NOVAC

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Beyond Foucault's pendulum

by Guy Brandenburg

BOOK REVIEW:
The Life and Science of Léon Foucault: The Man Who Proved the Earth Rotates, by William Tobin
(Cambridge University Press, Cambridge, UK, 2003; 338 pages)

If you are an amateur telescope maker, you have probably performed the Foucault knife-edge test on a mirror. You may have heard of Foucault's pendulum, or even seen the one that used to swing in the hall of the Smithsonian's Museum of American History right in front of the flag that flew over Fort McHenry. But you probably know next to nothing about the remarkable French scientist who made these and other remarkable inventions and discoveries in a number of different areas of physics. A new, heavily illustrated and well-documented book by William Tobin has brought the life, historical era, and accomplishments of Jean Bertrand Léon Foucault (1819–1869), better known simply as Léon Foucault, to an English-speaking audience.

As astronomers (professional or amateur), our interest in Foucault's life would normally be based on these three of his principal achievements:

1. He was the first to develop methods for reliably producing parabolic silvered-glass mirrors for astronomical telescopes; modern-day amateur mirror-makers still use some of his techniques. Up until then, virtually all reflecting telescopes used speculum metal mirrors, which were very difficult to figure correctly and also tarnished very fast—and when they tarnished, they had to be re-polished and refigured! What's more, before Foucault, they had no way of predicting whether the mirror would produce good images before it was put into the scope. Foucault's methods were reliable, involved only local refiguring, and, what is even better, when the

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ASTROPHOTO CORNER: ROBOSCOPE IN ACTION

Crab nebula (M1) December 21, 2003, 0400 UT—4 exposures of 120 seconds each, stacked with Registax.

MESSAGE FROM THE PRESIDENT

Exciting times

What an exciting time to be an amateur astronomer. The Stardust mission has obtained its sample of commentary dust, we have two Rovers exploring Mars, and the public support to prolong the Hubble Space Telescope's life is astounding!

NOVAC President Rob McKinney

Closer to home, the club's Roboscope development continues, we've added features to the website, and we're expanding topics offered at the General Meetings. Add to that the observing opportunities coming up, like the Messier Marathon season, the advent of Monthly Observing Sessions at Observatory Park, and hope for a bright comet (2002 T7 LINEAR) this Spring and the opportunity to be part of the excitement is wonderful!

The club's longer-term future is likewise exciting. For example, we're considering buying a dark-sky site for remote/observatory scopes (any realtors, lawyers, or financial advisers out there?)

NOVAC is a wonderfully progressive club, no doubt about it. You are the engine of that progress. Your membership is key, but it goes beyond simply paying dues. Consider the ways you can make NOVAC better: subscribing to the Newsletter via electrons versus paper can save us hundreds, even thousands of dollars; donating equipment to the Mentor and Loaner Scope programs helps promote the hobby to newcomers (we were all newcomers once!); offering advice and assistance, from astronomy-related expertise to help with club projects; even buying a NOVAC t-shirt! Most

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Foucault, from page 1

silver coating tarnished, it could be removed and restored by chemical means, causing no changes in its optical figure.

2. Foucault also participated with others (François Arago and Hippolyte Fizeau) in the first accurate laboratory measurements of the speed of light, and in showing that light travels as a wave and not as particles (we now think that it takes either form, depending on the experiment being used to test it). His later experiments (1862) showed that the speed of light was 298,000 km/s, as opposed to 308,000 km/s. (The currently accepted figure is 299,792.458 km/s, which is used to define the meter.)

3. Foucault gave the first physical proof that the earth actually rotated, both by his famous and eponymous pendulum, but also via the gyroscope, which he also invented and perfected. It may be surprising to know that not even Galileo or Newton were actually able to give physical proof that the earth rotated; Foucault's pendulum did this because the direction of the swing of the pendulum changed as the day progressed, and experiments revealed that this rotation depended on the latitude of the pendulum. The gyroscope has been used for many decades as an aid to navigation on board ships, submarines, and aircraft, until the advent of the Global Positioning System.

Other contributions to science

But this is not the total extent of his contributions. Others:

• Foucault was one of the first amateur photographers, using the daguerreotype, some of which still survive. In fact, he and Fizeau did daguerreotypes of the sun, which clearly showed sunspots, and—for the first time—limb darkening, which showed that the Sun was neither a liquid nor a solid.

• He developed efficient heliostats, which would focus the bright light from the sun onto a fixed target, so that, for example, an entire hall of medical students could see the same microscopic sample from the same microscope at the same time. He also used his heliostat to photograph (via the daguerreotype) and to publish pictures of blood cells, milk, spermatozoa, and various crystals (1840's). These were soon forgotten, partly because the germ theory of disease had not yet been proved. The first widely used published micrographs of healthy and diseased tissues and cells came about 20 years later in the work of a US Army surgeon, Lt.-Col JJ Woodward.

• Foucault was a very important employee of the Paris Observatory, although he often had problems in working with Urbain le Verrier, its temperamental director, who is famous for having predicted where the planet Neptune could be discovered.

• He was the first to photograph a total eclipse of the sun in Spain, in 1860, along with two other people (Warren de la Rue and Father Angelo Secchi). Unfortunately for Foucault, le Verrier refused to publish his photographs, although de la Rue's pictures were widely circulated.

• Foucault also developed an inflatable rubber cushion to sit underneath his relatively thin telescope mirrors; the observer could fine-tune the performance of his mirror by blowing more air into the cushion or letting some air out—all of which brings to mind, and anticipates today's thin warped mirrors for amateur telescopes and adaptive optics for large, professional ones.

• He developed improved "governors" for steam engines and other devices, regulating how fast they would run.

• He developed automatic, self-stabilizing carbon arc lights that would not go out when the carbon electrodes wore down.

• He visited the "Leviathan" telescope of Lord Rosse in Ireland, and wrote to a friend, in passing, that it was "a joke" (une blague). I don't know whether he was referring to the distorted images that were most likely produced by this off-axis telescope, or the mirror's poor optical figure, or the fact that it was not maneuverable…

• He pioneered modern science reporting by writing knowledgeable and readable reports, published on the front page of one of the leading Paris newspapers (Le Journal des Débats) on the weekly meetings and discussions of the French Academy of Sciences.

