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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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ASTROPHOTO REVIEW

The presentation at the February meeting is **Jim McCarthy's Astrophoto Review**. Jim will show the latest additions to his collection which include photos from the 2001 Leonid display. It should be a great show as usual!

President's Message

February will be a treat for avid observers. Since January's observing event, "Freeze Your Buns", was clouded out, we will hold it on the Coffee House event scheduled for Friday, Feb. 15th. Also, a special Christa McAuliffe Planetarium (CMP) Skywatch on Feb. 20th will observe the lunar occultation of Saturn (occurring at approximately 7 p.m.). CMP will do a planetarium show prior to the Skywatch at 5:30 p.m. More details on these events will be available via e-mail and the NHAS website (www.nhastro.com).

In preparation for the Astronomy Day events in April and May, we will be looking for volunteers. [April 20 is the date for the Boston Museum of Science event, May 4th is date for the NHAS-CMP event.] We will also be taking ideas for the NHAS/CMP Astronomy Day t-shirt artwork. The theme this year is modern telescopes, for example, Keck, Chandra, Sloan Digital Sky Survey (SDSS), and Cerro Tololo Inter-American Observatory (CTIO). In the years prior to 2000, we catered to historic telescopes, but we are in a new millennium.

You can bring telescope pictures from a book, printout, or photo to the February meeting. The officers will make the final subject selection, but we welcome your submission, advice, and comments during the meeting. Also, if you are talented and wish to assist in drawing the picture selected, please let an officer

know. We can't reproduce existing copyrighted artwork or photographs and we will need your skills. **Joe Malinowski**, our legendary t-shirt provider, has even offered a **free t-shirt** to the submitter of the winning design.

I look forward to seeing you at one of our next events. Have a great month!

★ Barbara O'Connell
NHAS President 2002

Public Observing Highlights

On Jan. 16th, NHAS members attempted to put on a skywatch for Pack 104 at St. Catherine's Church in Manchester, but the falling snow had other plans. I did a short slide show instead and the kids seemed entertained anyway.

On Jan. 24th, I took the day off from work to talk to kids at the Mason-Rice School in Newton, Mass. These annual Newton trips are a special event for this school system. I was warmly received by students and teachers alike. They were sorely disappointed by the cloudy, rainy skies that evening. Oh well, wait till next year...

Due to popular demand, Freeze Your Buns has been rescheduled to Feb. 15th. It was only 30 degrees out at the "official" FYB in January, which did not seem nearly cold enough.

★ Ed Ting

Astronomy Day 2002

Astronomy Day at Christa McAuliffe Planetarium is on May 4th this year, and I have volunteered (was volunteered?) to be the Astronomy Day Coordinator. CMP is planning a "Space-tacular" celebration all day, with a skywatch that evening. Over the coming few months, I'll be asking for volunteers to staff the booths, set up solar observing during the day, and in

general keep order throughout this exciting (but hectic) day. Don't be shy; raise your hand at the next meeting to become a part of this!

★ Ed Ting

NHAS at Boston A-Day

NHAS has signed up to participate in the Boston Museum of Science (MOS) Astronomy Day on April 20, 2002.

This year NHAS will have two tables and some floor space, but the hall in which we are setting up has no windows or long lines of sight.

The MOS has asked that anyone participating have a 'hands on' exhibit, meaning the public will be able to interact with the exhibit. Some examples include interactive astronomy computer software, mirror grinding, and the like.

One idea was to do a comparative telescope magnification and field of view demonstration, however, MOS said that this is not possible in the area where the exhibit tables are located.

I am asking the NHAS membership to submit alternative hands-on exhibit ideas for review, given the above restrictions. Start with a blank slate and design something interesting and new, and we will look at it. Any help will be appreciated, once the ideas are submitted, I will post the results on the NHAS newsgroup and ask you all to comment.

Please send all responses to:

MikeStebbins@mediaone.net

★ Mike Stebbins

Feature Story
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ATM True Grit

Saturday Feb. 9 is the tentative clean up day for YFOS. We need to get the site ready for Freeze Your Valentine's B---, uh, Freeze Your Buns on Feb. 15.

There is no ATM meeting scheduled for February since my road is iced up.

★ Larry Lopez

AstroPhotons

The first 2002 meeting of the Astro-photo Committee will be at YFOS during the FYB event on Feb. 15th. If FYB is canceled due to bad weather, the photo meeting will also be canceled.

We will be discussing ongoing projects, future projects, and meeting times and locations. Please bring any show-and-tell photos with you. Thanks.

★ John Blackwell

Web Uploads

The main web page now contains real-time weather information. It gives current weather conditions for Concord, but you can type in your zip code and get details for your region as well. This service is provided free of charge by www.weather.com.

