

NOVAC

THE NEWSLETTER OF THE NORTHERN VIRGINIA ASTRONOMY CLUB

NO. 128 • VOL. 27 • NOVEMBER/DECEMBER 2006

The planet in the machine

by Diane K. Fisher and Tony Phillips

The story goes that a butterfly flapping its wings in Brazil can, over time, cause a tornado in Kansas. The “butterfly effect” is a common term to evoke the complexity of interdependent variables affecting weather around the globe. It alludes to the notion that small changes in initial conditions can cause wildly varying outcomes.

Now imagine millions of butterflies flapping their wings. And flies and crickets and birds. Now you understand why weather is so complex.

All kidding aside, insects are not in control. The real “butterfly effect” is driven by, for example, global winds and ocean currents, polar ice (melting and freezing), clouds and rain, and blowing desert dust. All these things interact with one another in bewilderingly complicated ways.

And then there’s the human race. If a butterfly can cause a tornado, what can humans cause with their boundlessly reckless disturbances of initial conditions?

Understanding how it all fits together is a relatively new field called Earth system science. Earth system scientists work on building and fine-tuning mathematical models (computer programs) that describe the complex inter-relationships of Earth’s carbon, water, energy, and trace gases as they are exchanged between the terrestrial biosphere and the atmosphere. Ultimately, they hope to understand Earth as an integrated system and to model changes in climate over



continued on page 3

MESSAGE FROM THE PRESIDENT

A new structure for the next generation!

The year is coming to a close and NOVAC is preparing for another election.

I’m not running for another term for a variety of reasons. The combination of being NOVAC president, Almost Heaven Star Party (AHSP) director, Virginia Outdoor Lighting Taskforce (VOLT) director, as well as spending time with my family and running a consulting business simply hasn’t left time for anything else—like observing! In my last article as president, I’m going to share some revelations and move forward with a plan introduced earlier.

After 25 years we have close to thousand members and NOVAC stands at a crossroads. While it is possible to continue to operate the club just as we have in the past, our growth in membership and related services is putting a strain on the club—specifically, on those members that volunteer a lot of their time. Recently, I took an informal survey of the volunteer time being invested in the NOVAC each year and found out it’s over 3,000 hours a year! The results confirmed what I have suspected; it requires a monumental effort to keep this club going.

The good news is that we are maintaining just enough volunteer involvement to allow us to offer events and services that make us one of the top astronomy clubs in the world. These services help us continue to draw new members, which in turn provide the funds necessary to take on new projects, such as



NOVAC President
Bob Parks

continued on page 4

ASTROPHOTO CORNER: M42 BY BYRON BERGERT



M42 with six geostationary satellites

- Taken November 25, 2006, UTC 07:22
- StellarVue SV80S APO, G11G mount guided with ST402ME and CCDOPS.
- Canon EOS 20DA
- Helicopter Landing Site
- 1 four minute exposure at ISO 800 processed with ImagesPlus (the sixth satellite is located in the lower right corner and may be a “tumbler”)



OFFICERS 2006

President

Bob Parks president@novac.com

Vice President

Phil Wherry vp@novac.com

Secretary

Barnaby Harkins secretary@novac.com

Treasurer

Pedro Martinez 703-534-2604
treasurer@novac.com

Trustees

Donna Blosser cdblos@erols.com

Alan Figgatt 703-860-8239
afiggatt@erols.com

Tom Finkenbinder tom@newedgecapital.com

Lyle Mars jonmars@cox.net

John Stewart thestewarts@erols.com

Directors

Membership Director

Kent Allingham kent.allingham@
verizonbusiness.com

Outreach POC

John Stewart thestewarts@erols.com

Important NOVAC Numbers

Savage (Chris Pauley) wodtrail@erols.com

Mason Neck SP 703-550-9960

Crockett Park 540-788-4867

NOVAC Web Site

www.novac.com

Webmaster

Phil Wherry psw@wherry.com

NOVAC Newsletter

Editor

Debra Van Putten newsletters@novac.com

Design & layout

Kim Bieler www.kbgd.com

Getting started on the Messier Awards

by Laquetta Karch

What is the Messier Certificate?

Charles Messier (1730–1817) was a French comet-hunter. He made a list of deep sky objects that resembled comets in the optics of his time so that he and his colleagues could avoid them. Ironically, what he is remembered for today is that list of objects which are some of the most beautiful objects in our night sky.

