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THE NHAS OBSERVER

Newsletter of the New Hampshire Astronomical Society

Volume 2002 No. 11 **"All the news that fits in print"** **November 2002**

Night of the Leonids

President's Message

NHAS Elections Next Month

In case you didn't get enough of election campaigning for this month, we've got NHAS 2003 elections coming up in December and we'll take nominations at the November meeting.

Being an officer is a very rewarding experience. You get to steer the direction of the club and become a key decision maker, no matter what office you hold. I am looking forward to some new names on the ballot this year, so if you are interested, please let me know and I'll provide you with more information.

Also, I'll be awarding the President's Award to a deserving member and there will be at least one other award given. I'll keep you all in suspense.

Leonid Meteor Shower

Lew Gramer, a fellow member and meteor observing expert, will be the guest speaker for the November 15 meeting (see his web site at: http://www.meteorobs.org/). Please join us to learn about meteor observing!

Also, we've got a club mini-event coming up for the Leonid Meteor Shower on November 18th-19th. Look for more information on the club web site in a few days.

★ Barbara O'Connell
NHAS President 2002

Public Observing Highlights

The Oct. 8 Skywatch at the Rundlett Middle School was well attended. The sky was clear but we had those nasty wall pack lights shining on our backs, making it difficult to see objects in the eyepiece. The kids left around 9 p.m. so

we had the field to ourselves and continued observing for a while.

On Oct 23rd, 15 NHAS members went to our annual Skywatch at Reed's Ferry in Merrimack, NH. Over 350 people showed up, a new record! Teacher **Barbara DeVore** expressed her appreciation to NHAS, and especially to those members who showed up, for making such a special night for the kids and parents.

Photos are courtesy of Bob Sletten.

★ Ed Ting

Night of the Leonids

The following information comes from the newsletter of the North American Meteor Network.

The November 2002 Leonids are very special as they may well be the last chance for us to see a real meteor 'storm' in our lifetime. Mark November 18th and 19th on your calendars now.

The rates are predicted to be much higher than normal this year, in fact, to hit storm level of at least several thousand meteors per hour, for several short periods of time. But the peak of the Leonids coincides with a full moon this year. Various experts predict peaks at several different times between 10:48 p.m. on the 18th and 5:47 a.m. on the 19th. Each peak is related to a debris path left behind by various visits of Comet Tempel-Tuttle.

Lew Gramer, who will be guest speaker at the Nov. 15 business meeting, offers the following advice:

- Do not combine data with others (no group counts).
- Record your location (longitude, latitude, elevation).
- Estimate limiting magnitude to roughly 1/10 of a magnitude (see http://www.seds.org/billa/lm/rjm.html for instructions).
- For each count, record start and end times to the minute.
- Estimate field obstruction within 10%.
- Record direction and altitude you were facing.
- Try estimating meteor magnitudes.

Mail your glowing meteor report to namn@atmob.org for analysis.

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Welcome New Members

NHAS welcomes these new members who are helping to swell our 2003 membership.

John Bouley, Goffstown, NH

Eric Cusson, Bedford, NH

Roger Goun, Brentwood, NH

Robert Hamlin, Hanover, NH

Ernie Lopez, Pembroke, NH

Jamie Panagos, Derry, NH

James Waterman III, Bedford, NH

James Waterman IV, Manchester, NH

Jill Whitmore, Concord, NH

ATM True Grit

The next ATM meeting is Sunday November 17, 12 noon at the Whipple Free Library in New Boston.

This might be a good time to cover how to purchase a telescope.

★ Larry Lopez

AstroPhotons

The next Astrophotography meeting will be on Nov 23, with the time and location to be announced by e-mail.

★ Mike Kertyzak

YFOS, You Ask?

We had a work session on Nov. 2, Saturday and **Dennis Miller** (a new member) installed a new heater.

Dennis was checked out on the observatory and warming room with assistance from **Larry Lopez**, **Chase McNiss**, and **Bob Sletten**.

Sara Miller did observing (of the observers installing the heater). Larry Lopez got busy on this project so we could have heat in time for the Leonids shower. Dennis Miller made it all look easy. Chase bought a small tank to replace the old one for the small heater.

To turn on the heat, turn the thermostat up. To turn the heat off, turn the thermostat down until it clicks. *Make sure you turn it off.*

The cost of the heater was about $405 for which Larry footed the bill. Materials for the tank and installation cost about $50 which Chase paid for. Chase and Larry will bill the NHAS.

The old heater was donated to Bob Sletten. I would have paid him to take it away. The small heater, by the way, was put in temporarily by Bob. It was never donated or paid for.

We will have a work session on Saturday, November 16, 10 a.m. for pre-Leonids site checkout.