• He began mass-producing 4-inch reflecting telescopes for sale to the public for 10 British pounds (250 French francs)—a large sum of money for the period, which meant that only the very wealthiest individuals could purchase one.

• He developed an improved polarizer for light out of two crystals of Iceland spar.

• He improved the spark coil, producing

discharges that reached 2 meters long in a vacuum tube; this sort of apparatus eventually became the key to the production of x-rays, radio waves, and the discovery of the electron.

• He independently discovered, after Faraday, currents that are induced in metals when they enter a magnetic field. These currents are today still called Foucault currents in France.

A child of the revolution

As a good biographer, Tobin goes into the massive political upheavals surrounding Foucault's life. He describes how Foucault (1819–1868) was just a child during the revolution of 1830 that brought down the restored Bourbon monarchy and put Louis-Philippe in power as an elected citizen-king. Foucault was a young adult when the revolution of 1848 founded the 2nd French Republic, and when Louis-Napoléon Bonaparte overthrew the republic 3 years later and founded a 2nd Empire, becoming Emperor Napoléon III. Interestingly enough, Louis-Napoléon had been imprisoned from 1840 to 1846 in the Château de Ham, where he set up and used a physics laboratory, sired two illegitimate children, and then escaped! Another interesting historical tidbit is that Napoléon I, the uncle of Napoléon III, was an accomplished mathematician as well as a military political leader, and has an interesting theorem about triangles named after him. Napoléon III admired and respected Foucault and his work, and did a lot to promote his career at the Paris Observatory and to save him from Le Verrier's wrath. Ironically, two years after Foucault's death, France suffered an absolutely catastrophic defeat at the hands of the Prussian army at Sedan, where Napoléon III was taken prisoner, causing the demise of the Second Empire, followed by the short-lived rise of the Paris Commune and eventually the Third French Republic, which lasted until World War 2. In the aftermath of the Paris Commune, which included the slaughter of thousands of the defenders of Paris by its right-wing besiegers, many papers were burned, including all records of where Foucault was actually born!

Foucault's life was not entirely happy. Though he appears to have liked women, he never married, perhaps because of his own fears for his mental stability. Besides problems with the director of the Observatory, he had mental problems from time to time that we know little about. He also died at a relatively young age from a somewhat mysterious malady that may be linked to those mental problems, and which progressively and completely disabled him almost at the prime of his accomplishments. His biographer suggests, based on the available evidence, that Foucault probably had multiple sclerosis, which does cause episodic bouts of psychosis, goes into remission on its own for long periods of time, and which is often fatal.

A personal recollection

It so happens that when I lived in Paris as a young boy in 1959, I lived only about 2 blocks from where Foucault had his home and private laboratory at the corner of the rue de Vaugirard and the rue d'Assas a century earlier. The house that Foucault dwelt in has since been torn down, but this biography has photographs of a monument that has been placed on the building that replaced it, commemorating his experiments with the pendulum. (Not that I noticed it at the time!) I also used to spend a good bit of time during our two-hour school lunch time and recess playing with other kids under the trees in the Luxembourg Gardens; it so happens that right at the south end of the Luxembourg gardens—one of the few large green places in Paris—is the Paris Observatory, which is where Foucault was supposed to work (when he wasn't feuding with his boss), and is the point from where the French scientific establishment wanted to measure zero degrees longitude. Recall that nearly every major power wanted to use their own capital and major observatory as 0

degrees longitude, since longitude is entirely arbitrary. Washington, DC has Meridian Hill Park on 16th Street, to remind us of American efforts to declare the White House as zero degrees longitude. Of course, the British, with the largest navy, won out, and everybody that I know of uses the observatory at Greenwich, England as the zero marker on their maps. But I wouldn't be surprised if North Korean globes use Pyongyang as the zero point!

Today, one can see brass markers on the stones and walls of the Luxembourg Gardens, and other parts of Paris, showing where the French zero longitude line passes. I don't know whether they were there 45 years ago or not, but I suspect they were placed there fairly recently.

The pendulum

Tobin describes how Foucault's pendulum demonstrates the rotation of the earth: the plane of vibration of the cord and weight tends to stay fixed, and at the equator, the undulations would not appear to change at all to an outside observer, no matter how long he or she waited. However, at the North or South Pole, plane of vibration of the pendulum would slowly describe a full rotation every 24 hours around the point directly under the place where the cord is suspended. In-between the poles and the equator, the time to rotate 360 degrees depends directly on the sine of the latitude, as Foucault's careful calculations demonstrated.

By the way, making an effective Foucault pendulum is a bit more complicated than just purchasing a heavy metal ball and some strong metal cable. There are lots of details

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Spruce Knob schedule

2004 dates (tentative)

April 15–17	3 nights
May 15–22	8 nights
June 18–19	2 nights
July 16–17	2 nights
August 13–14	2 nights
September 11–18	8 nights
October 14–16	3 nights

Foucault, from page 3

to consider, and Foucault did consider them. For one, the friction of the air tends to diminish the length of the swing in a fairly short time, and somehow needs to be increased again in such a way as to not disrupt the plane of vibration. Tobin describes various methods of using electro-magnetism to keep the length of the swing constant. Also, one has to try to avoid making Lissajous figures, where two or more pendulum motions work at cross purposes and create almost-chaotic (but very attractive) figures if you trace them on paper. Also, the metal cord undergoes a lot of stress at the point where it is supported at the ceiling, and great care has to be taken to prevent it from breaking and injuring someone. Tobin's book contains plans that can be followed by anybody interested in making such a pendulum today.

