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THE NHAS OBSERVER

Newsletter of the New Hampshire Astronomical Society

"All the news that fits in print"



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Astronomy Book & Social

At this month's meeting, the special guest is **YOU**. We're having an Astronomy Social after the business meeting, and this is typically a time to mingle and chat with each other. But we'd like you to bring a favorite Astronomy book and tell us what you liked about it. Jot down your thoughts on some index cards and bring them with the book. You don't need to make a polished speech, just tell us in your own words what you learned from the book and why we might want to read it.

President's Message

First, I'd like to thank the outgoing officers for all their hard work in 2001. NHAS continues to flourish and grow thanks to the dedication and effort of the most active members. As I write this, it occurs to me that this means you don't have to be an officer to make a significant contribution. There will be many opportunities in the coming year to participate in NHAS events.

In the near future, NHAS will host its annual FYB (that's "Freeze Your Buns") observing session at YFOS (the NHAS observing site; for more information or directions, write us via e-mail or regular mail; addresses are on the back of this newsletter). Also, we look forward to the Messier Marathon, Astronomy Day, numerous observing sessions, and Coffee Houses at YFOS. Several non-NHAS sponsored events are also well attended by NHAS members, such as Stellafane, Northeast Regional Star Party, and Northeast Astronomical Forum (in Suffern, NY). More information on each available event will be mentioned in either the NHAS newsletter, e-mail, or NHAS website calendar. I hope that you find something that interests you and take advantage of your NHAS membership.

Lastly, I welcome the new members and officers of 2002, and welcome back, veterans! I wish everyone health and happiness in the new year!

★ Barbara O'Connell

Election Results



Elections for 2002 NHAS officers were held at the Dec. 21, 2001 meeting. **Ed Ting** and **Bob Sletten** counted ballots. President, Treasurer, and Secretary slots went uncontested.

The new slate of officers appears in the photo, left to right:

Treasurer: **Jim Warena**
Secretary: **Michael Frascinella**
President: **Barbara O'Connell**

Vice President: **Joe Derek**
Board members (not shown): **Chase McNiss** and **John Pappas**

The voting details for Vice President and Board member were:

Vice President:

Joel Harris – 11 votes
Joe Derek – 12 votes
Bob Bain – 2 votes

Board:

John Blackwell – 2 votes
Chase McNiss – 14 votes
John Pappas – 8 votes

Because Barbara O'Connell won the President's position, a second vote was

taken to fill her vacated board chairman position, which runs until Dec. 2003.

Board Chairman:

Joel Harris - 8 votes
John Pappas - 9 votes
Bob Bain - 5 votes
Undecided - 1

The ballots are available for review and recount if deemed necessary.

★ Bob Sletten

Feature Story

More on the Leonids.....Page 2

Public Observing Highlights

Skywatches at East Derry on Nov. 29 and in New London on Dec. 4 were clouded out. The CMP Skywatch on Dec. 7 was well-attended, however. A few members of the general public kept us there until after 11 p.m. Views of Saturn and Jupiter were outstanding once the air settled down. We also picked up a couple of new members. The CMP Legislative Invitational on Dec. 12 was clouded out, although **Mike Townsend** did present a static scope display.

On Dec. 20, **Herb Bubert, Mike Townsend**, and I went to the Boy Scout Troop #240 in Derry. It was clear when we set out, but once we got there it had clouded over and snowflakes were flying. I brought my children's slide show and talked to the kids about astronomy for about 45 minutes. We were nearly mobbed afterwards, as boy scouts and parents alike flooded us with questions about observing and telescopes. There was much interest in my 6-inch homemade Dob, and one ambitious young scout even declared that he wanted to make one too!

Also, I recently uploaded the 2002 NHAS calendar. Please check my work, and advise me of any events I may have missed. You will notice, we will have somewhat more CMP events in 2002 than in the past.

★ Ed Ting

The annual 5th Grade Observing Session at Bow Memorial School was held under clear skies on Dec. 11. It was coupled with a science fair so more than 100 parents and students braved the cold to peek through the telescopes. Six astronomers manned the array of five telescopes (and binoculars) to keep many of the major objects on display. Objects included Saturn, Mars, Jupiter, Andromeda Galaxy, Ring Nebula, Pleiades, and Albireo. The binoculars gave the kids something they could hold and quickly compare to the naked eye view. Attending astronomers were **Andy Jaffe, Michael Frascinella, Bob Bain,**

Larry Lopez, Eric Fiske, and Bob Sletten.