★ Larry Lopez

Astronomy 101 Course

The first of several introductory astronomy classes will be held at 7:30 p.m., Friday, Nov. 8, in the warming room at YFOS. The first class, "Introduction to Telescopes" will run for about one hour, and the instructor is **Mike Townsend**. Mike is very well versed in all types of amateur telescopes and will add much insight into the inner workings and use of these instruments.

The lecture portion will run 30-45 minutes and end with a Q&A time to allow for drilling deeper into topics of interest to the class. A club Coffee House is also scheduled for this same evening so please take care entering the parking area.

★ Bob Sletten

Effects of Atmosphere on Seeing

An experienced observer with a large, expensive, well-known brand of 24-inch telescope was expressing disappointment with his new toy. Images were bright enough, but stars were fuzzy disks, and the planets were poorly defined. He had checked for dew, alignment, collimation, and adjusted everything he could think of, but nothing helped.

He sought the assistance of a neighbor with 12-1/2-inch telescope also known for its excellence, and to their amazement everything seemed a little dimmer *but better* in the smaller scope. They wondered if a smaller aperture instrument would surpass both of the larger, and eventually found a teenager with a homemade 6-inch mirror in a crude cardboard tube that proved to have the sharpest images of all.

Puzzled, they brought their dilemma to a business meeting, and an associate who spoke with all the authority and confidence born of years of experience and education said so all could hear: "That's because the smaller scope is looking through only 28 square inches of turbulence compared to 452 square inches for the larger. The larger instrument is looking through 16 times the environment. Of course the images will be more distorted."

Each person had heard these claims countless times before, and the latest experiments seemed to verify what was being said. So it became an accepted fact that, "A smaller aperture will outperform a larger aperture on nights of bad seeing." That's it. Case closed. No more discussion. Move on.

The actual diffraction limited star image, or point in an extended image, is limited by the optics and is less than 1/4 arc-second even in a smaller scope. One can verify this fact by imaging, and electronically freezing the motion.

Turbulence definition: For our experiment, turbulence may be defined as the major atmospheric mechanism that causes blurring of a distant light source in a telescopic image. Turbulence is what causes a star's diffraction limited point image to be randomly shuffled about rapidly from its true position, and due to persistence of vision the moving spot appears as a fuzzy disk the diameter of the RMS value of the motions. The "seeing disk" is the result of atmospheric motion, and persistence of vision. (See Figure 1.)

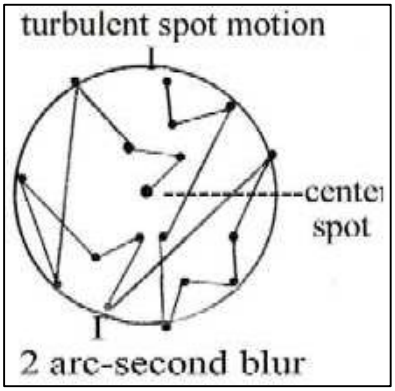

Figure 1

Turbulent motion: Turbulent motion is seldom less than one arc-second on the best mountaintops, or more than 10 arc-seconds in bad seeing areas; and is reasonably constant over periods of hours if the weather is unchanged. Moving pockets of air that are amorphous without physical boundaries

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Effects of Atmosphere on Seeing

(Cont'd. from p. 2)

other than the equally diffuse temperature boundaries of neighboring cells are formed by common local heating or cooling, and most cells are similar with comparable magnification.

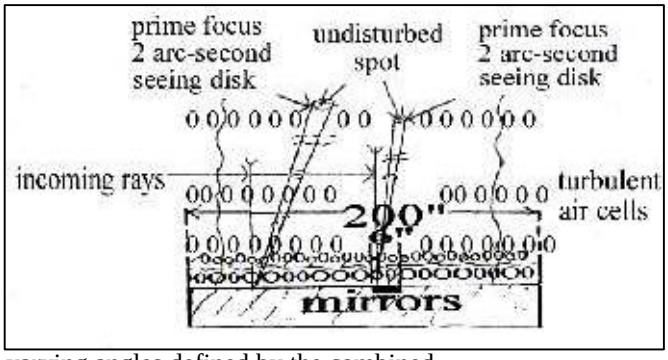
Local heating or cooling of air in the immediate area of an optic and ground heating of the surrounding air result in turbulence that decreases exponentially with altitude. The mirror may be warmer than its surroundings while still cooling down; or after a long period of exposure may actually be cooler than its environment due to radiation.

In either event *the first few inches above the optic have the greatest effect.* Therefore blowing a laminar airflow across the surface of a mirror to remove the turbulent layer, and shielding the optics from wind and outside thermal sources are the two most effective ways of improving performance.