Translating the original

A few years ago, I was invited by Rochelle Prescott, an engineer, to translate into English the 1859 paper wherein Leon Foucault first described his methods of fabricating parabolized, silvered glass mirrors for astronomical telescopes. In it, Foucault describes how he attached the a copper tool to a post, then suspended the glass blank by means of cords and springs to help with working the glass blank. He also describes grinding and polishing with emery, chalk, and rouge; using paper laps for the polishing; silvering the mirror by chemical means; and performing at least four different types of optical tests. One of those tests is still widely used and is still known as the Foucault knife-edge test, but has been modified by contributions by another French optical worker, André Couder, using masked zones so as to produce numerical ratings. Another one of his tests has also been somewhat modified and is known as the Ronchi test after an Italian scientist. It appears that mine was the first such translation, about 140 years after the article was first written! You can read my {rather literal} translation at *bobmay.astronomy.net/foucault/leontop.htm* or visit my own web page at *home.earthlink.net/~gfbranden/GFB_Home_Page.html.* A proposal to publish the translation in the pages of the Amateur Telescope Making Journal came to naught, mostly because the ATMJ folded. Also, Prescott disagreed with my interpretation of a couple of passages, and wanted to write his own introduction. As it happened, he passed away before he could write his introduction, and at about the same time that the ATMJ folded, so publishing it on paper for any sort of profit seemed moot.

When I did my translation, there was one point that really puzzled me. Foucault describes the process of parabolizing a spherical telescope mirror by thinking of it as being part of a large ellipsoid, with two foci. One puts the light source at one focus, and the eyepiece (and the observer's eye) at the other focus, and uses the knife-edge test to see if the entire mirror "nulls" all over at once. If not, then one does local polishing with an undersize tool (or "retouches locales"—probably using one's thumb) until it looks better; then one separates the two foci some more, and repeats; and finally pushes one focus to infinity and does some more "retouches locales" until all is perfect. Of course, you *cannot* push anything to infinity in any laboratory or workshop, no matter how big it is.

Foucault's first mirrors were about 4 inches across, but he eventually made one that had a diameter of 80 cm (31.5 inches), which was installed on an equatorial mount in Marseille, which has much clearer skies than Paris. Because of turned edge on that mirror (the bane of amateur and professional telescope makers even today!), Foucault only claimed that it had a useful diameter of 78 cm (30.7 inches).

Tobin's book on Foucault was printed in both English and French editions, but they are not identical. The author is from Manchester, England, originally, and studied at Cambridge U (England) and earned a PhD in astronomy at U. of Wisconsin. He has worked since 1987 mostly at the U. of Canterbury in New Zealand, but he has also worked at the Marseilles Observatory in France, where Foucault's largest telescope still resides. He is bilingual in both French and English. The French edition, adapted by James Lequeux, came out before the English edition, probably to coincide with a major exhibition on Foucault at a museum in Paris. Also, the French edition, which is a paperback, is considerably cheaper. The only complaint I have about the English edition is the price: $60.00! Apparently, the publisher decided not to aim this at the mass market, but at the much smaller market of Foucault enthusiasts such as myself. The index of the English edition is much better than that of the French edition; the tables of contents are arranged slightly differently; a few small topics appear to be left out of the French edition; but, otherwise, the texts are quite similar, though I have not had the patience to read the two versions side-by-side to find

Images by Richard Robinson

Both images were taken with my 8" LX 200 working at f3.3 with the Meade focal reducer, and MX-5C CCD Camera. I also used the IDAS Light pollution filter and tracked with the STAR 2000 auto tracker. The images are composites of individual exposures of 10 and 20 minute each. Total exposure for NGC 7635 was 80 minutes and for NGC 253 it was 70 minutes. All were taken from the light polluted skies of South Riding. You can see them in color on my web site: *astro.outerspaceconsultants.com.* ✶

little differences. If you can read French, the French version is much cheaper; otherwise, you should either try to persuade your local university or college library to purchase a copy, or else dig quite deep into your wallet for your own copy.

One of the last major amateur scientists

To sum up, was Foucault a major genius like Einstein, Newton, Leibniz, or Galileo? No. He was a lucid reporter on the inventions of others, but he was confused on the nature of electricity, was not a great mathematician, and has no major theoretical breakthroughs to his credit. However, he was a consummate and extremely careful experimenter, and one of the last major amateur scientists, since much of his work was not accomplished while in the employ of the French Government. Professional opticians do not use the knife-edge test today, and they don't use window glass and silver, but rather ceramics like Cer-Vit and more exotic substances like Pyrex or Zerodur and vacuum deposition of aluminum films. GPS, microchips and sensors have replaced gyroscopes and governors. However, we amateur telescope makers and the professionals as well are both "standing on the shoulder of giants," so to speak, because without the advances of Léon Foucault and others, our ability to see to the ends of the universe would be entirely speculative—pun intended. We would still be either limited to the relatively small refractors (remember, the Yerkes 48" is still the largest in the world!), or else we would be trying to grind and polish our speculum mirrors without poisoning ourselves with the antimony and arsenic that is mixed in the alloys, and refiguring those mirrors every month or two! ✶

President, from page 1

of all, your participation in Outreach events, club events like Astronomy Day, even attending meetings to enjoy our topics and guest speakers is so important.

It's a tug of war of cosmic proportions, I know, finding time for what's important to you; family and jobs, community projects, downtime . . . lots of priorities to juggle. Please think how you can participate in all the exciting things NOVAC presents.

I look forward to seeing you beneath the stars. ✶

We need your feedback...

In the past, the NOVAC membership list has been sent to the members each year as an attachment to one of the newsletters. NOVAC membership is now over 800, and the list is quite large and growing. (Yes, that's a good thing…) Add to that the problems of finding the list when you need to contact someone in the club, and the inherent "out of date" nature of an annual list… well, we think there is a better way.

The NOVAC Board is considering posting the membership list in a relatively secure way on the "members-only" portion of the NOVAC website. That way, you can have access to the list anytime you want, and it can be easily maintained so that you always have access to the latest information.

However, we understand some of you may have concerns about listing personal information on the web.

The NOVAC Board plans on making a decision on how to handle this in the next month or so, but before we do, we'd like to hear from you. You can, of course, discuss this on the email list, but that can be awfully hard to sort through and makes it hard to find all the other interesting stuff on the list. Instead, the board would like you to send your comments and opinions to this email address:

NOVACSurvey@aol.com

If you don't have email access, call 703-492-1894 and leave a short message addressing the points below. If you'd rather write us a letter, call that number and leave your name and number. We will call you back with a ground address.

We'll collect the results, post a summary to the mail-list, and present the summary to the board at one of our upcoming board meetings.