The teacher and many students and parents expressed their appreciation.

★ Bob Sletten

ATM True Grit and F-F-F-Freeze Your Buns

The ATM next meeting will be on January 13 at noon at the Lopez Lapidarium in New Boston.

It doesn't sound so bad if you say Congelate I Vostri Panini. The FYB event takes place at YFOS on Jan. 11. Contact me at lopez@mv.mv.com.

★ Larry Lopez

More on the Leonids

Having observed meteor showers for almost thirty years, I really had to hold back my excitement this year for the Leonids. Incredible estimates for storm levels (4,000/hr.) sounded too good to be true. I had seen the display of fireballs in 1996 but missed the subsequent displays between 1997-2000 due to poor weather and other commitments. Fortunately, the weather held and the evening of the 17th boasted only a small amount of haze that cleared shortly after midnight. Of course, there was a trade off. Clear skies also meant subfreezing temperatures to put a little chill in our bones.

Pollyann and I arrived at YFOS shortly after midnight dressed for the cold weather. After settling in, we were immediately treated with a display that was already at rates better than my 1996 observations. Recording the essential data of each meteor, I was able to count 47 Leonids in the time period between 1:40-2:40 a.m. Several were bright fireballs and many left

trains. To be ready for the peak display time, we took a lengthy break to warm up and get something to drink. We could hear each OOOO and AAHHH from inside and it was clear that rates were already picking up.

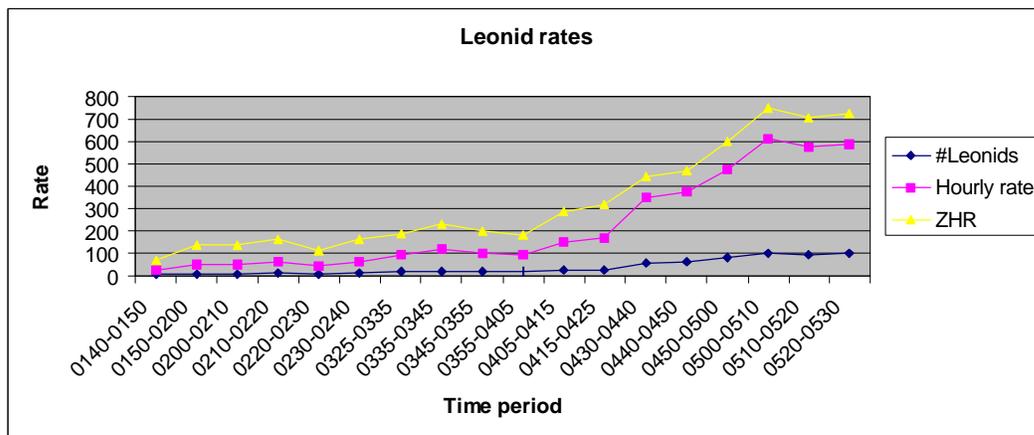
By the time I resumed my counts at 3:25 a.m., rates had doubled to 100 an hour. The fireballs continued to fly and several long trains were observed. One lasted six minutes. As Leo continued to rise, I realized that I had difficulty recording the data as rates kept climbing. This was not unexpected and I had come prepared for such an instance.

By 4:25, Leonids were being seen at about 3 per minute. I now shifted to plan B for recording the rates. I performed 10-minute counts with a simple hand counter, which I advanced every time I saw a Leonid. This worked well and I was able to easily record the number of meteors without any need for looking down at my clipboard.

By 5 a.m., the time of the predicted peak, the rates had more than tripled to 10 per minute (600 per hour). There were point meteors and instances of multiple meteors appearing at the same time. The one distinct characteristic I noted was the Leonids were quick, and over half left ion trains.

By 5:30 a.m., twilight began to interfere and I chose to end my counts. Yet, as I was gathering my gear, I could see more meteors crossing the sky and got the feeling that the rates were still climbing. It is very possible we missed the predicted meteor storm by only 30-60 minutes.

The figure below graphs my record of meteors during each 10-minute period of observation. ZHR is the computed



rate one would have had if the radiant were directly at the zenith.

As Polly and I drove away that morning, I wondered if we had seen the predicted storm. After looking back at the records for the 1966 storm, I would say we got second best. In those accounts, an observer had the impression of motion through space (like the old Windows screen saver). While there were brief flurries of this type of activity, we never had the full effect. Still, I would not have missed it for the world. It was an impressive display that had to go in any observer's record book as a night to remember. The lion roared for us but not as loud as it could have.