The Astronomical League offers a certificate for observing and logging information on 70 of them and a certificate and pin for observing and logging all 110. If you like using binoculars, they also have a certificate and pin for observing 50 in binoculars (several NOVAC members have observed all 110 in binoculars). If you go to the “Resources” page on the NOVAC website, and scroll down to “Astronomical League,” you will find a list of club members who have completed the requirements for these awards (www.novac.com/resources/al/).

What are the requirements for the certificates and pins?

Well, the intent of the award is to encourage people to learn the night sky as well as introduce them to the beauty of the objects, so the first rule is that you must find the objects manually . . . no use of electronic digital setting circles/go-tos to find the objects is allowed. Second, there is the requirement to observe the objects and keep a record of your observations. Finally, give your log to your club’s awards coordinator (in NOVAC, that’s the ALCor) who will read your log and write a letter to the awards coordinators certifying that you have met all the requirements for observing and logging the required number of objects.

What am I required to log?

The sponsors of the various observing awards set the criteria, so always be sure to check the Astronomical League website

continued on page 3

Messier object descriptions

OPEN CLUSTERS

1. Can the cluster be distinguished from the background stars?
2. What is the overall shape of the cluster?
3. Are there more stars in one area than another?
4. Are there any particularly bright stars?
5. If so, can you see color in any of them?
6. Is there any area devoid of stars?
7. Any other object in the same field?

GLOBULAR CLUSTERS

1. What is the shape?
2. Are all of the stars concentrated in the center?
3. Are there any outlying stars? Any color?
4. Any other object in the same field?

PLANETARY NEBULA

1. What is the shape?
2. Is there any color?
3. Are the edges sharp or diffuse?
4. Is one area brighter or dimmer than another?
5. Any other object in the same field?
6. Do filters make a difference? Which ones?

GALAXIES

1. What is the shape?
2. Is it uniformly bright?
3. Are there bright patches within it?
4. Are the edges fuzzy or sharp?
5. Does it seem smooth or grainy?
6. Any other object in the same field?

NEBULAE

1. What is the shape?
2. Are some parts brighter than others?
3. Any stars seem to be part of the nebula?
4. Are nebula outer edges sharp or fuzzy?
5. Any other object in the same field?
6. Do filters make a difference? Which ones?

DOUBLES

1. Any star color observed?
2. Magnitude of each of the stars
3. Seconds of separation and angle of separation
4. Seeing
5. Power used to split

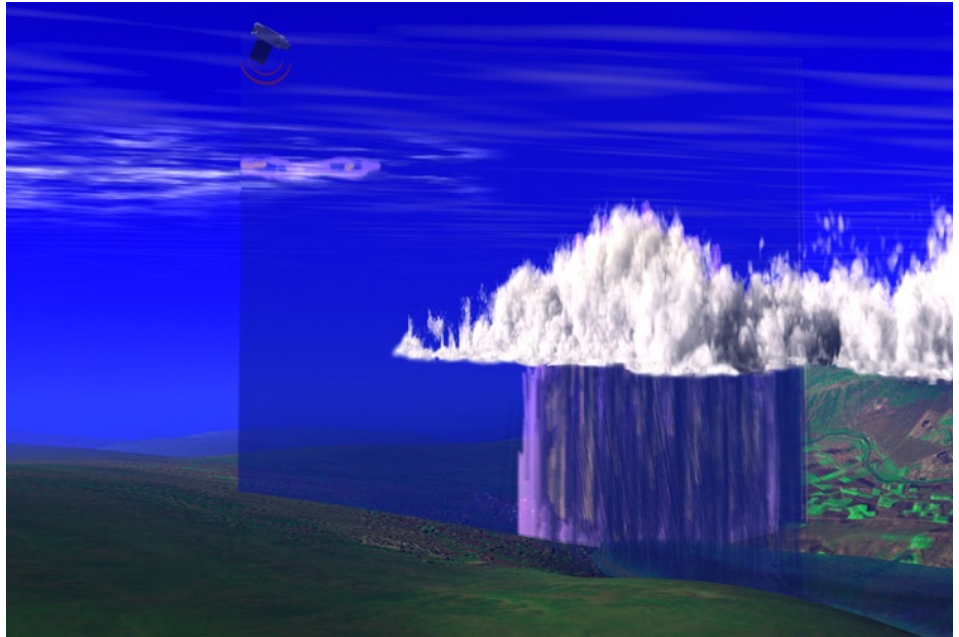
Earth system, from page 1

the next 50–100 years. The better the models, the more accurate and detailed will be the image in the crystal ball.