In your response, please try to address some or all of the following:

- **Do you use the membership list? If so, what do you use it for?**
- **Are you concerned about having your personal information listed on the web?**
- **Would your concerns be relieved if only some of your information was listed (for example: name, city/state, and phone number), but not all (i.e., street address and email address)**
- **Other than NOT providing members a list (which we are considering), do you have any other possible solutions? If so, include your name and contact information.**

It is important that we hear from you before the end of March 2004 if your desires are to have an effect on the Board's decision.

Meeting highlights

Board of Trustees Meeting
Tuesday, January 6, 2004

✶ New club President **Rob McKinney** opened the meeting. On administrative matters, he noted that preparations were being made by **Bob Stewart** to hold an election at the next General Meeting for his previous Board position as trustee for the remainder of the term. He also appointed **Laquetta Karch** to be the club's new **Astronomical League coordinator (Alcor)** and **David Yustein** to continue as **newsletter editor.** He said all other appointed officers of the club should consider themselves reappointed.

✶ Treasurer **Pedro Martinez** circulated the club's end-of-year 2003 financial information. In summary, actual revenues exceeded the budget forecast by over $5,000. We received a total of $19,108.88 in revenues and for the year we budget for $14,105.00 in revenues and we received $5,003.88 additional revenue over the budget. The additional $5,003.88 revenues come from new, corporate, supporting, and patron members that was not budgeted for. Also revenues came from donations to the **Spruce Knob, Ed Boyer Fund,** and the **Robo Telescope.** The total expenses for the year came out to $15,800.28 and I budgeted $16,105.00, which means a savings of $304.72 occurred. Once you take the revenues and deduct the expenses you end up with the net income of $3,308.60 and I expect that NOVAC will end up with a loss of $2,000.00 for 2003. The $5,308.60 difference in the net income comes from the $3,308.60 surplus plus the $2,000.00 project loss that did not occur.

✶ Membership Director **Gene LaTour** provided a summary report of membership for December 2003. There are 785 active members from 608 households, only a slight change from November. Comments from renewal forms were positive, with praise for the **Monthly Observing Sessions,** the website and the e-mail list server.

✶ Vice President **Ed Seward** noted that his predecessor, **Craig Tupper,** had already lined up speakers for the coming months, including optometrist and former NOVAC president **Myron Wasiuta** on Lasik eye surgery and amateur astronomy for January, and physicist **Ron Turner** on Space Weather. **Alan Figgatt** was still thinking of ideas for the sky tour and thought doing a presentation on how to accurately describe seeing conditions might be useful at some point. There were suggestions that he report on comets that may be visible.

✶ **Alan Figgatt** reported progress regarding plans for **Observatory Park,** including money for the roll-top roof building. Several members suggested that a stronger partnership with the Society, which might make the site—convenient for northern Fairfax club members—available to the club and a potential location for a club observatory at some point. Some urged caution, noting that the primary purpose for the site is educational, meaning outreach, not personal observing, and that those NOVAC members interested in the site have been encouraged to join the **Analemma Society.** It was agreed that this should be part of a larger plan to develop relationships with other astronomical clubs and could be discussed further as a new business item.

✶ Astronomical League Coordinator **Laquetta Karch** reported that there are two awards ready for presentation at the General Meeting.

✶ **Alan Figgatt** reported the switch of the **10-inch Dobsonian** to a new custodian. It was suggested that the club might want to replace some existing loaner telescopes with new ones.

✶ **Observing Coordinator** asked and received permission from the Board to reserve the Panorama shelter at **Crockett** for use during the **June 16 NOVAC picnic.** It was also suggested that the website list **Mercer Park** as an inactive site due to its relative inaccessibility.

✶ **Bob Parks** reported that the **January MOS** would be dedicated to the **Mentor Program.** Some suggested that **Franklin Park** be considered for a MOS, and **Will Stewart** and **Bill Burton** should look into this possibility.

✶ Outreach Committee member **Donna Blosser** reported on one upcoming activity at **Mantua Elementary School** in Fairfax County.

✶ **Craig Tupper** reported that work continues with the structure and an electronic glitch with the telescope's drive.

✶ **Mike Mills,** speaking about the **34-inch mirror,** noted that space is still needed to build the telescope for this mirror. It was suggested that **George Mason University** might be asked whether it has some space for amateur telescope making.

✶ **Pedro Martinez** presented his revised club budget for 2004. It forecast revenues of $18,675 and expenditures of $22,444, generating a deficit for the year of $3,769. A breakdown of expenditures for the **Robotic Telescope** project was subsequently discussed. Considerable concern was expressed regarding the substantially increased dues required by the **Astronomical League** and their impact on the budget, which will generate debate about NOVAC remaining an AL affiliate. While Board members expressed their views on the mater, it was generally agreed that any decision to leave must be made by the club as a whole. Some expressed concern about having a budget deficit, while others felt a greater concern was the impact of growing reserves on the club's non-profit status. It was felt necessary to clarify that the **Ed Boyer Fund** is to be dedicated to assisting those new to the hobby of amateur astronomy, and that this was interpreted largely as the **Mentor Program,** either in conjunction with or separate from the **Monthly Observing Sessions.** It was suggested that an additional $250 might be needed

for the NOVAC annual picnic.

General Meeting
Sunday, January 11, 2004

✶ Approximately 60 people attended the meeting. Club President **Rob McKinney** welcomed the 6 or so first-time visitors.

✶ **Dr. Daniele C. Struppa,** Dean of George Mason University's College of Arts and Sciences, asked for the floor, first to ask for assistance in developing the contacts necessary to raise $500,000 for a telescope and other equipment for the university's planned observatory, and second to acknowledge the contribution of NOVAC member **John Avellone** to the installation of a radio telescope on top of one of the campus buildings.

✶ Astronomical League Coordinator **Laquetta Karch** presented a **Binocular Messier certificate** to **Will Stewart,** along with compliments for his good observing log and advocacy of binocular use.

✶ Other club programs, including telescope making, video imaging, and outreach efforts were discussed. **Craig Tupper** and **John Deriso** are fixing glitches in the drive for the Roboscope while **Pete Johnson** is fitting the telescope's structure with necessary equipment for remote usage. **Rob McKinney** indicated a desire to have people report on their observing sessions at the meeting. **Greg Piepol** was elected by the club members to fill the vacant slot on the Board of Trustees.