★ Barbara O'Connell

Scatter! Incoming Photons! (Part 5)

Definitions: To the first approximation, scattering is photon energy refracted, reflected, or diffracted in random directions as the result of interactions with matter; the energy arrives at the focal plane without contributing to the desired image.

The sources of scatter in order of importance are: the atmosphere, contamination, diffraction, optical irregularities, and stray light.

Given: (1) any optic presents a varying slope to incident light because of its surface profile. (2) As one moves from midpoint to periphery of most optics, the angle at which light arrives and departs the surfaces increases. (3) Steeper incident angles cause defects to have elongated shadows and therefore greater apparent length.

Common telescopic diffraction scattering is due to displacement of energy at the boundaries between air and dust, scratches, pits, and other defects, the boundaries between

atmospheric cells of different densities, air to obstructions such as the secondary and holder, and the boundaries of optics, aperture stops, and baffles. The amplitude of impinging energy times the length of an illuminated boundary determines the magnitude of diffracted scatter energy.

A diffraction image is the orderly scattering of light by regular boundaries that bend or scatter in a predictable, well-defined manner. For example, diffraction line spikes created by the spider of a reflector or the diffraction rings seen in a refractor's image.

Surface diffraction: In addition to boundaries and contamination, all optics have stains, strains, stria, and thousands of small, microscopic, and sub-microscopic bumps, sleeks, pits, and holes in their substrates, coatings, and surfaces. Dust, dirt, scratches, oxides, smudges, and other contaminants increase in number exponentially as they diminish in size. Most have elongated irregular boundaries exceeding that expected from a cursory examination of their minute volumes. Dust and other three-dimensional defects that spread beyond the optical plane also cause "3D" effects similar to the lunar mountains and valleys.

Consider that the surface of the full Moon is a speculum that reflects light much as a dirty mirror, and that the relative sizes of typical craters on the Moon to defects on an optic are similar. If illumination and viewing angles are nearly perpendicular to the surface, as during Full Moon, both surfaces appear smooth, well polished, and capable of supporting an image. But as the moon moves, shadows elongate and reveal countless hidden flaws.

One might claim the Moon is not a good comparison. Have you looked at a commercial optic from a diameter/defect size relationship of the Moon to an optic pit, that is, viewing a commercial lens with a powerful microscopic? The quantity and size ratio of a typical defect in a mass-produced optic is similar to that of the typical crater to Moon diameter. As a test, observe the surface of an older speculum as you slowly tip it from perpendicular to horizontal. Like the Moon, when the viewing angle is

straight on, it will appear bright, and seem near perfect. But microscopic defects will cause the surface to dull at steeper angles and look like an old oxidized aluminum plate.

Effect of aperture on scattering energy: Defects and contaminants have essentially a proportional distribution to the surface area, and scattered energy thus increases as the radius squared.

Effect of "f" value on scattering: Contemplate incident light impinging first on the middle of a "fast mirror", then at the edge, where the increased angles of defects result in elongated shadows. Since the length of the diffracting boundary and the magnitude of the incident light determine scatter magnitude, scattered energy is greater at the edges where we have steeper angles, resulting in longer shadows. The lower the "f" number, the greater the total scattering.

Why do professional instruments have less scattering?

(1) Polishing for professional astronomy is always better than the low cost production market (see Article, Part 3). The professional astronomical optician has years instead of minutes to produce a finished product and works with machines that cost more than one's home! To be competitive commercial producers *must* use lower cost, less advanced technologies, applied by low-wage day workers, who mass-produce quantity, rather than formulate quality.

(2) Assume all surfaces are anti-reflection coated, and 95% perfect. A typical professional telescope with a primary and CCD detector can utilize 95% of the incident energy. At the other extreme, an amateur instrument uses a magnificent, infinite-expletives eye-piece with up to a dozen elements with two-dozen surfaces. In addition, this telescope may contain an active secondary, image transfer optics, focal reducer, Barlow, field flattener, and viewing aids, with up to 24 more optical surfaces, all having optical figuring errors and defects that degrade the image.

(3) In addition to image degradation, add at least 5% scattering and reflection loss per surface. The amount of energy lost by 26 elements and 30 surfaces is over 80% of the input energy. Only

about 20% of the incoming light forms a useful image, and most of the lost 80% illuminates the background.

(4) Because of the way amateur instruments are used, they more quickly develop a coating of contaminants and require attention. But amateurs are not able to replace coatings frequently so cleaning is required – but cleaning introduces damage! So it comes down to an individual judgment call: do we prefer scattering from contaminants or cleaning damage? The old adage of “Let sleeping dirt lie” is infinitely more important when applied to optics than any other topic. “Dirt is temporary, but a scratch is forever.”

