



URANOGRAPHOS



*Newsletter for the
Shoreline Amateur Astronomical Association*

President- Robert Wade, D.Phil.

Vice President- Peter Burkey

Secretary- Michael Coté

Treasurer- Mark Logsdon

Robert Wade, Editor.

March 1990

March Meeting

The March meeting of the Shoreline Amateur Astronomical Association will be held on March 15, at 7:30 PM in the West Ottawa Middle School Planetarium in Holland, Michigan. The agenda will be as follows:

- 7:30-7:35 The March Night Sky Tour.
- 7:35-7:45 The Observer's Log - A review of objects to observe in the constellations Leo (lē'ō) and Coma Berenices (kō'ma ber'e-nī'sēz) presented by Steve Tuls.
- 7:45-9:00 *Light and the Eye: Some Observing Tricks* - is the title of a program to be presented by Eric Schreur of the Kalamazoo Astronomical Society. Eric is also Planetarium Director for the Kalamazoo Public Museum. Anyone interested in joining our guest speaker for dinner before the meeting should contact Bob Wade at 396-3614 by March 14th.

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February Meeting Highlights

The meeting was postponed until February 22 due to inclement weather on the 15th. We started late due to an unavoidable conflict with community education class which already had the planetarium reserved. We had a short business meeting in which we voted to fund a subscription to the magazines *Astronomy* and *Odyssey* for the Herrick Public Library. Incredulously enough, they currently have no magazine subscriptions covering astronomy. We also discussed briefly the club's first observing program. A sheet detailing objects to observe was passed out. When we moved into

the planetarium, Mark shared with us objects worth observing in the constellations Cetus and Lepus.

Michael then presented a well researched program on Lunar Geology and answered several questions from the audience about various Lunar features.

[These minutes are abbreviated due to lack of a report from the Secretary - Ed.]

February Executive Meeting

The February Executive meeting was called to order March 1 (yes, I know it says March and not Feb.) at 6:30 P.M. Robert Wade, Peter Burkey, Michael Coté, Mark Logsdon, and Sandra Plakke were present.

Astronomy magazine subscriptions were discussed. Club subscriptions will run from April - March on a yearly basis. This should allow time for members who are tardy paying their dues to get on the subscription list for the current year. Anyone who is not a Full Member and who currently subscribes to *Astronomy*, let Mark know when your subscription runs out and provide him with your subscription number. Kalmbach will allow us to give you a temporary subscription running through next March at club discount rates, i.e. \$1.17/month. This will also upgrade your membership from Contributing to Full status.

Plans are on track for our Astronomy Day presentation at the Library April 30. Please bring the same information/items you brought last year. Contact Peter Burkey for further information and ways you can help make this a community success. The public star party is scheduled for Kollen Park Saturday evening, April 28. Bring yourself, a telescope, binoculars, and a friend. Contact Michael Coté for more information.

We are gearing up to hold a big star party when John Dobson is a Vivekananda later in May/June. We are hoping to start at Vivekananda early in the evening and move to a different site later on so as to not disturb the monastery. Peter is looking into Fennville High School as a possible site.

Michael is looking into T-shirts or sweat shirts with club logos. He had no further information.

Club members who have paid their dues and have not yet received a membership card, please let Mark Logsdon know so we can get you one. Members who have not paid their dues will be dropped from the mailing list after this month.

Other talk centered around meeting speakers and the forthcoming occultation. See article later in the newsletter.

The meeting was adjourned around 8:45 P.M.

[These minutes are also abbreviated due to lack of a report from the Secretary - Ed.]

Hubble Space Telescope - Part II

Last month I reported on some of the amazing aspects of the HST, especially its light weight and low expansion/contraction characteristics. Let us now turn our attention to how the primary mirror was constructed to meet the extreme demands of outer space operations.

Although it measures almost eight feet in diameter, the primary mirror is one of the lightest large mirrors ever built. This was accomplished by making the mirror hollow and building it from a welded honeycomb core ten inches thick with one inch thick front and back plates fused to the core. Each hollow is vented to allow air to escape when the telescope is launched into space.

