

NOVAC

THE NEWSLETTER OF THE NORTHERN VIRGINIA ASTRONOMY CLUB

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Polar alignment in depth

by Gene LaTour

Polar alignment is simply positioning the telescope's equatorial mount so that its polar (right ascension) axis is parallel to the Earth's axis of rotation (identified in the sky by the North Celestial Pole (NCP). When this is done, the apparent motion of the sky can be cancelled out by the telescope's drive motor, or by hand to minimize the object's "drift" as it is being observed.

For normal viewing, a rough polar alignment will dramatically reduce the rate of drift at low and moderate magnifications, but for high magnification viewing, or astrophotography a more refined alignment is needed.

Rough polar alignment method

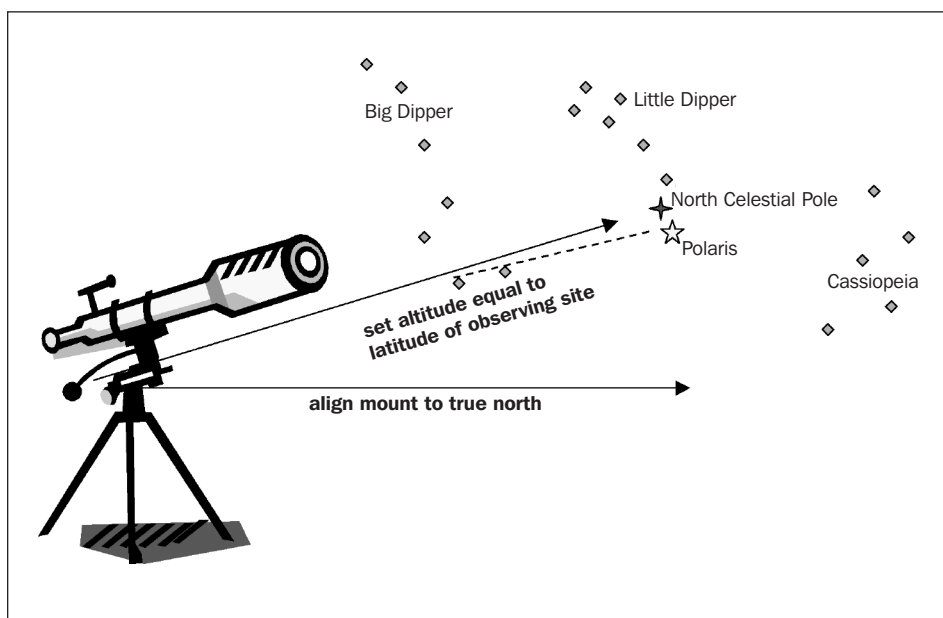
Rough polar alignment involves positioning the telescope's mount so it is aligned with the polar axis.

This is done in three steps:

1. **Level the tripod and mount** using a small bubble level and align the telescope and finder scopes on a distant object using a moderate magnitude eyepiece.

While this step isn't necessary to polar align, it makes finding objects using the

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^{new}
MESSAGE FROM THE PRESIDENT

Part joy, part "calling"

I grew up in northern Nevada and never knew how lucky I was when it came to stargazing. Talk about dark skies! It was easy to take for granted the abundant scatter of lights that glittered against the dark dome. Maybe the wealth of opportunity and views is why it took me so long to seize astronomy as a hobby.



NOVAC President
Rob McKinney

Back then I learned to find the Big Dipper and North Star, but that was as far as my astronomical education went. My wonder and awe, however, have yet to be sated.

That "wow!" feeling came with my first view of the Pleiades through Dad's binoculars. It's a sight that thrills me still and brings back memories of standing beside the dirt road, the old Willy's jeep idling behind me in the quiet with the stunted sage and crunch of crusted snow beneath my boots at the periphery of my senses. Warm memories despite the frigid weather that accompanies viewing the Seven Sisters, even today!

But it wasn't that experience, not even the full Lunar eclipse rising over Star Peak a few years later or seeing Comet Kohoutek in 1973-4 that brought me into the hobby. Instead it was missing out on Halley's Comet in 1986. It was a life goal to see it. Now I'll have to live to be 103! But from that missed opportunity came a desire to enjoy amateur astronomy.