NASA's Earth System Science program provides real-world data for these models via a swarm of Earth-observing satellites. The satellites, which go by names like Terra and Aqua, keep an eye on Earth's land, biosphere, atmosphere, clouds, ice, and oceans. The data they collect are crucial to the modeling efforts.

Some models aim to predict short-term effects—in other words, weather. They may become part of severe weather warning systems and actually save lives. Other models aim to predict long-term effects—or climate. But, long-term predictions are much more difficult and much less likely to be believed by the general population, since only time can actually prove or disprove their validity. After all, small errors become large errors as the model is left to run into the future. However, as the models are further validated with near- and longer-term data, and as different models converge on a common scenario, they become more and more trustworthy to show us the future while we can still do something about it—we hope.

For a listing and more information on



CloudSat is one of the Earth observing satellites collecting data that will help develop and refine atmospheric circulation models and other types of weather and climate models. CloudSat's unique radar system reads the vertical structure of clouds, including liquid water and ice content, and how clouds affect the distribution of the Sun's energy in the atmosphere. See animation of this data simulation at www.nasa.gov/mission_pages/calipso/multimedia/cloud_calip_mm.html.

each of NASA's (and their partners') Earth data-gathering missions, visit science.hq.nasa.gov/missions/earth.html. Kids can get an easy introduction to Earth system science and play Earthy word games at spaceplace.nasa.gov/en/kids/earth/wordfind. *

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Messier, from page 2

at www.astroleague.org/observing.html to get the most up-to-date information and a list of Messier objects grouped by season. Currently, the regular Messier certificate requirements state that:

Your notes must show:

- Date of observation;
- Time of observation;
- Seeing conditions;
- Aperture size of telescope;
- Power used;
- A short note describing your observation of the object.

Also include the observing location, since the sponsor always requires that information be provided in the cover/certification letter.

The binocular award requires essentially the same information, but substitutes size and power of the binoculars for the telescope aperture and power used. The binocular rules state:

To record your observations, you may use the log sheets found in the back of the Astronomical League's manual "Observe: A Guide to the Messier Objects," or any similar log sheet. The required information is: the name of the object; date and time of the observation; an estimate of the seeing and transparency; the size and power of the binoculars used; and perhaps, a brief comment on what you saw.

Am I required to use paper forms? May I log electronically?

You may keep paper records or electronic ones, whichever you prefer as long as you record the required information.

May I do all my observations in one night at the spring Messier Marathon?

The A.L.'s website states:

"Messier marathon" sessions where all the objects are found in one occasion is to be discouraged if the beginning observer depends on other experienced observers to find the object to be observed.

What should I record under seeing conditions? May I use limiting magnitude?

The Binocular Messier Certificate requires seeing and transparency so you must provide them for the Binocular certificate. The regular Messier Certificate simply requires "seeing conditions"; however, seeing and transparency are common ways of describing seeing conditions. Limiting magnitude is one way of talking about transparency. There are several scales available for transparency and for seeing and you may use whichever ones you like. Other useful pieces of information you might want to include are temperature, moisture content of the air, local light pollution and similar items.

What am I required to include in my note? I don't have a scientific background.

New observers should not feel intimidated by this requirement. There are no rules for the content or length of the note, just that you

continued on page 8

President's message, from page 1

RoboScope. It also allows us to improve existing services like the NOVAC website, newsletter, library, loaner scopes and observing sites.

The bad news is that we continue to wear out a lot of our "superstar" volunteers. While we may have come to accept this as a normal process, it reflects some serious structural issues that should be addressed to minimize the strain that is continually put on a relatively few volunteers.

In the beginning, NOVAC consisted of less than 50 members. Bylaws were created that placed a great deal of the responsibility for the operation of the club on the president. At that time, there weren't many services with the exception of the general meeting and the newsletter. The president

I believe our membership needs to understand how much effort is being invested and why we have grown too large to expect a handful of members to run the club.

was charged with appointing members to positions necessary to fulfill the mission of the club and forming committees. Since that time, the club has grown almost twenty-fold and the growth in services has kept pace. What has lagged behind is the management structure of the club. We still rely on the president to make most of the decisions and maintain many other responsibilities related to the services offered.