✶ **Alan Figgat**'s monthly **Sky Tour** gave planetary updates: Venus prominent in the evening sky; Mars is now less than 8 arc seconds in diameter and being invaded by Earthlings, Saturn reached opposition on December 31, and Jupiter now rises before 10 pm. He also noted the visit of two comets, 2002 T7 LINEAR now in Pegasus at about magnitude 8, and 2001/Q4 NEAT which is better suited for southern observing but may be bright enough to grace northern Virginia's morning twilight sky come mid-May. Alan added some cold weather observing tips, including the reminder that, unlike hiking or other outside activity, you are standing or sitting and therefore generating less body heat while observing. He believed there might be some good cold-weather gear on sale now, just before bathing suits and summer gear stock the shelves of sporting goods stores.

✶ **Pete Johnson** supplemented the Sky Tour with a new **Observer's Challenge.** He highlighted M101, a large spiral galaxy with low surface brightness that nevertheless contains a large number of separately catalogued objects, including nebulae, satellite galaxies and H-II regions. To observe these or other challenging objects, you need a good telescope and dark sky, of course, but you also need to develop serious observing skills, best done by spending time at the eyepiece studying the object.

✶ The guest speaker for the evening was **Myron Wasiuta,** an optometrist in Fredericksburg, VA, accomplished amateur astronomer and past NOVAC President. The title of his presentation was **"Star Wars and the Human Eye,"** focusing on developments in **LASIK eye surgery** and its implications for those wanting good vision at night. He traced LASIK history from the first U.S. operation in 1991, through FDA-approved studies leading to FDA approval in 1998, to the lessons learned after 2 million procedures having been done in this country. A wide range of people can now have this surgery, but corneal thickness has been found to be critical in avoiding future problems. The cornea is no longer removed as in the past; and the procedure is done precisely in accordance with the patient's prescription. Recovery is much quicker and less painful than in the past.

The potential problem with LASIK for amateur astronomers is that vision correction can cause problems, especially when doing things like looking at points of light under conditions of darkness. Indeed, the procedure could induce or make worse some of these problems. Myron highlighted spherical aberration, coma and trefoil as 3 common problems. He highlighted the recent development of wavefront technology that allows for correction of some of these problems. New types of contact lenses may also help alleviate these problems.

In short, LASIK surgery may not necessarily cause problems for amateur astronomers, but those considering this procedure should be cautious and review the results of a thorough examination of their eyes' characteristics carefully. He expressed a willingness to review test results for NOVAC members and seemed optimistic that the wavefront technology and other advances may minimize current concerns.

Monthly Observing Sessions

2004 Schedule

March 13	Camp Highroad	Messier Marathon
April 24	Crockett Park	Astronomy Day
May 15	Mason Neck SP	
June 12	Crockett Park	NOVAC Picnic
July 10	Camp Highroad	
August 14	Spruce Knob	
September 11	Crockett Park	NOVAC Star Gaze
October 16	Mason Neck SP	
November 13	Observatory Park	
December 11	Camp Highroad	

Statement of cash received and disbursed

NORTHERN VIRGINIA ASTRONOMY CLUB — JANUARY 1, 2003 THROUGH DECEMBER 31, 2003

CASH RECEIVED:			
Membership Dues:			
Regular and Additional:			
Renewals	$9,640.00		
New Members	5,690.00		
Corporate–New	200.00		
Supporting–New Member	300.00		
Supporting–Renewal	100.00		
Patron–New Member	400.00	$16,330.00	
Interest Income		139.88	
T-Shirt & Sticker Sales		95.00	
Spruce Knob		180.00	
Spruce Knob Donations		1,390.00	
Dept. Store Telescope Making Kits		0.00	
Robo Telescope Donations		424.00	
Ed Boyer Fund		530.00	
Donation		20.00	
Total Cash Received			**$19,108.88**
CASH DISBURSED:			
Newsletter:			
Printing & Assembly	3,255.22		
Postage	445.35	3,700.57	
Astronomical League			
Astronomical League Dues		1,896.50	
Astronomy Day			
Publicity		0.00	
NOVAC Picnic:			
Baroque Food & Supplies		214.57	
NOVAC Star Party Expenses		45.09	
Observing Site Improvements:			
Porta-Jon Rental-Savage Farm	877.80		
Porta-Jon Rental-Camp Highroad	751.05		
Spruce Knob Site Rental	1,869.00		
Other Improvements	43.82	3,541.67	
Monthly Observing Session (MOS)		133.76	
Webpage Expenses		650.00	
Award for Volunteers-MOS		265.63	
Flowers for Ed Boyer Funereal		100.00	
International Dark-Sky Association (IDA)		100.00	
Science Fair Prizes		68.94	
Big Monster-34" Telescope		0.00	
Robotic Telescope Project		1,782.00	
Sweet Sixteen Telescope Project		218.47	
Administrative:			
Liability Insurance	359.00		
Printing–Membership Applications	6.58		
Printing–Administrative	96.01		
Postage	625.80		
Supplies	512.12		
State Registration Fee	25.00		
Personal Property Tax	83.22		
Check Printing Charges	14.95		
Bank Service Charges	6.00	1,728.68	
Total Cash Disbursed			**15,800.28**

EXCESS OF CASH RECEIVED OVER CASH DISBURSED		3,308.60
Cash at beginning of period:		15,465.98
CASH AT END OF PERIOD		**18,774.58**
Cash At End Of Period		
Checks Received, Undeposited	0.00	
Checking Account	1,478.69	
Savings Account	9,679.12	
Certificate of Deposit Due 1/2/2004	3,086.01	
Certificate of Deposit Due 11/2/2004	2,419.84	
Certificate of Deposit Due 5/2/2004	2,110.92	18,774.58