Conclusion: After turbulence and optical aberrations, scattering is the next cause of poor performance in amateur telescopes. Professional instruments have better contrast simply because they have fewer, cleaner, and better optical elements, in that order. When contrast and resolution are important, keep all focal lengths long, use the minimum number of components, keep all curves shallow, use eyepieces with a minimum of elements, and keep optics pristine by covering them when not in use.

★ Ed Dougherty

The Bottom Line

Membership continues its upward climb, now at 109. Bank balance is about \$9,100.

NHAS also welcomes to the club and gives a big thank you for donations to these new members:

Susan Anderson \$35
Jim Moe \$50

★ Jim Warendanda

Looking Back at Last Month

Opening. 2002 President **Barbara O'Connell** presided over her first meeting.

Book of the Month. See end of report.

Scope of the Month. **Barbara O'Connell** has the club 6-inch scope.

Committees. ATMs: **Larry Lopez** said meetings are now at **Don Ware's** home. They will restart projects in the spring. Larry was going to plow YFOS on Sat. Jan. 17. **Joel Harris** asked for suggestions for the 2-inch focuser on the club 16-inch Dob. **Ed Ting** suggested one from University Optics.

YFOS. Ed Ting reviewed past events including the ill-fated FYBO event in which five members observed many clouds.

Public Observing. Ed noted that upcoming events include FYBO the Sequel on Feb. 15 (as long as it's plowed) and Messier Marathon on March 15. Ed has graciously offered to coordinate (Yay!) the 2002 Astronomy Day at CMP on May 4th (see story on p. 1). Astronomy Day at the Mall of NH may not happen because they now want \$500 for use of floor space.

Treasury. **Jim Warendanda** reported a \$9,000 balance and 106 members, a new record for January membership.

Chase McNiss suggested that we purchase setting circles for the club 16-inch Dob at YFOS.

Evening Program. Several members presented Favorite Astronomy Books followed by an Astronomy Social.

Chase McNiss presented *Backyard Astronomer's Guide* by Dickinson. He said it was a good beginner's book that provided A to Z information on equipment, optics, binoculars, and telescopes. The best chapter covered myths about telescopes. An abridged version is called *Skywatch*.

Marion Hochuli showed off her vintage copy of *A Beginner's Star Book* by Kelvin McKready dated 1912. It was a guide to the stars that had been handed down through several generations. She told about it being on her mother's bookshelf, how her mother used it to teach her about astronomy, and how those experiences kindled her own interest in the subject.

Joel Harris wowed us with a board game, *Astronomy Monopoly*. Instead of buying real estate, you bought planets and galaxies. The tokens were scopes and related objects. **Jim Murphy** wanted to buy it on the spot and everyone else loved it.

Steve Stefanik chose *New CCD Astronomy* as his book because it offered a great treatment of CCD cameras and their use on telescopes. The book also

included reference information about CCD software.

Jim Murphy displayed his trusty *Observer's Handbook*, which he called an excellent source of descriptive information and data on the sun, moon, planets and other objects.

Bob Sletten flashed his new pocket lamp, a Red Photon III Micro-Light. He also showed us all the other colors, all based on LED technology. Prices ranged from \$9-18 from www.hosfelt.com. A high-end model offered seven modes of operation [excluding OFF].

Bob also reviewed **Stephen Hawking's** *The Universe in a Nutshell*, a book of dense mathematical concepts and intriguing illustrations.

Michael Frascinella reviewed *First Light* by **Richard Preston**, author of *The Hot Zone*. He elaborated on three themes that Preston wove into this excellent book about real-life professional astronomers at Palomar Observatory: 1) biographies of the major characters both current and past like **James Gunn**, the gadgeteer, 2) anecdotes and strange stories about Palomar and the Hale telescope like "Palomar Glue," and 3) astounding facts like why we're lucky not to live near a quasar.

Roger Greenwood presented *Turn Left at Orion* [and straight on till morning?], a Christmas gift book. He found it to be well written, clear, and concise, and it provided basic but thorough information on subjects like the moon, planets, and occultations. The book presented the sky in seasonal sections with charts, descriptions, and drawings of objects as viewed in a small scope.

★ Michael Frascinella

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Astrophoto Review, Planetarium

NHAS Upcoming Events

Event	Date	Time	Location
February meeting	Feb. 8	7:30 p.m.	Planetarium, Concord, NH
Freeze Your Valentine Coffee House	Feb. 15	7:00 p.m.	YFOS, NH all night
Mensa Skywatch	Feb. 16	6:30 p.m.	Merrimack, NH
CMP Occultation Skywatch	Feb. 20	6:30 p.m.	Planetarium, Concord, NH (occultation at 7 p.m.)
CMP Skywatch	Mar. 1	7:30 p.m.	Planetarium, Concord, NH
March meeting	Mar. 8	7:30 p.m.	St. Anselm's College, Goffstown, NH