★ Tim Printy

How Big Is That Diagonal in the Window?(Part 4)

In parts 1 and 2, we discussed obstructions in the optical path of telescopes, and found they did not degrade the image except when greater than 35% of the diameter of the objective. In part 3 we focused on optical design, manufacturing, and testing procedures, and found them inadequate. Now we examine seeing.

First assume the following: 1) Two different telescopes: a small beginner size and a quite large instrument. 2) Both have perfect optics. 3) The small telescope can resolve two arc-seconds. 4) The larger can resolve 0.01 arc-seconds. 5) Atmospheric turbulence is the typical two-arc seconds. Next, consider these factors.

Atmospheric turbulence: The atmosphere is composed of moving bubbles of air at temperatures that differ from their surroundings. Bubbles are a local phenomenon caused by heat variations in the local terrain, have an irregular outline, are comparable in size and shape, and drift with the wind.

The strength of the air lens (or bubble) is determined by its curvature and by the temperature difference in and out of the bubble. This difference results in a dissimilar air density, and therefore an altered index of refraction. A bubble refracts, or bends light toward its center (denser cooler air) and creates a weak convex lens that both defocuses and moves the image. A small telescope will intercept fewer air bubbles than a

larger instrument, and intuition tells us that fewer air bubbles in the path means a smaller effect. But is this so?

Blurring due to resolution limit:

Using the small telescope to examine an object in space is like attempting to paint a magnificently detailed portrait with an oversized, clumsy, 2 arc-second diameter brush that is 1/10th the object. It cannot be done. But the larger instrument can resolve a more reasonable 1/2000th of the object.

Blurring due to motion: While attempting to view an object in space, air bubbles randomly and rapidly move the image many times a second, resulting in a "motion disk of confusion." The motion disk diameter is the peak-to-peak effect of the air bubbles. And the peak value is essentially the same whether few or many bubbles are involved. So a large aperture is affected the same as a small. Adding the diameter of the resolution spot to the motion disk of confusion results in a "total disk of confusion" of 4 arc-seconds diameter for the smaller telescope, and 2.01 for the larger.

Question: Photographic film requires time to record and will blur a moving image. But doesn't the eye see in real time? Why are visual images also blurred? Shouldn't we simply see the Airy disk in motion?

Answer: The eye is *not* a real time device, but relatively slow as photon detectors go. Each photon carries only a small packet of energy, and many packets must be gathered to stimulate a simple spot response in the eye-brain. To form an image, we must gather and accurately position thousands of these spots on the retina. To prevent blurring this must be done in less than 1/25th second. If more time elapses, random streaks develop and merge to form a motion disk of confusion.

Under bright conditions, more photons arrive per microsecond and shorter integration periods are required. There

is less blurring, and images are more stable and finely resolved. At the threshold of visibility, when photon flux is low, some fully dark-adapted eyes can store photon energy for almost a full second, with a nearly proportional increase in sensitivity, but at the loss of fine detail and color.

Defocusing as a result of atmospheric turbulence: In addition to blurring by motion, the air bubbles also defocus the image. Think of bubbles as a haphazard stack of large, poor quality, low power lenses, inches to several yards in extent. They move rapidly across the air column in front of the objective, alter focus, and rearrange the image. Again this is a peak value, and the effects are not additive, so a single air bubble, or several in parallel paths, can produce a similar level of defocusing. A large aperture is not defocused more than a small one by turbulence.

Increased tolerance of large telescope to optical defects: The larger telescope when used in outer space will resolve 0.01 arc-seconds, or 200X better than the smaller one. If we add the motion disk of confusion to the resolution spot, the total motion disk of confusion is 2.01 arc-seconds in diameter. Even though the telescope can resolve 0.01 arc-seconds in space, 2.01 arc-seconds is the ground-based limit!

The resolution of the larger telescope could be degraded until it approaches the size of the motion disk of confusion before it becomes a significant factor in the final image. Thus, optical defects can be tolerated until the resolution disk becomes about 1/6 the size of the motion disk of confusion without a significant change in the resolution.

(Cont'd. p. 4)

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In other words, we could degrade the large telescope optics enough to increase aberrations so they enlarged the resolution disk nearly 50X, and the effect on the final image would be just barely detectable beyond the motion disk of confusion. And it would require about a 200X increase to cause the final image to be as large as the smaller scope with perfect optics.

That is not to say that a large telescope can tolerate 50 wave errors, and still resolve to the atmospheric limit, but that a large telescope, with algebraically lower quality optics compared to a smaller telescope, delivers resolution equal to or exceeding the small scope with perfect optics. A large telescope can tolerate greater optical errors before exceeding the atmospheric limit.