Respectfully submitted,
Pedro Martinez, Treasurer

Projected budget for 2004

NORTHERN VIRGINIA ASTRONOMY CLUB

REVENUES			
Membership Dues			
Renewals Regular & Additional	$11,210.00		
New Members Regular & Additional	5,515.00		
Total for Membership		$16,725.00	
Interest Income		150.00	
NOVAC T-Shirt & Sticker Sale		200.00	
Spruce Knob Donations		1,400.00	
Spruce Knob		200.00	
Total Revenues Expected			**$18,675.00**
EXPENDITURES			
Newsletter			
Printing	$4,000.00		
Postage	500.00		
Total for Newsletter Expenditures		$4,500.00	
Astronomical League			
Dues		$3,120.00	
Library			
Books	$100.00		
Total for Library		$100.00	
Observing Site Expenses			
Porta-Jon Rental-Savage Farm	$878.00		
Porta-Jon Rental-Camp Highroad	816.00		
Spruce Knob Site Lease	1,869.00		
Other Improvements	206.00		
Total for Observing Site Expenses		$3,769.00	
NOVAC Annual Picnic			
BBQ Food & Supplies	$250.00		
Publicity–Printing & Postage	250.00		
Total Picnic Expenses		$500.00	
NOVAC Star Party			
Publicity	$ 25.00		
Printing	35.00		
Miscellaneous	140.00		
Total Star Party Expenses		$200.00	
Monthly Observing Sessions (MOS) & Mentoring Program			
General Expenses	$260.00		
Awards for MOS Volunteers	270.00		
Total MOS Expenses		$530.00	
NOVAC WebPage Expenses		$325.00	
Science Fair Prizes		$100.00	
Astronomy Day			
Publicity (Printing & Postage)		$20.00	
Award for Volunteers		$500.00	
International Darksky Association Membership		$200.00	
Big Monster-34 1/2 inch Telescope		$1,500.00	
Robotic Telescope		$5,000.00	
New Projects		$500.00	
Administrative			
Liability Insurance	$400.00		
Printing-Membership Applications	20.00		
Printing-Stationary	20.00		
Printing Administrative	100.00		
Postage	650.00		
Supplies	350.00		
State Registration Fee	25.00		
Personal Property Tax	150.00		
Printing-New Checks	15.00		
Bank Service Charge	10.00		
Total for Administrative Expenses		$1,740.00	
Total Expenditures		**$22,694.00**	
Net Revenue/Loss		**($ 4,019.00)**	

	2000	2001	2002	2003	2004
Newsletter	$6.43	$7.78	$7.28	$6.25	$7.06
International Darksky Membership	$0.24	$0.21	$0.20	$0.17	$0.31
Astronomical League	$3.07	$3.62	$3.36	$3.20	$5.04
Administrative	$3.27	$2.54	$2.00	$2.92	$2.73
Operations	$6.11	$5.32	$11.23	$10.78	$17.14
Total	**$19.12**	**$19.47**	**$24.07**	**$31.89**	**$32.28**

Welcome to our new members

Charles A. Berry
Silver Spring, MD 20901

Sanjeev Joshi
Potomac, MD 20854-2827

Eric Kearsley
Silver Spring, MD 20902

Kevin and Lauren Angel
Reston, VA 20194

John Applegate
Bealeton, VA 22712

William Arey
Herndon, VA 20170-2854

Carl & Barbara Audrey
Upper Marboro, VA 20772

Michael J. Ball
Warrenton, VA 20187

Robert Beamer
McLean, VA 22101-0357

Ramsey Bordcosh
Fairfax, VA 22033

Allen Boutz
Springfield, VA 22153

Jeffrey Brooks
Vienna, VA 22182-2312

James C. Brown
Centreville, VA 20120

Kahn Bui
Burke, VA 22015-3333

Sherry Clarke & family
Alexandria, VA 22308

Joseph Colaccino
Arlington, VA 22204

Nick Demidovich
Alexandria, VA 22301

Leah and Robert Doordan
Springfield, VA 22151

Shereen Elghamrawi
Alexandria, VA 22304

Leonard S. Fischer
Great Falls, VA 22066

Eric Goplerud
Vienna, VA 22182

Richard Hayden
Ashburn, VA 20147

Richard Kennington
Fairfax, VA 22030

James T. King
Vienna, VA 22181

Frederick and Stephen Kuhl
Oak Hill, VA 20171

Tom Manteuffel
Vienna, VA 22182

Jeff Mittereder
Annandale, VA 22003-4758

Robert L. Morales
South Riding, VA 20152

Bobby L. & Janet K. Nichols
Manassas, VA 20110

Thomas Patrick, Jr.
Leesburg, VA 20175

Tai Phan
Springfield, VA 22152

Rodney Ramsey
Reston, VA 20191-1109

John Reynolds
Fairfax, VA 22030

E. E. "Sandy" Sanders, Jr.
Mechanicsville, VA 23111

Michael & Cathy Scheiman
Vienna, VA 22181

George Scott
Alexandria, VA 22303

Mark Thompson
Gainesville, VA 20155

Stephanie Thompson
Leesburg, VA 20175

Robert Venafro
Chantilly, VA 20151-3635

David Williams
Stafford, VA 22554

R. Ann Wimmers
Vienna, VA 22181-5538

Sue J. Worden
Warrenton, VA 20188-3032

George Zachmann
Alexandra, VA 22314

Sky Meadows public observing nights

2004 Schedule

Date	Comments
April 17, Saturday	2 days before new moon. Astronomy Day April 24.
May 22, Saturday	3 days after new moon
June 19, Saturday	2 days after new moon
July 17, Saturday	New moon
Aug 14, Saturday	2 days before new moon.
Sept 18, Saturday	4 days after new moon.
Oct 9, Saturday	3 days after last quarter moon.
Oct 28, Thursday	Lunar eclipse! Program starts at sunset. Umbral phase starts 9:14 pm; total eclipse 10:23–11:45 pm; ends12:53 am Friday
Nov. 13, Saturday	1 day after new moon.

Saturday observing time is sunset–11 pm.

Sky Meadows State Park, near Paris, Virginia—Join Sean O'Brien, staff astronomer of the Albert Einstein Planetarium, and other local amateur astronomers, for public telescopic observing under dark, star-filled skies, away from city lights. The evening begins with a short night sky orientation at dusk, followed by telescopic observing of various astronomical objects.

Sky Meadows State Park is west of Washington, D.C. on US Route 17 North, 1 mile south of US Route 50, or 7 miles north of Interstate 66, Exit 23. The park contact phone number is (540) 592-3556. There is a $4 parking fee per car. Please cover flashlights with a red filter or a brown paper bag. Dress warmly. In case of clouds or rain, an amateur astronomer will lead a short alternate program.