The seeing disk: Because of the extremely long and similar focal lengths of air lenses, the amount of change in focus is small and may be ignored. Since the height of the vertical column of air is the same with a fairly constant magnitude of turbulence over hundreds of feet, it causes the same effects on large or small areas. A bigger optic simply captures more area of the common turbulent air column. Each air cell diffracts light by similar amounts in random horizontal directions, and the sum of all of these moving spots is a circle of confusion called the seeing disk. (See Figure 1 and 2.)

Image blur and focal length (magnification): Basic physics states that the incident angle of a ray on a mirror equals the angle of the exiting ray. Plain geometry shows the spot of confusion at focus is equal to the tangent of the peak angular deflection, times the sum of the effective focal length of all optics in the path; times two. The size of the disk of confusion at the image plane is proportional to the magnitude of turbulence, and the magnification used. The seeing disk is the result of the effective focal length, horizontal atmospheric deflection, and persistence of vision.

What is 2 arc-second seeing? Incoming rays from a distant source will arrive at the primary optic with



varying angles defined by the combined momentary tilts of all air pockets in the optical path. At all times there are a number of simultaneous images caused by individual cells refracting light to different parts of the optic, all-moving independently. Say the typical motion is 2 arc seconds peak-to-peak. This means turbulence is causing a deviation of 90% of the rays such that the primary's diffraction-limited spots are moving over a 2 arc-second disk 2 to 300 times per second. Persistence of vision blurs this motion into a disk that is 2 arc-seconds in diameter. (See preceding Figure 1).

Effect on large and small aperture: Let's extend our observer's earlier evaluation of instruments to include the world's great professional telescopes, where diameters are measured in tens of feet rather than inches. We know for example the 200-inch Hale telescope on Mt Palomar has upwards of 1100 times the area of our 6-inch allowing it to capture over 1100 times more light, but it also looks through over 1100 times the area of air as our 6-inch. If the postulation that blurring is proportional to aperture were correct, the Hale star images should be a thousand times more blurred under the same seeing!

We know that normal seeing above Mt. Palomar is 2 arc-seconds, and on occasion it is that good locally. We have seen that the prime focus image of a good 6-inch reflector in 2 arc-second seeing is about four one-thousands (0.004) of an inch. Multiply this by 1000 to account for the greater area of turbulence for by the larger aperture and star images would be blurred to a 4-inch in diameter (see Figure 2). *All of these behemoth instruments would be useless!* Obviously this is not so! What is wrong?

To be continued.

★ Ed Dougherty

The Bottom Line

Balance: $8,500. This reflects recent expenditures for the YFOS 16-inch truss mount that we ordered and the new LP heater system for the YFOS warming hut.

2003 members: 84

Donations

NHAS offers its thanks those who joined or renewed this month and for the following donations:

John Newhall	laser collimator won at Stellafane
Daun Smith	$30.00
Marion Hochuli	$25.00
Jim McCarthy	$ 5.00

★ Jim Warenda

Looking Back at Last Month

Opening. Barbara O'Connell welcomed new members by name, then reviewed items in the mail.
Book of the Month. none this month.
Scope of the Month. none this month.

Public Observing. Ed Ting reviewed skywatches held at the Manchester VA Hospital, Loudon Elementary School, Geneva Point in Moultonboro, and Rundlett School in Concord. The big upcoming event would be Reed's Ferry School in Merrimack on Oct. 23. He also mentioned some skywatches planned for November.

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Looking Back (Cont'd. from pg. 3)

YFOS. Larry Lopez said the winter preparations were almost done. The warming room needs a new heater. He reminded new members to get a walk-through on use of the site. Barbara noted that the directions need rewriting because of the new bypass.

Committees. ATMs: **Larry Lopez** said no meetings were planned until Nov. Photo Comm.: **Chase McNiss** recapped the previous meeting and said the next meeting was TBD. Membership: Bob Sletten is working on the Astronomy 101 course for beginners. He had one instructor signed up and was working on a date.

Other News. Michael Frascinella reported on a lecture given by **Dr. Story Musgrave** at Daniel Webster College in Nashua. Dr. Musgrave gave a fantastic talk and slide show on the Hubble Telescope Repair Mission for which he was Payload Commander. **Mike Kertyzak** and Mike F. got in line to briefly talk to Dr. Musgrave and receive autographed photos.

Members talked briefly about holding a Leonid Meteor Event at YFOS.

Chase McNiss said the order for the truss mount for the 16-inch club scope would be placed shortly. Delivery was now 5 months away. Chase cleaned the mirror and said it looked perfect. **Ed Dougherty** offered to refurbish the old mount and tube in the interim.

Treasury. Jim Warenda reported that all bills were paid and the bank balance was about $9600. We ended 2002 with 170 members and we had 71 members only a month into the new year.

