family calendar for my observing activities. And, I'm taking more time to do the research on nearby locations that offer true dark sky conditions. I've focused most of the efforts on two sites, Spruce Knob in West Virginia and Cherry Springs State Park in Potter County, Pennsylvania. While both will require considerable driving time, each also offers the opportunity, on great nights, to observe under true mag. 7 skies.

I've been fortunate enough to observe at Cherry Springs on just such a night, but have never observed from Spruce Knob. And, since the driving time to Spruce Knob is considerably longer than the trip to Cherry Springs, I decided to ask those that have actually observed at both sites to give me their opinions. While there are very few people here in New Jersey that routinely observe at either location, an active group of observers from the Northern Virginia Astronomy Club (NOVAC) frequently observe from Spruce Knob. I found these folks on an Internet discussion group dedicated to Spruce Knob observing. While several of the members offered opinions, Tom Dietz offered the following comparison, listing pros and cons for each site:

Both are excellent sites. I prefer observing near Spruce Knob at Gatewood Campground. We can leave our equipment set up there, something you can't easily do on the parking lot at the summit. It's also more sheltered from the wind. Below is an evaluation of each site:

Spruce Knob (actually Gatewood Campground)

1. Higher elevation (4,500 ft.) than Cherry Springs.
2. Slightly darker on the best nights than Cherry Springs. On a clear night with low humidity, the limiting magnitude is easily better than 7. The Gegenschein and M33 are easily visible with direct vision. I've seen both the morning zodiacal light and the summer Milky Way cast shadows at the site. The only significant light dome is from Elkins to the northwest, but it's blocked by the trees and causes no problem. The site is between a 1 and a 2 on the Bortles scale.
3. Less dew formation than Cherry Springs. The elevation helps in this regard.
4. Except during hunting season and the peak summer getaway season, there usually aren't many non-astronomers there.
5. Hunters camping at the site can be a real pain in neck during the fall. Some are not at all courteous toward those who wish to sleep during the day. Gatewood is open to all on a first come, first served basis. There are only six camping areas, but one may pitch a tent anywhere in the National Forest.
6. One must tote equipment about 100 ft. from the parking area to the meadow where we observe. No driving on to the field.
7. The trees at Gatewood block a bit of the western horizon, but also block the wind, which can be very strong at 4,500 ft.
8. The site is essentially inaccessible during the colder months. Because of the elevation, snow melts and refreezes on the gravel road to the site, making access extremely difficult as late as March.
9. No water or electrical power. The site has two vault-type toilets. The nearest stores are about ten or twelve miles away.
10. The last ten miles of road to the site is unpaved. Avoid the road that goes directly over Spruce Knob. It's awful. Take the road that runs south of ridge. It's better. The driveway up to Gatewood is getting pretty bad near the top, however. Go slowly, and you should make it okay.
11. The site's more southern latitude allows bet-

ter views of some southern objects than at Cherry Springs.
12. Except for lights from cars entering the parking area and other campers (not usually a problem), there are no security or street lights anywhere near the site.

Cherry Springs

1. No quite as dark as Gatewood, but close. A solid 2 on the Bortles scale on the clearest nights. The light dome from Coudersport is almost unnoticeable. The best limiting magnitude that I've seen at Cherry Springs has been on the order of 6.7 to 6.8. I have no doubt that it might be a bit darker on the clearest of nights with low humidity.
2. Lower elevation and its location downwind from Lake Erie mean that there is often a lot of low level moisture and resulting dew at Cherry Springs. This is less of a problem during the summer, but dew was a major problem for many at the 1999 and 2001 Black Forest Star Parties. The site is in the Lake Erie snow belt during the winter.
3. The light across the street at the airfield is very distracting. It truly degrades the site.
4. Non-astronomers entering the park with their headlights on have been a problem in the past. I understand that measures will taken this year to limit this problem.
5. The observing field is reserved for astronomers only. No conflicts with other campers there.
6. Water is available. And during the BFSP, power is also turned on at the site.
7. Paved roads all the way to the site.
8. A nice group of "regulars" with whom to observe. More of a club presence with two organized star parties each year.
9. Great support from the park. At Gatewood the Forest Service seems disinterested in what we're doing, unless we drive where we're not supposed to.
10. One can drive on to the field, set up equipment, and camp in the same area.

As with Tom Dietz, most people that have observed at both sites give Spruce Knob a slight edge. Still, both sites are great locations, far superior to anything we have locally. I've decided to observe from both sites this year, beginning as early as this month.

You can learn more about Cherry Springs by visiting http://members.aol.com/CherrySpSP/. NOVAC maintains Spruce Knob information at http://www.novac.com/spruce/index.htm.

Upcoming Events

Star parties are an important part of the amateur astronomy experience. Listed below are several events offering dark skies and astronomical fellowship.

April 10 – 14, The **8th annual Star Gaze Star Party** will be held by the Delmarva Star Gazers. http://www.delmarvastargazers.org/sgVIII/index.html for more information.