As part of a study to quantify what is required to run the club, I recently asked many of our volunteers to estimate the time they spent on the club's behalf. I believe our membership needs to understand how much effort is being invested and why we have grown too large to expect a handful of members to run the club. For years I thought that the biggest problem the club faced was the lack of volunteers; to my surprise, that isn't the biggest concern. The problem isn't finding members willing to help — it's finding somebody to manage and motivate them. In the past, this has primarily been

the job of the president. For every new volunteer recruited, somebody needs to spend additional time to help him or her get up to speed and to stay motivated. As the list of positions has grown, the time required to manage this volunteer effort has exceeded what can be reasonably expected from a single volunteer. For the last two presidents, the annual investment has exceeded 450 hours a year!

A review of the membership rolls revealed that about 85 members, or about 10 percent of the club regularly volunteer in some way. Of this group, 9 members spend 100 hours or more each year, and 5 of these spend over two hundred hours each year. To

put this into perspective, 1% of the membership contributes over 50% of the total time needed to run the club each year. It's not fair to expect so small a group to take on so much, just because they will. We need to break the cycle, because the inevitable result is burnout. The members who don't say "no" eventually will say "goodbye" instead. Some leave the club completely; some take extended absences, often for years. When they do come back, they seldom become involved again. They feel, rightly so, that they have paid their "dues" for life.

Unless we take measures to share the management load as well as the total time invested among more members, we will

NOVAC Committees

Program & Special Events

Chair	Open
General Meeting Program	Open
Speaker Acquisition	Open
Annual Picnic Coordinator	Open
Star Gaze Coordinator	Open
Astronomy Day Coordinator	Open
AHSP Coordinator	Open
Messier Marathon Coordinator	Open
Youth & Children Programs	Open
Volunteer Recognition & Rewards	Open

Public & Media Relations

Chair	Open
Media Relations	Open
Community Relations	Open

Finance/Fundraising

Chair	Open
Members	Bob Parks Barnaby Harkins Phil Wherry Harold Geller Tom Finkenbinder John Stewart

Observing Sites/MOS

Chair	Open
New Site Acquisition	John Mars
Crocket Coordinator	Jim Mosquera
Mason Neck Coordinator	Rob McKinney
Camp Highroad Coordinator	Ramon Miro
Savage Coordinator	Bob Stewart
TMI Coordinator	Open
Fringe Group Chair	Open
MOS Coordinator	Mike Mills
MOS Assistant	Open

Outreach & Education

Chair	Open
Outreach Coordinator	John Stewart
Light Pollution Coordinator	Open
JPL Solar System Ambassador	Open
Night Sky Network	Esther Li
Education Liaison	Open
Science Fair Judges	Bill Burton David Eastin
Astronomical League Liaison	Laquetta Karch
Astronomy Clubs Liaison	Open
Analemma Society Liaison	Alan Figgatt
VAAS Liaison	Barnaby Harkins

Member Services

Chair	Open
Webmaster	Open
Web Design	Kim Bieler
Web Development	Phil Wherry Matt Roper Harry Foxwell Bryan Anschuetz
ListServ Manager	Chewing Toulmin
Newsletter Editor	Debra Van Putten
Writers	Open
Loaner Scope Coordinator	Bob Parks
Librarian	John Deriso
Audio-Visual, Video & Photo	Open

Membership & Volunteer Development

Chair	Open
Membership Director	Kent Allingham
Membership Development	Open
Mentor Coordinator	Open
Volunteer Recruiting	Open
First Contact Team	Open
Awards & Motivation	Open

continue to operate what I call the “NOVAC Black Hole.” We as a club also suffer as a result of the volunteer burnout. Each time a member moves on, we lose the institutional knowledge and experience of these leaders. They possess the ideas and imagination needed most to advance NOVAC and meet the challenges of the Next Generation. We can’t afford to lose them.

We need to implement the committee structure that was outlined in the May/June 2006 issue of this newsletter. At the end of this article, is a revised list of the committee structure. It shows the names of volunteers that already are participating in the operation and management of the club, as well as the vacancies that exist. We need your help. Please make a commitment to keep the wheels of NOVAC turning. The chair positions will be the day-to-day managers of the club and each chair will be responsible for finding members to fill the positions on their committee.