Because the HST will operate above the distorting influences of the earth's atmosphere, the designers wanted it to focus light much more accurately than ground-based telescopes. The entire optical system was to be capable of reflecting light to a focus with a total error no greater than 1/20th of the wavelength of helium-neon laser light. (Most large telescope mirrors are good to only about 1 wave.) To achieve 1/20th-wave accuracy for the entire telescope, the surfaces of the mirrors had to be much better than that. Thus, the design team speci-

fied that the primary mirror be accurate to no less than 1/65th-wave.

Polishing and figuring the primary required extraordinary care. Because HST will operate in a weightless environment but its mirrors were constructed here on Earth, the primary mirror couldn't simply be put on a machine and polished since the pull of gravity would cause it to sag under its own weight. If the mirror were supported at its edge in three places, the center would sag a thousand times more than the allowable 1/65th-wave error. Therefore, the mirror had to be polished in the same zero-gravity environment it would experience in orbit.

How can you fake zero-gravity with a one-ton mirror? This was accomplished by building a support mechanism of 138 rods, each exerting a precise force on the back surface of the mirror. The sum of all the upward forces exerted by the rods exactly equaled the weight of the mirror, thereby negating the downward pull of gravity. About 50 engineers worked for three years to build the zero-gravity simulator!

The normal method of "figuring," or shaping, a mirror is to use a small polishing tool to take off small amounts of glass. HST engineers employed a computer-controlled machine that uses a polishing tool several inches in diameter. Over a polishing run lasting a day or two, the tool polishes the entire mirror surface as the computer directs the polishing head to spend more time on high spots than on other areas. A total of 25 cycles were required to figure the mirror, each cycle taking about a week. The end result was a mirror accurate to better than 1/90th-wave!

The next step was to coat the mirror with a layer of aluminum 2.5 millionths of an inch thick, followed immediately by a one-microinch-thick layer of magnesium fluoride. This had to be done in a high-vacuum chamber at a temperature of 250 degrees Fahrenheit, but not until after the surface of the mirror had been cleaned, a process that took five days and consumed 2,400 gallons of hot, ionized water. After four years of preparations, the coating team had flawlessly coated the mirror in four minutes and had even given NASA 11% more

photons in the far ultraviolet than specifications called for.

Hopefully, the Hubble Space Telescope will soon be in orbit and scientists will be able to reap the benefits of the years of precision engineering that went into the construction of the most accurate optical systems ever built.

Pleiades Occultation

At last, an evening faded into a crystal clear sky on a date on which a club star party was also scheduled - the first for the SAAA in 1990! The star party was held at the home of Bob Wade, south of Holland. He had his 13.1" Dobsonian, tape recorder, and Radio Shack Time Kube (source of WWV time signals). Pete Burkey showed up around 7:30 with his C-8 followed by Arlin Ten Kley (and two junior astronomers) with Pete's 10" Dobsonian.

Since the main events didn't begin until just after 10 P.M. local time, the brave souls went inside to get warmed with hot chocolate and cookies provided by Wendy Wade.

Around 10 o'clock the action picked up tremendously: time signals were piercing the air, Bob kept shouting which stars were about to get occulted, and Pete kept snapping photos through the C-8 while also trying to time some occultations. Some sporadic high cirrus clouds prevented us from seeing the occultations of a few faint stars, and ruined the graze of SAO 76142 completely. Some of the Pleiades are double stars with separations too small to be visible through a telescope. Occultations such as these offer an opportunity to detect these because if the separation is favorable from the earth, an observer may see a stepped event where in the space of a fraction of a second the light seems to disappear in discrete steps as each component of the double star is occulted. Four such events were detected below. Not bad for first timers! (pun intended)

Nevertheless, it was quite a successful evening which Bob, Pete, and Arlin won't soon forget. Pete will have some photos of the event to

share at the next meeting and Bob will bring the tape recording of the event. Several other occultations are visible from our area this year, and we hope more of you will come out and join us.

SAO Number	Time (UTC) (disappearance)	Comments
76126	miss	
76152	miss	
76155	miss	
76041	00:31:36.4	
76046	00:59:00.0	stepped
76113	03:05:34.1	
76104	03:13:00.4	
76119	03:30:25.9	
76117	03:33:47.3	
76140	03:43:12.8	
76137	03:46:41.1	
76149	03:53:30.9	
76142		too cloudy!
76159	03:56:22.2	windy
76164	04:01:09.8	stepped
76183	04:25:46.5	high cirrus
76184	04:28:50.6	stepped
76194	04:32:43.2	stepped

all times are ± 0.2 sec