I have that same desire, part joy, part "calling," in wanting to serve as the club President. I know I'll have fun because the

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How far is it? The cosmic distance ladder

by Prof. Harold Geller

Distances in astronomy are so vast that it is difficult for most people to grasp the true scale of things. Not only is it difficult, but enquiring minds want to know how we know how far things are from our planet. I hope to address these questions in this short article by referring to what some astronomers call the cosmic distance ladder.

What is the distance ladder? The cosmic distance ladder in astronomy relates to the concept that the distance to objects in the universe has been established like a ladder leading up to the sky, each rung necessary before going on to the next.

Our closest neighbor: the Moon

Let's start with the nearest celestial object, the Moon. How far away is the Moon anyway? Textbooks tell us that the Moon is about 384,000 kilometers away or about 250,000 miles away. That is a large distance, so how do we know? We don't have the ability to take one step at a time and walk to the Moon. Lasers determine the distance most accurately. By simply pointing a laser at a mirror on the Moon, placed there by astronauts that really did land on the Moon, we can determine the distance to within a centimeter or less. Over about 30 years of measurement of the distance to the Moon, we have been able to determine that the Moon is actually moving away from the Earth, about 3 centimeters per decade. This is due to the tidal effects of the Moon, and what physicists call the conservation of angular momentum.

Moving out to the planets

After the Moon, the celestial objects that are closest to the Earth are planets (ignoring the occasional asteroid and comet). Venus, Mars, and Mercury come the closest to the Earth of any of the planets.

We can most accurately determine the distance to these terrestrial planets (having a rocky surface) by using radar; after all, we haven't had any astronauts land on either planet. The technique for measuring the distance to these planets using radar is really similar to the technique used by the laser. With the laser we aim a beam at the Moon and are able to determine how long it takes

to return to us on Earth. With a radar beam, from say the Arecibo antenna in Puerto Rico, we can do the same.

We can aim a radio beam to the planets Venus and Mercury and determine the time taken for the pulse to return to us on Earth. In fact, with a little bit of mathematics, we cannot only determine the distance, but we can also determine the speed at which the planet is travelling around the Sun and the rotational speed as well.

Measuring the nearest stars

With some celestial object distances measured directly, we next approach the distance measurements to the Sun and other planets. The Greeks were keen mathematicians and they had the geometry necessary to work out the relative distance between the Sun, Earth, Moon, and nearby planets. They knew of the effect called parallax.

Parallax is the apparent change in position of an object by observing it at two different positions. You can easily demonstrate this by using your own body, namely your eyes and your finger. If you stick out your index finger in front of you at arms' length, you may notice its apparent size compared to, for instance, the clock at the back of a room. Now look at it with just one eye open and place it directly over the clock (or whatever other convenient object you have). Once positioned, now open the closed eye and close the open eye. Notice how the position of your index finger has now changed, relative to the clock (or other object) in the rear. That's parallax, and that is something that the ancient Greeks were aware of, and could use their mathematics to determine by geometry, the distance to distant objects.

Actually, with trigonometry and a couple of measurements, anyone can determine the distance to distant objects, as long as the angles involved are large enough to measure. Anyhow, geometric parallax is used to determine the next rung in our distance ladder.

It turns out the distance to the stars is so enormous (about 24 trillion miles) that we are not able to measure the geometric parallax of more than the nearest stars. Proxima Centaurus is the nearest star and its distance of 4.3 light years does not even demonstrate

a parallax of one arc second (which by the way represents 3.26 light years). The fact that no stars demonstrated any parallax to the ancient Greeks was used as a reason to believe that the Earth itself must not be moving, or we should be able to measure the parallax to the nearest stars, or so they thought.

The Greeks were not aware of the fact that without a telescope, measuring parallax as small as an arcsecond is not possible. With telescopes we can measure the geometric parallax to the nearest stars, but only about two dozen or so, even with the best individual telescopes.

Getting to the center of the Milky Way

There is another type of parallax, not related at all to geometric parallax, called spectroscopic parallax. This type of distance measure is based upon our knowledge of the different types of stars and how bright they should appear if they were all at the same distance. Technically, to understand this approach you should be familiar with the Hertzsprung-Russell (H-R) Diagram.

An H-R Diagram is a plot of stars' true brightness versus its surface temperature. Astronomers determine the surface temperature of a star by applying what is called Wien's Law. This law allows us to tell the temperature of a star by taking its spectrum. Alfred Wien determined that the peak wavelength of any object's spectrum is inversely proportional to the object's temperature. That is, if the peak wavelength of the spectrum is shorter, then its temperature is higher.