The goal of this initiative is to better utilize the existing pool of talent and volun-

teer investment that currently exists in the club. We must start to move some of our superstars into managing small teams of volunteers who invest a modest amount of time to help the club in a clearly defined role. It has been my experience that most members are willing to give the club a few hours when

The goal of this initiative is to better utilize the existing pool of talent and volunteer investment that currently exists in the club

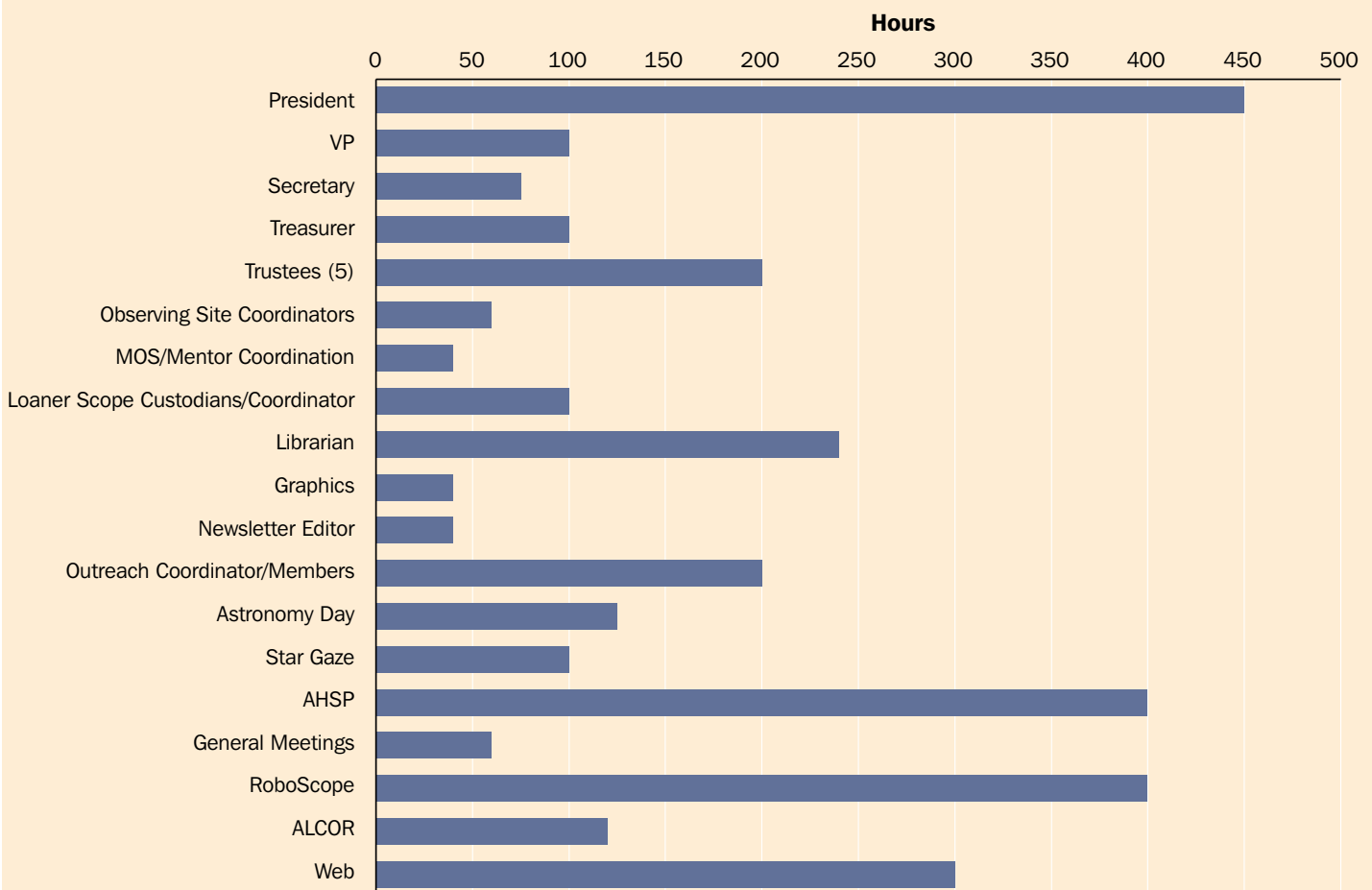
asked, but many are wary of the NOVAC Black Hole. If we can disperse the management of the club and diffuse the 3,000+ hours of volunteer investment more evenly over the 10 percent of volunteers that already regularly lend a hand, we will easily meet the challenge for the Next Generation. In the process, we will also be able to stem the flow

of our superstars who regularly get sucked into the NOVAC Black Hole.