Upcoming issues will explore the real causes of degraded performance so often attributed to large aperture or large diagonals, and explore other universally held but equally erroneous myths. Some may still want to cling to the old ways and vigorously dispute these assertions; so at end of the articles we will conduct a series of double blind tests to verify or disprove all claims.

★ Ed Dougherty

The Bottom Line

NHAS thanks **Steve Forbes** for his generous labors – installing deadbolt locks on the YFOS buildings, making them more secure.

Here are the numbers for the 2002 membership year.

2002 members: TBA

Club balance: TBA

★ Jim Warena

Looking Back at Last Month

Opening. **John Pappas** officiated at his last meeting as President. He reminded us to bring in a favorite astronomy book for next month. Prospective member **Joel Rosenblatt** introduced himself. **Ed Ting** presented CMP with a sympathy card for **Jan Derby**, a long-time CMP volunteer who died a few weeks ago.

Book of the Month. none this month.

Scope of the Month. None this month.

Club scope : Still with **Mike Pelletier**

Committees. **ATMs:** Next meeting to be on Jan. 12 (13?) in New Boston.

Web Comm: **Barbara O'Connell** reviewed the problem with web access last month. It was due to the web registrar not our ISP.

Photo Comm: **Joe Malinowski** noted that they examined photos taken with LE400 film. The next meeting would be in January, date to be determined. He also asked if anyone would like to run the committee for the coming year.

YFOS. **Larry Lopez** and **Joe Derek** worked on the 16-inch Meade scope. Joe and **Chase McNiss** displayed the good-looking scope cradle they had built from plywood. **John Pappas** thanked **Steve Forbes** for installing deadbolt locks on both buildings. The winter access policy is that the site is open except if not plowed after a storm. The next coffee house is the Freeze Your Buns event on Jan. 11.

Public Observing. **Ed Ting** said we were clouded out many times last month, except for the Dec. 20 Derry Skywatch. He has uploaded many 2002 events to the website. CMP is willing to host more skywatches next year.

Treasury. **Jim Warena** tallied 90 members and a bank balance of \$8600.

2002 Elections. **John Pappas** took final nominations and projected the list of candidates onto the dome. The results appear on page 1.

Evening Program. **David Speltz** presented "Eclipse 2001 in Africa."



He led us through a slide and video show that covered his 3-week trip to Africa, including the solar eclipse in Zambia. We enjoyed many excellent photos of wild animals and the star field photo taken the night the hyenas visited camp. David ended with a video

of the initial phases of the eclipse and the diamond ring effect.

Ed Dougherty tried to show a video taken through a \$9.99 telescope but the VCR wasn't tracking properly. Maybe next time. **Bob Sletten** wrapped up the meeting with candid camera snapshots taken during the meeting.

★ Michael Frascinella

DEADLINE Feb. 2002 Issue: 5 PM Feb. 1st

E-mail your articles to the Editor. Phone if you have a late submission.

CHANGE OF ADDRESS

Notify the Treasurer. Include your full name and new street address. If changing an e-mail address, specify whether you want to add, modify, or delete an e-mail address.

Happy New Ear!

**How to Join N.H.A.S.****Write to us:**

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Attn: Treasurer

Send E-mail to:

Treasurer@nhastro.com

Use our web site:

<http://www.nhastro.com/>

2002 Officers (new!)

President:: Barbara O'Connell President@nhastro.com

Vice Pres.: Joe Derek VP@nhastro.com

Treasurer: Jim Warenda Treasurer@nhastro.com

Secretary: Michael Frascinella Secretary@nhastro.com

New Hampshire Astronomical Society
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NHAS Upcoming Events

Astronomy Social, St. Anselm's

Event	Date	Time	Location
CMP Skywatch	Jan. 4	7-9 p.m.	Planetarium, Concord, NH
Freeze Your Bunz Coffee House	Jan. 11	7 p.m.	YFOS, NH all night
ATM Meeting	Jan. 13	noon	Lopez Lapidorium, New Boston, NH
Pack 104 Skywatch	Jan. 16	7-8:30 p.m.	St. Catherine's Church, Manchester, NH
January meeting	Jan. 18	7:30 p.m.	St. Anselm's College, Goffstown, NH
CMP Skywatch	Feb. 1	7-9 p.m.	Planetarium, Concord, NH
February meeting	Feb. 8	7:30 p.m.	Planetarium, Concord, NH