Using this information and an H-R Diagram, you can determine a star's absolute magnitude. Knowing the absolute and apparent magnitude (brightness as it appears from Earth) you can then calculate the distance. For example if you know the kind of flashlight you have, you can determine the distance to the flashlight just by measuring the brightness you observe (incorporating the dimming of light with distance, a radiation law). Thus, spectroscopic parallax is able to provide a measure of distance a good ways to the center of our own galaxy. Beyond a few thousand light years, one needs to consider variable stars.

Distances to nearby galaxies

Henrietta Leavitt is responsible for the next rung on the distance ladder. She studied thousands of stars that change brightness with time, known as Cepheid variables, for the constellation within which they were first discovered. She determined that the variation in the light received from these stars, was directly related to the star's actual luminosity, or true brightness. Then, by comparing the measured, or apparent brightness, to true brightness, she was able to determine the distances to these stars.

Edwin Hubble was able to use this technique, applying Cepheid variables to the nearest galaxies. He first used this for the Andromeda galaxy, determining its distance on the order of two million light years. Beyond a few million light years, we use the next rung, which is the Tully-Fisher relationship.

Closing in on a billion light years

The Tully-Fisher relationship is also known as the mass/luminosity relationship of spiral galaxies. Astronomers learned that they could estimate the mass of a galaxy by determining the Doppler shift of the light from opposite ends of any spiral galaxy. That's because the rotation rate of a galaxy depends on its mass. Once done, the overall luminosity of any spiral galaxy could be determined. Then by comparing its luminosity to its apparent magnitude, a simple calculation can determine the distance to the galaxy.

The Tully-Fisher relationship is sensitive enough to be used out to distances on the order of a billion light years. There is another technique for determining such distances to galaxies, and that is the use of Type Ia supernovae which works for even greater distances.

There are basically two main types of supernovae. A Type II supernova is the catastrophic explosion of a very massive individual star. Such a star has gone through all the possible fusion reactions in its core, all the way to having iron in the core. A Type Ia supernova is the detonation of a star that is part of a binary star system. These supernovae have specific measurable spectral characteristics. Astronomers have discovered that Type Ia supernovae have the same absolute brightness. Thus, all that needs to be done after a supernova has been categorized as a Type Ia is to compare its expected absolute brightness to its apparent brightness in the sky. The most recent measurements associated with Type Ia supernovae have caused astronomers to re-examine their estimates to the furthest galaxies.

The ultimate scale: cosmic distances

Edwin Hubble, and his able assistant Milton Humason, are responsible for the next rung in the distance ladder. This represents the final rung and the one that allows us to determine the distance to the furthest objects in the universe. Stated succinctly, Hubble's Law states that there is a direct relationship between the redshift of a galaxy and its distance from our own Milky Way galaxy. This relationship between galactic redshifts and their distance allows astronomers to determine distances to many billions of light years. As the universe is estimated to be less than 15 billion years old, Hubble's Law is sufficient (although arguably so) to measure the distance to

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Meeting highlights

NOVAC General Meeting

November 8, 2003

- ★ Approximately 53 people attended the 8 November General Meeting. **President Ed Karch** led the group through various club activities, including the Monthly Observing Sessions, the Outreach effort, the Mentor Program and the Library.
- ★ **Craig Tupper** summarized progress in the construction of the **Robotic Telescope**. It was announced that elections for open positions on the Board of Trustees would be held at the next meeting.
- ★ For the **Sky Tour**, **Mike Mills** talked about the rare opportunity to observe the Moon's Mare Orientale due to favorable libration.
- ★ The guest speaker was club member **Steve Robinson**, who covered the subject of cataclysmic variables. Working with the **American Association of Variable Star Observers (AAVSO)**, Steve uses his 18-inch reflector, CCD camera, and a sophisticated set-up to image high-energy objects like the occasional supernova or gamma ray burst at home, but much of his program consists of imaging these binary systems as mass is transferred from one to another with explosive results. His work is forwarded to a database used for the study of cataclysmic variables.

NOVAC General Meeting

December 14, 2003

- ★ Wintry weather kept attendance to 33 people. Election Committee representative **Bob Stewart** conducted elections for the Board of Trustees. **Rob McKinney** was elected President; **Ed Seward**, Vice President; **Bob Hand**, Secretary; **Pedro Martinez**, Treasurer; and **John Deriso** and **Bob Parks**, Trustees. The election of **Rob McKinney** to the presidential post opens a trustee slot that will be filled through an election at the January Meeting.