This isn't an official NOVAC event, but NOVACians are the preponderance of telescope volunteers. Telescope volunteers get in free, and can observe until 1:00 am.

Events in March and April

Shading indicates days that Crockett Park is open

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	MAR 1	2	3	4	5	6 FULL MOON
7	8	9	10	11	12	13 LAST QUARTER **MOS–Messier Marathon@ Camp Highroad**
14 **General meeting 7pm @GMU**	15 Martin Luther King, Jr., Day	16	17 St. Patrick's Day	18	19	20 NEW MOON Vernal equinox **Public observing night@ Crockett Park**
21 **ATM-SIG meeting (location TBA)**	22	23	24	25	26	27
28 FIRST QUARTER	29 ✶ Mercury & Venus at greatest eastern elongation	30	31	**APR 1**	2	3
4 Daylight savings time begins	5 FULL MOON	6 Passover	7	8	19	10
11 Easter LAST QUARTER **General meeting 7pm @GMU**	12	13	14	15	16 ✶ Mercury in inferior conjunction	17
18 **ATM-SIG meeting (location TBA)**	19 NEW MOON ✶ Partial solar eclipse	20	21	22	23 ✶ Lyrid meteor shower peaks	24 **MOS–Astronomy Day@ Mason Neck SP** **Public observing night@ Crockett Park**
25	26	27 FIRST QUARTER	28	29	30	**MAY 1**

Jeff's observing report

Jeff Stetekluh

Jeff's astronomical calculations are made for the Northern Virginia area. See *www.novac.com/jeff/jrefs.html* for calculation references and further details.

Jupiter eclipse events on Friday and Saturday nights

Mar 14	10:13 pm	Io Eclipse end
Mar 21	2:52 am	Europa Eclipse end
May 8	9:49 pm	Callisto Eclipse start

The Sun

Mar 14	rises at 6:20 am	sets at 6:15 pm
Apr 11	rises at 6:37 am	sets at 7:42 pm
Apr 11	rises at 6:37 am	sets at 7:42 pm

The Moon

Mar 20 New Moon	Apr 11 Last Quarter
Mar 28 First Quarter	Apr 19 New Moon
Apr 5 Full Moon	Apr 27 First Quarter

Events

Mar 20	Vernal equinox
Mar 29	Mercury is at greatest eastern elongation
Mar 29	Venus is at greatest eastern elongation
Apr 4	EDT starts
Apr 16	Mercury is in inferior conjunction
Apr 19	Partial solar eclipse; mag=0.741
Apr 23	The Lyrid meteor shower peaks (active Apr 16 to Apr 25)
May 4	Total lunar eclipse; mag=1.296
May 5	The eta-Aquarid meteor shower peaks (active Apr 19 to May 28)

The Planets

Mar 14	Rises	Transits	Sets
Mercury	6:47 am	12:55 pm	7:04 pm
Venus	8:06 am	3:05 pm	10:04 pm
Mars	8:58 am	4:10 pm	11:22 pm
Jupiter	5:05 pm	11:34 pm	6:06 am
Saturn	11:43 am	7:04 pm	2:29 am

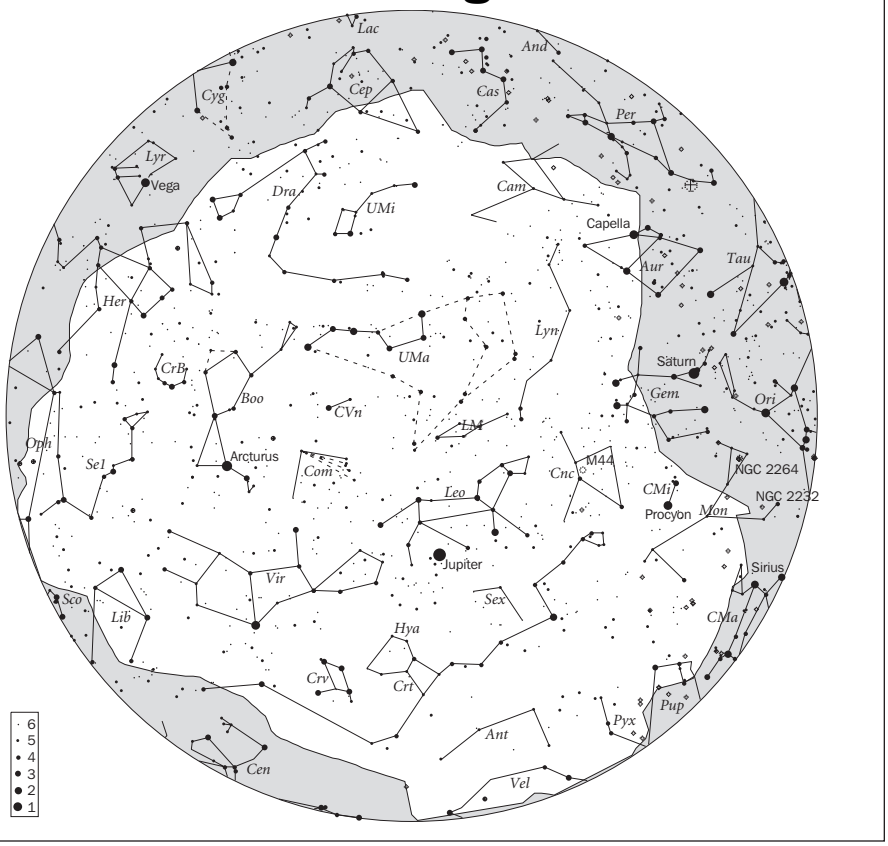
Apr 11	Rises	Transits	Sets
Mercury	6:48 am	1:37 pm	8:26 pm
Venus	8:33 am	4:06 pm	11:41 pm
Mars	9:10 am	4:36 pm	12:02 am
Jupiter	4:01 pm	10:33 pm	5:09 am
Saturn	10:57 am	6:19 pm	1:44 am