May 5 – 12, The **24th annual Texas Star Party** will be held at the Prude Ranch. Visit http://www.metronet.com/~tsp/ for information.

May 18-19 – The **11th annual Northeast Astronomy Forum (NEAF)** will be held at Rockland Community College in Suffern, New York. For more information, visit http://www.rocklandastronomy.com/neaf.htm.

June 5 – 9, The **4th annual Laurel Highlands Star Cruise** will be hosted by the Amateur Astronomers Association of Pittsburgh. Visit http://lhstarcruise.org/ for information.

June 7 – 9, The **Jersey Starquest** will be hosted by the Amateur Astronomers Association of Princeton. anthony_monticello@hotmail.com is the contact for more information.

June 7 – 9, The **13th annual Mason-Dixon Star Party** will be hosted by the York County Astronomical Society. For more information, visit http://home1.gte.net/dmdewey/mdsp.html.

August 1 – 6, The Oil Region Astronomical Society's **ASTOBLAST** will be held near Franklin, Pa. Visit http://www.oras.org/ for information.

August 2 – 11, The Rockland Astronomy Club's **Summer Star Party 2002** will be held at Shady Pines Campground near Pittsfield, MA. Visit http://www.rocklandastronomy.com/members/ssp2002/index.htm for more information.

August 9 – 10, The **67th annual Stellafane** will be held outside Springfield, Vt at Breezy Hill. http://www.stellafane.com/

September 6 – 7, The **Blackwater Falls Astronomy Weekend** will be held at Blackwater Falls State Park, WV. For information, visit http://www.kvas.org/AstronomyWeekend%202002.htm

September 6 – 8, The **2002 Black Forest Star Party** will be held at Cherry Springs State Park in Potter County, PA. For more information visit http://www.bfsp.org/starparty/

October 4 – 6, Stella Della Valley XVI will be held by Bucks-Mont Astronomical Society. Visit http://bmaa.freeyellow.com/Sdv.html for more information.

October 12, The **12th annual NOVAC Star Gaze** will be held at Franklin Park, 45 miles west of Washington, DC. Information at http://novac.com/gaze.

October 28 – November 4, The **8th annual Mid-Atlantic Star Party** will be held at a central North Carolina site that boasts mag 6.5 skies and southern sky objects that cannot be viewed from New Jersey. For more information, visit http://www.masp.org/maspindex.htm.


Apr 4


Apr 12


Apr 20


Apr 27

Solution to last month's puzzle

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+ P T + + + + S + M A + + + +
+ + O U + + E + I R O + + + +
+ + + L A R + Z I + I + + + +
+ + + + A H A M + + R + + K L
+ + + T + R L + + + I + + O A
+ + N + + + I A + + B P + C B
C A P E L L A S M + L R + A I
R O T S A C + + + O A O X B Z
E S U E G L E T E B F C U + +
+ T H U B A N S + + + Y L + +
+ D + A L A U + + + + O L + +
+ + E T C I K + + + + N O + +
+ + A N R I + R + + + + P + +
+ I + I E + P + A L E G I R +
R + S + + B + S + M + + + + +
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April Constellations

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R H B H G I I Z C R O C V H A
O R O B Y L N U Z G O A M B G
N A O Z U D P I R H B N E U I
I Y T J Q H R I M L E E L J R
M A E T A C V A E E B S Y B U
A J S G R M Z S R F G V N M A
S M B A Z D A O X C J E X V R
R N T D Q V N S K V L N S M J
U E S E C I N E R E B A M O C
R C K Q M V X H O U V T G X O
I T A O S E X T A N S I M S O
O D E N C U X Y D I L C I P N
H L Q B C H B M O W I I X V R
D R A C O E D Z L S U V R O C
Q E Q J K M R V Q K J S M N M
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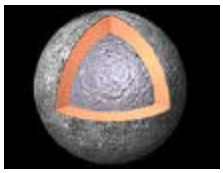
AURIGA, BOOTES, CANCER, CANES VENATICI, COMA BERENICES, CORVUS, CRATER, DRACO, GEMINI, HYDRA, LEO, LEO MINOR, LYNX, SEXTANS, URSA MAJOR, URSA MINOR, VIRGO

Fun Facts – Did You Know?



- Mercury is the closest planet to the Sun & the eighth largest.
- Mercury is named for the Roman god of commerce, travel, and thievery. The Greek counterpart, Hermes, was the messenger of the gods.
- Though smaller than the moons Titan and Ganymede, Mercury is much more massive.
- Mercury's orbit is highly eccentric, 46 million km from the Sun at perihelion while 70 million km at aphelion.
- Mercury's orbit slowly precesses around the Sun, a discrepancy that was understood only through application of Einstein's Theory of General Relativity.
- Mercury rotates three times during two of its "years". Daytime temperatures approach 425 degrees C while nighttime temps fall to – 180 degrees C.

Scopetoon *by Steve Fedor*