- ★ Rob took the floor and led the club in expressing thanks to **Ed Karch** for his 3 years of service as the club's President, as well as **John Avellone**, who is leaving the Board as a Trustee and stepping down as the club's veteran **Astronomical League** coordinator (Alcor).

- ★ For the **Sky Tour**, **Alan Figgatt** noted upcoming club events and the favorable apparition of many planets, including Mercury and Venus in the evening sky, Saturn's closest approach in about two decades, and Jupiter's rising before midnight. Mars continues to be visible but shrinking. He also highlighted the constellation Gemini, in particular the double star Castor, the open cluster M35, the Eskimo Nebula, and NGC 2419, a dim and extremely distant globular cluster.

- ★ The night's presentation was given by **Craig Tupper**, who led the group through a simulation of imaging with the **Robotic Telescope** currently located in his backyard, but ultimately destined for a West Virginia mountaintop. With help from several other NOVAC members, the project is developing nicely; an easy-to-use program was developed that will allow club members to do imaging from their home.

Board of Trustees Meeting

Tuesday, November 4, 2003

- ★ Treasurer **Pedro Martinez** circulated the club's projected budget as of October 31, 2003. Net revenue for the year stands at \$3,425.60. Questions arose regarding **Spruce Knob** expenses, which have been greatly assisted by donations. For next year, the cost of Spruce Knob could possibly be lowered by reserving fewer nights, and using the cancellation policy. It was suggested that the **Spruce Knob Year-Long Star Party** schedule for 2004 be examined at the next Board Meeting.
- ★ Membership Director **Gene LaTour** provided a summary report of membership for October 2003. There are 758 active members from 581 households.

Comments from renewal forms were positive, with praise for the newsletter, the willingness to share resources and expertise and the safety and company provided by the observing sites. One member noted that the newsletter sometimes lists events that have already taken place.

- ★ Vice President **Craig Tupper** announced that Club member **Steve Robinson** will speak on cataclysmic variable stars at the November 9 General Meeting. He also indicated a desire to do a live demonstration of the Roboscope at the December 14 General Meeting, and agreed to check with GMU Professor **Harold Geller** regarding access to the web from the Enterprise 80. Former Club president **Myron Wasiuta** will speak on Lasik surgery and observing the night sky in January. **Mike Mills** agreed to fill in for Alan Figgatt and provide the Sky Tour at the next General Meeting.

- ★ **Alan Figgatt** reported that there are two candidates for President, one each for the other three officer positions, and three candidates for the two open trustee positions. The quorum required for the elections is not different than that for holding a General Meeting, and should therefore pose no problems.

- ★ **Alan Figgatt** reported that the public is now turning out for the Friday night events at **Observatory Park**. The next event has been rescheduled for Saturday night in order to observe the lunar eclipse, and a food concession will be opened. Fairfax County schools are beginning to plan visits. Fund-raising continues, and plans for the "Quad Building" are ready for discussion.

- ★ **Astronomical League** Coordinator **John Avellone** reported that there are no requests with the League for observing certificates, but one should soon be ready for review.

- ★ In a written submission, editor **David Yustein** asked whether it was necessary to print the names and addresses of all new

members in each issue. **Gene LaTour** explained that the problem that prompted this question was a large backlog of new members, since the last newsletter listed none. It was decided to list the new members somehow, perhaps in an abbreviated format, at least until the backlog was gone.

★ Related to the newsletter listings, a question had been raised regarding the publication of the **membership list** in a secure area of the club website, replacing the more expensive annual printing of the list. Several expressed concern about adequate security on the website, and the ability of hackers to retrieve e-mail addresses from the list. It was suggested that website manager **Greg Piepol** should be asked about making a member-only section even more secure, and to set up a poll for the members asking if they would want the membership list on the website.

★ **Alan Figgatt** reported which telescopes are loaned out and which are not. In light of a query by the person who donated a 10-inch Meade SCT for club use, Alan agreed to ask the current host of that telescope, **Renee Pleasant**, to provide an update of the public programs she initiated with the telescope, that was considered too big and complex to be used as a regular loaner telescope.