Evening Program. Joe Dechene presented an amazingly detailed exposition of the making of a Stellafane Award Winning Telescope. The 14.5-inch split-ring Newtonian scope took two years to build. He also built a web site to document the project.

He reviewed all the requirements that he chose to incorporate, for example, usable for photography and easily portable. Next he discussed the wealth of detail that went into the design of the mirror cell. He calculated the weight of all the components and figured out a way to balance the tube without use of counterweights.

The truss took a lot of work because of all the machining needed. The truss rods are one assembly that fastens to the mirror box and the eyepiece cage. The eyepiece cage, not the tube assembly, rotates to provide convenient eyepiece placement.

The base is easily polar-aligned and allows for latitude adjustment by moving two of the feet. The split ring is hollow, made of plywood, and folds flat for storage. Motor drives mounted in the base use roller blade wheels to transfer rotation from motor to mirror box. Joe adjusted the friction to allow quick repositioning of the scope without disrupting the motor drive.

He finished the presentation with several photos – 16-second, unguided exposures – taken with a digital camera. He estimated that the overall cost of the project was about $1400.

His web-based presentation is now available at:

http://town-center.org/static/nhas/

★ Michael Frascinella

NASA Space Place

Black Holes: Feeling the Ripples

Astronomers have finally confirmed something they had long suspected: a super-massive black hole in the center of our Milky Way galaxy. The evidence? A star near the galactic center orbits something unseen at a top speed of 5,000 km/s. Only a black hole two million times more massive than our Sun could cause the star to move so fast. (See the Oct. 17, 2002, issue of *Nature* for more information.)

Still, a key mystery remains. Where did the black hole come from? For that matter, where do any super-massive black holes come from? There is mounting evidence that such "monsters" lurk in the middles of most galaxies, yet their origin is unknown. Do they begin as tiny black holes that grow slowly, attracting material piece-meal from passing stars and clouds? Or are they born big, their mass increasing in large gulps when their host galaxy collides with another galaxy?

A new space telescope called LISA (short for Laser Interferometer Space Antenna) aims to find out. Designed by scientists at NASA and the European Space Agency, LISA senses ripples in the fabric of space-time itself – gravitational waves.

Albert Einstein first realized in 1916 that gravitational waves might exist. His equations of general relativity, which describe gravity, had solutions that reminded him of ripples on a pond. These "gravity ripples" travel at the speed of light and, ironically, do not interact much with matter. Thus, they can cross the cosmos quickly and intact.

Gravitational waves are created any time big masses spin, collide, or explode. Matter crashing into a black hole, for example, would do it. So would two black holes colliding. If astronomers could monitor gravitational waves coming from a super-massive black hole, they could learn how it grows and evolves.

Unfortunately, these waves are hard to measure. If a gravitational wave traveled from the black hole at the center of our galaxy and passed through your body, it would stretch and compress you by an amount far less than the width of an atom. LISA, however, will be able to detect such tiny compressions.

LISA consists of three spacecraft flying in formation - a giant triangle 5 million km on each side. One of the spacecraft will shoot laser beams at the other two. Those two will echo the laser signal right back. By comparing the echoes to the original signal, onboard instruments can sense changes in the size of the triangle as small as 0.0000000002 meters (20 picometers).

With such sensitivity, astronomers might detect gravitational waves from all kinds of cosmic sources. The first, however, will probably be the weightiest: super-massive black holes. Will "feeling" the ripples from such objects finally solve their mystery, or lead to more questions? Only time will tell. Scientists hope to launch the LISA mission in 2011.

This article was provided by Nancy J. Leon, Jet Propulsion Laboratory, California Institute of Technology, under a contract with NASA.

DEADLINE Dec. 2002 Issue: 5 PM Nov. 30

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

CHANGE OF ADDRESS

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Leonid Meteor Prep, St. Anselm, Nov. 15

NHAS Upcoming Events

Event	Date	Time	Location
Coffee House	Nov. 8	7:00 p.m.	YFOS
Goffstown Skywatch	Nov. 13	7:30 p.m.	Mountain View Middle School, Goffstown, NH
Nov. Meeting	Nov. 15	7:30 p.m.	St. Anselm's College, Goffstown, NH
YFOS Work Session	Nov. 16	10:00 a.m.	YFOS
Leonid Meteor Party	Nov. 18-19	dusk - dawn	YFOS
Penacook Skywatch	Dec. 2	7:00 p.m.	Washington Street School, Penacook, NH
CMP Skywatch	Dec. 6	7:30 p.m.	Planetarium, Concord, NH
Alton Central School	Dec. 12	7:00 p.m.	Alton Central School, Alton, NH
December Meeting	Dec. 13	7:30 p.m.	Planetarium, Concord, NH