In closing, I personally thank the many members who have answered the call to assist NOVAC while I have been president. I will continue my service as the AHSP director and I hope to increase the profile and educational activities of VOLT.

Our annual volunteer award presentation ceremony and elections will be held at the December general meeting. Immediately prior to the general meeting, a reception with food and refreshments will be held for our volunteers. The reception is a way to thank all the members that have kept NOVAC going this year and to let members get to know each other a little better. It is open to anyone who has volunteered to help the club this year and to members who would like to become volunteers. Please come to the reception and discover how rewarding it is to be involved. We have a great club, please be a part of making it even better. ★

NOVAC volunteer investment



Developing an astro-outreach presentation

by Max Corneau

To Observe and to Help Others Observe” is NOVAC’s motto. In keeping with this motto, I would like to inform you about my latest JPL Solar System Ambassador (SSA) presentation. I don’t present “canned” information from JPL, although so much of it is downright amazing. My SSA outreach presentations result from observing groups, thinking about space, science, and astronomy, then allowing it all to “come together.”

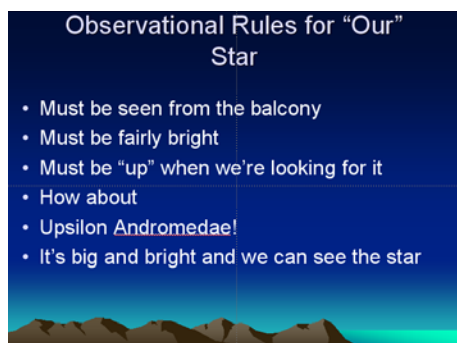
This latest presentation, given for the first time on October 6th in Westerly, Rhode Island, takes the audience on an adventure that is both hands-on and decidedly other-worldly. The presentation has two parts. In the first, a stage-setter, the audience is introduced to the vast expanse of our Universe in nine easy steps as a frame of reference. After explaining the Sun is an average star and putting things in perspective with a handy box of Morton Salt to represent stars and galaxies, the subject turns to NASA’s Planet Quest mission.

Why this subject matter for an SSA presentation? I believe strongly in the search for extra-solar planets as a fundamental step on our quest to discover life beyond Earth. Unfortunately, NASA’s difficult budget process has cut much of Planet Quest’s funding. A primary goal, besides teaching, in presenting this program is to inspire a generation of young people who will want us to continue on this noble quest.

Typical of JPL efforts, Planet Quest has a website and it’s really appealing to nearly all ages and education levels. The URL is planetquest.jpl.nasa.gov/index.cfm To demonstrate that the Planet Quest is alive and here today, the program begins by pointing out that someday we will be able to navigate to other planets where life might exist and then dramatically (lights dim, salt goes away) introduce a screenshot of the website on the day I started building the presentation. On that day the dynamic planet count was 194. On the first day of presentation, two weeks later, the count contained four more newly discovered planets.

We spend time navigating the site and then I introduce a star with planets that will be “ours.” Criteria for the evening’s target extra-solar host star varies according to the venue and visibility. For the Rhode Island presentation, here’s the criteria that led us to

choose Upsilon Andromedae on this night:

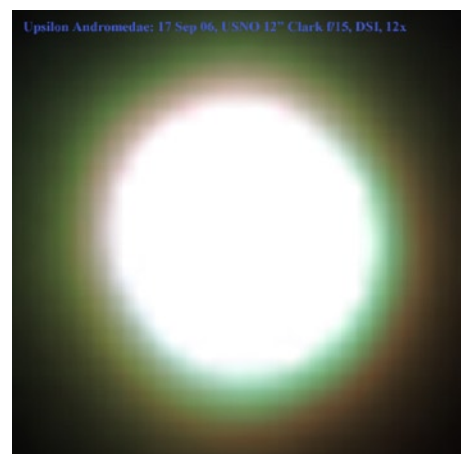


In preparation for the presentation I made an image of “our” star and grossly enlarged it for effect (at right). Since it’s astronomy, and I believe strongly in “Observe and Help Others Observe” everyone would see the star for themselves through my 80mm refractor. Of course, weather holds the ultimate trump card on weather we ever do any observing. Typical of an October night in Rhode Island, the skies were totally overcast on the night of the presentation. Thanks to the wonderful support staff at the historic Westerly Public Library, we had an enjoyable night of discussion and snacks after the presentation in lieu of hands on observing. Instead of far-out science

fiction or extremely complex physics, this program balances a sense of science with a feeling of real discovery as observers see the actual mystery with their own eyes.