★ **Bob Parks** asked about the possibility of using **Observatory Park** as a Club site. It was argued that the site would meet the needs of those on the northern side of Fairfax County seeking a convenient place to observe. It was explained that the Fairfax County Park Authority controls the park but has given responsibility to the **Analemma Society** with education as the primary purpose. A NOVAC lock could be placed on the gate, but there is concern that access could develop into a commitment by NOVAC to assist the Society with its planned programs. It was then suggested that having one or two **Monthly Observing Sessions** at Observatory Park might be considered.

★ A motion was made, seconded and carried to explore the use of **Observatory Park** for NOVAC events up to 2 times a year.

★ Discussion continued about the possibility of having a **permanent, NOVAC-owned site**. It was recalled that many supported the idea in the past, but issues of location, maintenance, and money thwarted further action. Access to **The Mountain Institute**, near Spruce Knob, was raised. It was agreed that this should be pursued further by contacting people who may have been using the site. Recalling Observing Site Coordinator **Tilly Smith's** recent e-mail regarding a site possibility near Harpers Ferry, **Bob Hand** and **Ed Karch** agreed to check it out. Some are concerned that light pollution in the area will make it a less attractive site.

★ **Bob Parks** said the recently held **MOS at Mason Neck** was a success, with some public turnout. The November event is "Lunatics Night Out" in light of the lunar eclipse. Bob then listed the dates and expected locations of 2004 MOS events, to which general agreement was expressed.

★ Outreach Committee members **Bob Traube** and **Donna Blosser** reported on upcoming activity at various schools in the area. Volunteer turnout has reached a limit, and concern was expressed about burdening the **Outreach Committee** with a variety of volunteer activity. It was agreed that the Outreach Committee would be primarily responsible for responding to requests for programs by outside groups, while others in the club would handle star parties and public nights at club observing sites.

★ **Craig Tupper** reported user interface with the **Robotic Telescope** is going well and that the structure, which will house the telescope, is near completion.

★ **John Avellone** reported that the **Sweet-16 telescope** has been re-converted to a folded telescope due to height considerations.

★ **Mike Mills** suggested that some plan needed to be developed for work on the **Powers Mirror**, and suggested that it might be best to have it professionally made while the Club focuses on building the telescope. It was agreed that the ATM SIG look at the issue and make a proposal to the Board for action.

★ **Bob Traube** reported that he had been contacted by the **Foxcroft School** near Middleburg regarding club assistance in refurbishing the school's observatory and equipment. Questions were raised regarding the use of the school as an observing site. John Deriso agreed to check with the school about such an arrangement, and then to present the idea at a General Meeting to see if some Club members might be willing to help with the observatory.

★ **Bob Parks** raised several new initiatives he had earlier suggested in e-mails, specifically, having a service requirement associated with membership, encouraging levels of advancement in the hobby beyond the beginner-oriented programs, purchasing land specifically for club use as a permanent observing site, and merging some **MOSs** with **General Meetings**. Debate over these issues included the possible need to amend the by-laws and the need for the Board to take more time than a regular meeting allows to examine the overall direction of the club and to discuss new activities with a view toward presenting a specific proposal to the Club rather than raising a more general question. There was considerable opposition to merging the MOSs and General Meetings.

★ Astronomical League President **Bob Gent** reported that the growth of AL membership has posed certain challenges and prompted a decision to open a national office. As a result, dues will increase by \$1.50 per club member. In the meantime, the AL is working on fund-raising, developing new awards and channeling efforts like the one that saved the site of the annual **Stellafane** star party. The Board recalled past debates on AL membership and concluded the issue would likely come up again in light of the dues increase.

Board of Trustees Meeting Tuesday, December 2, 2003

★ Treasurer **Pedro Martinez** circulated the club's 2003 statement of cash received and disbursed as of November 30, 2003. In summary, total cash received amounted to \$17,538.01, including \$530 to the **Ed Boyer Fund**. **Bob Parks** indicated he will work with **Kevin Beamer** to

Meeting highlights, cont.

ensure the donations for the Boyer fund are used for MOS/Mentor Program activity. Payment of \$3,700.57 for the newsletter topped the list of expenditures for a total of \$13,660.46 disbursed, leaving a net gain of \$3,877.55. Pedro also provided statistics on how a member's dues are allocated.