Notes

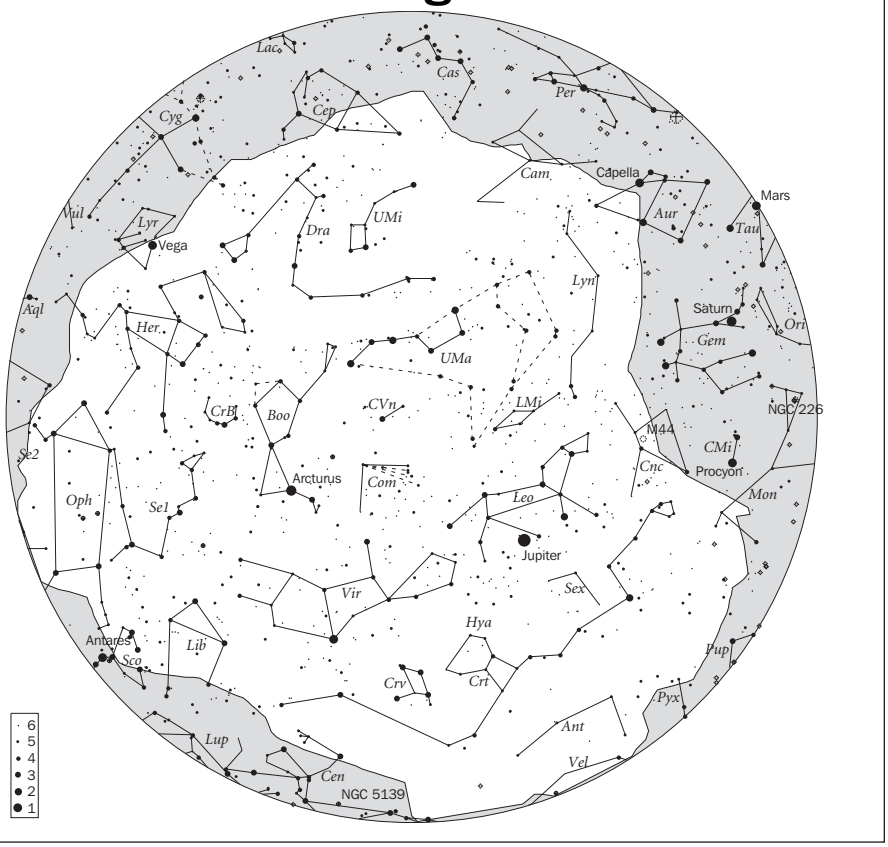
	mag	**diam**	**Mar 14**	**Apr 11**
Mercury	–1.4	5.4"	W, 9*	8*
Venus	–4.3	20.3"	WSW, 43*	43*
Mars	1.3	5.3"	WSW, 57*	48*
Jupiter	–2.5	44.3"	E, 13*	42*
Saturn	2.3	18.8"	SE, 71*	66*

* degrees elevation at sunset taking into account atmospheric refraction.
mag = apparent magnitude
diam = apparent equatorial angular diameter

March skies from Savage Farm



April skies from Savage Farm



Each map depicts the sky at 0 hours for the 15th day of the respective month. The shaded area approximates the local horizon obstruction at the site.

"To observe, and to help others observe"

NOVAC is a non-profit, all-volunteer organization chartered to advance amateur astronomy in Northern Virginia. Members benefit from:

Access to dark sky observing sites:
NOVAC maintains agreements that provide club members with year-round access to observing sites away from city lights

Monthly meetings
Monthly meetings are held at 7 p.m. on the second Sunday of each month in Room 80 of the Enterprise Building on the campus of George Mason University. Each meeting features a lecture on an interesting topic by a local expert. See the web page or future newsletters for a schedule of speakers.

Bimonthly newsletter
The NOVAC newsletter provides information specifically for NOVAC members, as well as general interest articles on such topics as observing reports, equipment reviews, upcoming events, ATM projects, and more.

High-quality telescopes to borrow
NOVAC members may borrow one of the clubs several "loaner" telescopes at no charge. Members may choose from among three 6" reflectors, two 10" f/6 reflectors, an 8" SCT, and a hydrogen-alpha solar scope. Binoculars are also available for loan.

Club website
Up to date information about club events and activities is maintained on the club website at *www.novac.com.*

Large club library
NOVAC maintains a well stocked library that members may borrow from by contacting John Deriso *(seaotter@bellatlantic.net)*. A full list of titles is available from the club website.

Private e-mail list-serve
Members keep up with current club information by subscribing to the NOVAC e-mail list, without fear of flame wars or spam e-mails.

Public outreach opportunities
Several times each year, volunteers from NOVAC present astronomy programs to schools, churches, Scout troops, and other public groups.

Membership in the Astronomical League
Through NOVAC's membership in the Astronomical League, NOVAC members gain access to the AL's newsletter, services, and observing programs.

Discounts on astronomy magazines and books
Subscriptions to *Sky & Telescope* and *Astronomy* magazines are offered to club members at a considerable discount. Also, astronomy books purchased through the club are eligible for a 10–25% discount.

See your *Membership Guide* for more details.

The *NOVAC Newsletter* is the official publication of the *Northern Virginia Astronomy Club* and is published six times per year. The NOVAC Newsletter is sent to members of NOVAC as a regular membership benefit.

Membership
Membership in the Northern Virginia Astronomy Club is $25.00 per year and is open to anyone interested in astronomy or the sciences. Additional memberships at the same address without additional copies of the newsletter are $5.00 per person. Contact:

Gene LaTour
807 S. Filbert Court
Sterling, VA 20164
703-444-6674
genel2r@earthlink.net

Change of address
All notices of change of address should be sent to Joe Pierson. Please include both old and new addresses.

Advertising
NOVAC does not knowingly accept advertising for products of inferior quality nor does it accept responsibility for the quality of advertised products.

Submissions to the newsletter
NOVAC members are invited to submit articles for publication in the *NOVAC Newsletter.* The editor reserves the right to edit all materials submitted. Send article submissions to the Editor, Dave Yustein, at *david.yustein@aero.org.*
The deadline for submissions is two weeks in advance of publication: Friday, April 2 for the May/June 2004 newsletter.

In this issue...

NOVAC

THE NORTHERN VIRGINIA ASTRONOMY CLUB

c/o Gene LaTour, Membership Director
807 S. Filbert Court
Sterling, VA 20164

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