Just one more thing, this is a living presentation. Note that on the day I first created it, the extra-solar planet count was 194. As of this writing, the count remains 199. Imagine that on the image to the left, there lies a planet in the goldilocks zone . . . the same place Earth resides in its Solar domain. *

Max Corneau is a NOVAC member and JPL Solar System Ambassador



New observing site—Great Meadows

NOVAC has a new observing site. Great Meadow is a 200-acre site dedicated to the preservation of open space located near The Plains, VA. The focus of the facility is equestrian events including the Gold Cup (greatmeadow.org/index.cfm).

We are working out the fine details including access and schedule. Initially, the site will be available based on a fixed schedule. So it will be important members refer to the observing sites section of the NOVAC website before heading out to observe. To introduce the club to the new site, we changed the location of the November 18th MOS from Camp Highroad to Great Meadow.

Watch the NOVAC website for more info about the site and details like access and parking. Please come out and see the new site for yourself. The location is just far enough out that it is substantially darker than any of our existing local observing sites. We hope that over time this site may evolve into a replacement for the club’s major events. We have no plans to discontinue the use of any of our existing observing sites. However, once our negotiations with Great Meadow are complete, we will have a much darker observing site within 40 minutes of Fairfax, VA.



“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 (olgazer@verizon.net). A full list of titles is available from the club website.

Private email listserv

Members keep up with current club information by subscribing to the NOVAC email list, without fear of flame wars or spam emails.

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 \$30.00 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:

Kent Allingham
3510 Country Hill Drive
Fairfax, VA 22030
kent.allingham@verizonbusiness.com

Change of address

All notices of change of address should be sent to Kent Allingham. 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, Debra Van Putten, at newsletters@novac.com.

The deadline for submissions is two weeks in advance of publication: Friday, December 15 for the January/February 2007 newsletter.

© Copyright 2006, The Northern Virginia Astronomy Club. All rights reserved.

The NOVAC Newsletter may be reproduced with proper attribution.

Messier, from page 3

say something. It's your log and what you say and how much or how little is up to you. Ask yourself what kinds of things you'd like to know about that night if you were to reread your log in a few years. See page 2 for a list of ideas if you have trouble getting started.

What are some resources to get me started?

There are lots of good books, but two I like are:

- *The Year-Round Messier Marathon Field Guide: With Complete Maps, Charts and Tips to Guide You to Enjoying the Most Famous List of Deep-Sky Objects* by H.C. Pennington. (Willmann-Bell, July 1997, ISBN: 0943396549)
- Stephen James O'Meara's *Deep Sky Companions: The Messier Objects* (Cambridge University Press, July 2000, ISBN: 0521553326).

Pennington's book is a very practical observing book. "Guidepost stars" and finder charts point the way to the detail pages which show star hops to the objects *and* drawings of what the objects can be expected to

look like in a 10x50 finder (both right angle and straight-through) and in the telescope. Additionally, Telrad circles are drawn on the charts to assist in the star hops. O'Meara's book contains lots of detailed information on the objects plus his wonderful drawings of the objects and is a reference book I enjoy going back to time after time. Both can be had used off the internet for \$16 or less at the time I wrote this article.

Finally, there is also information on these

objects on the web. One of the oldest sites is the SEDS group at www.seds.org/messier/ and it is a good place to start. NASA's Astronomy Picture of the Day site has an index to their Messier object photos and information at www.apod.nasa.gov/apod/lib/messier.htm. Googling "Messier Objects" will turn up even more links. ★

Laquetta Karch is NOVAC's Astronomical League Coordinator (alcor@novac.com).

ASTROPHOTO CORNER: M45 BY TOM KENNEDY



The Pleiades

- Taken on October 21, 2006, at Savage Farm, VA
- F7, 80mm; 3 mins
- 11 images stacked
- ISO 1600; (dark subtract) w/autoguidin



THE NORTHERN VIRGINIA ASTRONOMY CLUB

c/o Kent Allingham, Membership Director
3510 Country Hill Drive
Fairfax, VA 22030

Non-Profit Org.
US Postage Paid
Reston, VA
Permit No. 6595