- ★ Membership Director **Gene LaTour** provided a summary report of membership for November 2003. There are 788 active members from 607 households. Comments from renewal forms were positive, with praise for the access to observing sites, the newsletter, the Robotic Telescope Project, and Outreach. One suggestion was for the continued inclusion of **Franklin Park** for club observing sessions.
- ★ Vice President **Craig Tupper** announced that he intends to do a live demonstration of the **Roboscope** at the December 14 General Meeting, and will use a simulator if the weather does not cooperate. Former Club president **Myron Wasiuta** will speak on Lasik surgery and observing the night sky in January, and a **George Mason University** astronomer will be speaking at the February meeting.
- ★ **Alan Figgatt** reported that a presentation was made regarding plans for **Observatory Park**, including work on the existing observatory building.
- ★ Astronomical League Coordinator **John Avellone** reported that there is one "regular" **Messier certificate** ready for presentation at the General Meeting. He also stated his intention to step down as AL coordinator at year's end. Someone has already volunteered to serve as the new coordinator, to be appointed in the new year. Appreciation was expressed for John's work as Alcor over the years.
- ★ Webmaster **Greg Piepol** reported via electronic mail that he began a process to upgrade to a higher level of **web hosting** for an additional 54 per year and that a calendar and weather satellite photos have been added to the site. He also

reported that in the past 30 days the website had 41,000 requests from 8,600 distinct users in 63 countries.

- ★ **Bob Parks** reported that the **December MOS** would be a no-frills event at **Crockett Park**, and that the January event would be dedicated to the **Mentor Program**.
- ★ Outreach Committee members **Bob Traube** and **Donna Blosser** reported on the upcoming activity. Due to a lack of volunteers, one outreach event had to be cancelled. There was some discussion on use of the **Foxcroft School** near Middleburg as an observing site, in return for helping the school revamp its telescopes and observatory facilities. John Deriso is pursuing contacts with the school on this matter.
- ★ **Mike Mills**, supported by **Pete Johnson** and **Bob Parks**, presented a proposal for building the club's 34-inch telescope. Having optics professionally made is expensive, but a good investment and preferable to the time, energy, and money for the club to do it. Instead, qualified persons could concentrate on building the telescope itself. A permanent space is needed to do this work. A trailer may be needed for transporting the telescope, and its completion will confront the club with a need to find a permanent good, dark-sky location for its use, **The Mountain Institute** being one possibility. Support was expressed for the idea of finding permanent work space for the 34-inch telescope and future club ATM projects.
- ★ **Bob Traube** circulated a new paper outlining a recognition process for service to the club and summarized comments provided during e-mail discussion. Support was expressed for the paper. At the same time, some argued that awards should be spread out to acknowledge and encourage a wide range of activity, including contributions to astronomy and not just the club.
- ★ Concern was expressed over the \$1.50

increase in per-member dues for the **Astronomical League**, that amounts to a considerable sum for a large club like NOVAC. While many continued to see merits in being associated with the Astronomical League, some feel the club is contributing much more in funds than it is getting in benefits. Subsequent discussion focused on the possibility of selective AL membership for NOVAC members. It was agreed that this issue would remain on the agenda for the next meeting.

- ★ **Bob Parks** reported that **John Nusbaum** is looking for a new coordinator for the **Year-Long Star Party**. In the meantime, given the uncertainty regarding reservation of the **Gatewood campground** and its cost each year, it was generally agreed that finding a permanent club site near Spruce Knob with very dark skies might be a better option. If this option is pursued, the club should contract an attorney for property issues.
- ★ It was generally agreed to locate two **2004 MOS** events at **Observatory Park**. Some support exists for doing an event at **Franklin** as well. **Mercer** is not viewed as a useful site, but it was concluded that its low maintenance meant there was no need to drop it now. There was agreement that NOVAC should continue in 2004 to serve as the host of the Year-Long Star Party at Spruce Knob.
- ★ Treasurer **Pedro Martinez** presented a proposed budget for the club for 2004. Anticipated income amounts to \$16,155 while expenditures amount to \$18,100, leaving a deficit of \$1,945. During the discussion, however, some felt the amount allocated to the **Robotic telescope** should be increased to allow for certain equipment purchases. Other issues which came up included the need to designate the **Ed Boyer Fund** as for either MOS or the **Mentor Program**. Pedro will revise the proposed budget in preparation for the Annual Meeting in January.

Polar alignment, from page 1

finder and setting circles much easier.

2. **Using the mount's latitude scale, adjust the altitude** (height angle) to match the latitude of the observing site. Most of NOVAC's observing sites are roughly at 39° North (Crockett and Mason Neck are approx. 38°).
3. **Position the mount so that the polar axis is pointing north** using a compass or a known landmark. If using a compass, remember that magnetic north lays about 9.5 degrees west of true north. Swing the tube to read 90° in declination. You can fine-tune the position by using the mount's azimuth adjustment to move the mount side to side.

These adjustments can be made before dark and fine-tuned after dark to position Polaris in the center of a moderate power eyepiece.

Right ascension method to refine polar alignment

Since Polaris is not precisely at the NCP, aligning on Polaris will not result in a perfect polar alignment. To get closer I use a simple method to adjust some of the offset in Polaris's position.

I am not sure where I picked up this method, but it is a moderately quick and fairly accurate method to refine the polar alignment. It is limited only by the accuracy of the mount's alignment and the setting circles.

1. **Select a bright star** as close to the celestial equator as possible, preferably a star with a declination of $\pm 10^\circ$. Depending on the season, one of these star's may be used:

Star	RA	Dec
Procyon	7h 38m	+05° 13'
Betelgeuse	5h 55m	+07° 24'
Rigel	5h 14m	-08° 12'
Altair	19h 50m	+08° 52'
Regulus	10h 08m	+11° 58'
Spica	13h 25m	-11° 09'
Polaris	02h 32m	+89° 16'

2. **Turn on the mount's right ascension drive** if equipped so that the clock drive can begin to compensate for drift while you are aligning.
3. **Site the star in the finder** and adjust its position in a medium-high power eye-

piece (one with cross hairs is preferred). When centered set the telescope's right ascension setting circle to the indicated RA value. The Dec circle should indicate the correct Dec value.

4. **Release the RA and Dec locks** and turn the telescope's tube so that the RA and Dec setting circles is set for Polaris (RE: 2h 32m' Dec: +89° 16') and lock the adjustments.
5. **Without adjusting the telescope's RA or Dec positions**, move the mount's



azimuth and altitude until Polaris is centered in the eyepiece. Be careful when adjusting the altitude on fork-mounted telescopes since the weight of the telescope may cause it to fall suddenly. Do not reset the RA or Dec setting circles.

6. **Now swing the telescope back to your first alignment star** and center it in the eyepiece. Reset the RA and Dec setting circles to the star's values.
7. **Repeat steps 5 and 6** being sure that adjustments in step 5 are done only by moving the azimuth and altitude adjustments (not RA and Dec) and adjustments to step 6 are done by moving the RA and Dec setting circles (not azimuth or altitude). Each adjustment to steps 5 and 6 will fine-tune the alignment.
8. **When you have completed step 6** without making any further adjustment to the RA setting, you are very closely polar aligned

Declination drift method for precise polar alignment

This method should only be necessary if you are planning long-exposure guided

astrophotography. You will need a high power reticle eyepiece with a reticle (use a Barlow to increase power).

Select two bright stars near the celestial equator ($\pm 5^\circ$ in Dec). One should be near the eastern horizon and the other due south within 30 minutes of the meridian. The star in the east will reveal any north-south alignment error while the star near the meridian will show errors in east-west alignment.

1. **Center the star at the meridian** and adjust the diagonal so the eyepiece is straight up and the reticle is oriented with the Dec and RA movements.
 - If the star drifts *south*, the polar axis is too far *east*
 - If the star drifts *north*, the polar axis is too far *west*Use the mount's azimuth adjustment to correct for the drift.
2. **Center the star in the East and monitor its drift.**
 - If the star drifts *south*, the polar axis is too *low*
 - If the star drifts *north*, the polar axis is too *high*Make adjustments to the polar axis by adjusting the mount's altitude adjustment.
3. **Repeat steps 2 and 3** until the drifts are cancelled.

More information on polar alignment

Websites

Celestron's website has more detailed information at:

www.celestron.com/polar.htm

See also:

www.onlinecol.com/users/daveastro/polar.html

Books

- The Backyard Astronomer's Guide*;
Dickinson, Terence and Dyer, Alan;
Firefly Books, 1991; pp 259–61
- How to Use an Astronomical Telescope*;
Muirden, James; Simon & Schuster, 1985;
pp 52–6
- Astrophotography for the Amateur*;
Covington, Michael; Cambridge
University Press, 1991; p.94

I think most, if not all, of these books have been revised since I bought them, but I am sure the revisions all have sections on polar alignment. ★

Message,

from page 1

people who are NOVAC are neat folks. And having been a Trustee in 2003, I've experienced the dedication to the hobby and the wealth of ideas the club officers and members provide. Honestly, I'm certain I'll get more out of this next year than I might give! What do you want in 2004, for NOVAC, for yourself? The Board serves the club, serves you, and serves the larger goals of our hobby as well. I encourage you to participate, both in your solitary pursuit of observing and in the activities the club sponsors. I encourage you to encourage others to join NOVAC. And I encourage you to put me and the other club officers to work on your behalf. I look forward to seeing you under the starry heaven. That is, if we can bring ourselves to look down from all that sparkles above. ★

Distance,

from page 3

quasars, the most distant galaxies known in our universe.

Thus, I hope I conveyed the works that have allowed us to take a measure of the celestial objects, from the Moon to the stars, and the most distant galaxies beyond.

Web links of interest

Sonoma University presentation on Cosmic Distance Scale:

nbsp.sonoma.edu/resources/presentations/nbsp_distances/nbsp_distances.ppt

Michigan State University presentation on Cosmic Distance Ladder:

www.pa.msu.edu/courses/isp205/sec-1/w11end.pdf

Humboldt University presentation on the Cosmic Distance Scale:

www.humboldt.edu/~phyx/faculty/kornreich/104/Lec34.html

University of Washington Astronomy Labs (including distance measures):

www.astro.washington.edu/labs/clearinghouse/labs/labs.html

We would like to thank Robert Ehrlich for his review of and recommendations to this article. ★

Monthly Observing Sessions

2004 Schedule

January 17	Crockett Park	Mentor Month
February 14	Camp Highroad	
March 20	Camp Highroad	Messier Marathon
April 24	Mason Neck SP	
May 15	Crockett Park	Astronomy Day
June 12	Crockett Park	NOVAC Picnic
July 10	Mercer Park	
August 7	Spruce Knob	
September 11	Crockett Park	NOVAC Star Gaze
October 16	Mason Neck SP	
November 13	Mercer Park	
December 11	Camp Highroad	

Welcome to our new members!

Paolo Amedeo	Jason T. Luttgens
Steve Anolik	Gary Lee Mahmoud
Larry Bell	Steven Meyers
Laurent S. Bernard	Paul A. Minkus
William A. Blackwell & Howard Balmer	Eileen Molinari
Larry Boyer	Stephen P. & Marsha H. Nelson
Weihshueh Chiu	Tim Nicholson
Douglas & Marianne Cook	Monica Ouedraogo
Chris Cordova	Antonio J. Pena
Linda Gudrun Corey	Marc Pfeiffer
Roberta A. Culver	Art and Susan Powell
Mike DiBona	James Providakes & family
Wade Duvall	John Radin
J. Mark Evans	Carter Starnes
Kit Farwell	Ciprian Sufitchi
Mark, Marta, Eric & Cheryl Hansen	Terry Treadwell
Michael and Tiffini Janowich	Pat & Carl Tribble
David M. Komar	Bijan Vakili
Alice M. Kottmyer	

Events in January and February

Shading indicates days that Crockett Park is open

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
4 * Earth at perihelion	5	6 Monthly Board meeting	7 FULL MOON	8	9 Prime observing	10 Prime observing
11 General meeting 7pm @GMU	12	13	14 LAST QUARTER	15	16	17 MOS, Crockett Park
18 ATM-SIG meeting (location TBA)	19 Martin Luther King, Jr., Day	20	21 NEW MOON	22	23	24 Public observing, Crockett Park
25	26	27	28 FIRST QUARTER	29	30	31
FEB 1	2 Groundhog Day	3	4	5	6 FULL MOON	7
8 General meeting 7pm @GMU	9	10	11	12	13 LAST QUARTER	14 St. Valentine's Day MOS, Great Falls
15 ATM-SIG meeting (location TBA)	16 President's Day	17	18	19	20 NEW MOON	21 Public observing, Crockett Park
22	23	24	25	26	27 FIRST QUARTER	28
29	MAR 1	2	3	4	5	6 FULL MOON

“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
gene12r@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, February 6 for the March/April 2004 newsletter.

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Announcements • Monthly Observing Sessions • Welcome to our new members!

Regular features • Message from the (new) President • Meeting highlights • Events in January and February • Jeff's observing report • Sky maps



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