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 *July 1990*

July Meeting

The July meeting of the Shoreline Amateur Astronomical Association will be held on July 19th, beginning promptly at 7:00 PM in the West Ottawa Middle School Planetarium in Holland, Michigan. The agenda will be as follows:

7:00-7:10	The July Night Sky Tour.
7:10-7:30	The Observers' Log - A tour of the constellations Ophiuchus and Sagittarius by Rob Tuls.
7:30-8:30	*Project SETI*: a video will be presented concerning current topics in the search for extraterrestrial intelligence.

June Meeting Highlights

Sandy led our customary night sky tour followed by an observers view of Boötes and Hercules by Bob Wade. We then had a business meeting where a couple of important issues were decided. After extensive group discussion, we voted to not seek non-profit IRS status at this time. Instead, we will look into perhaps setting up a club telescope fund. It was generally felt we needed a club telescope for those members who do not as yet have their own scope. An 8" Dobsonian seems to be the best in terms of observing utility and portability. This

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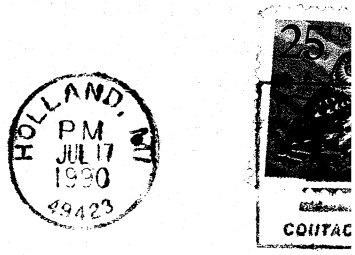


could either be entirely or partially made with donated time by club members. Stay tuned for further information.

June Executive Meeting

The meeting was held on July 5, 1990 with Bob, Mark, and Sandy present. Old Business: Mark will proceed with a second portfolio for Westshore Mall, this one including photos by SAAA members and a description of our proposed mall display. Bob will check with Herrick library to confirm that they are receiving subscriptions to *Odyssey* and *Astronomy* magazine donated by SAAA members. New Business: Board members are working on updating our

SAAA constitution for possible action this autumn. There are a few loose ends which need tidying up. A membership packet may be organized and provided to all SAAA members. It would be especially useful for new members. Mark will provide the Astronomical League with our ALCOR database update. The July star party on the 20/21st was originally scheduled for Vivekananda and is rescheduled for Mark Logsdon's home. Treasurers' report as of 6/30/90: $316.91. An extra board meeting is scheduled for Thursday, September 6. This does not replace the regularly scheduled meeting on September 27.

Submitted by Mark Logsdon.

[The next couple of newsletters will have information regarding astrophotography. The articles were downloaded from the Astronomical League Bulletin Board. --*Ed.*]

Films for Astrophotography

Films keep changing, month to month, year to year. What was once a great film for astrophotography, say by virtue of its superior red sensitivity or high contrast can virtually overnight become useless. This was the case with the old Fujichrome 400 slide film or the Konica SR400 print film. Now that they are gone, what is left?

Recently, I have been involved in an extensive film testing task for a major astronomical type magazine, and now have a better feel for what's out there and what isn't. The primary film series for these tests were the new Ektar films along with some of the usual standbys for comparison. Lets start at the bottom of the focal length range and work our way up.

Wide angle work: This includes fisheye, 28mm - 70mm lenses and a focal ratio range of f/1.4 to f/3.5. Typical subjects include constellations, the Milky Way, and aurora or meteor work. Slide films are generally preferable by many because of the enlargement possible on the big screen to scrutinize small details. There are only two choices here I would recommend. While the "new" formula of Fujichrome 400 is not very red sensitive, it doesn't give the pea green backgrounds that Ektachrome 400 will, and has much less reciprocity failure. Even at f/2.8, exposures will be on the order of 30 to 45 minutes at a dark site. A better choice used by a large number of wide field astrophotographers in our club is Agfachrome 1000 slide film. The grain is still surprisingly fine, and it is better in the red end of the spectrum, so important for recording those ruby emission nebula.

For a print film, the Konica SR1600 is good, but a bit grainy. We have found no good 400 speed print film for a higher resolution, not even in the new Ektar films. There is however a film that will satisfy even the most demanding of wide field sky shooters. It has extraordinary contrast, very high red sensitivity and a relatively high speed. There is a catch though. You don't get something for nothing! The film is Fujichrome RD100 slide film, hypered, developed as a negative. You must shoot through a 30cc magenta filter first of all, and then develop the film in C41 chemistry yourself, because photo finishers will not develop a slide in print chemistry. It shortens the life considerably of their chemicals. If you do the work however, the results are outstanding! 50mm shots at f/2.8 through the 30cc magenta filter will take a mere 15 minutes and record every shred of emission nebulosity in the field.

For prime focus astrophotography, the demands on the film are more severe. For slides, there is only one choice, Agfachrome 1000. All other slide films are grainy green garbage. The selections for negative films are better. We found out some very interesting information in our recent tests that will influence your choice of emulsion here. The three choices to consider are Gas Hypersensitized 2415, unhypered Ektar 1000 and Konica SRV3200. The reason for not hypering the last two films is that we found out that they experience a severe color balance shift toward the green or blue when hypered.

The SRV3200 is of course the fastest of the three, but the grainiest too. It is moderately red sensitive, good in the blue and is a good choice for beginning astrophotographers to get started checking out their setup. Once your guiding is improved to the point that every shot is pinpoint star images and clear crisp focus, only then should you move on to the other higher resolution films.

Now here is something to ponder, in our most recent testing, the hypered Ektar 1000 had the same speed in long astronomical type exposures as the hypered 2415 film! In my 14" f/5 newtonian, in typical 20 minute exposures the limiting magnitude was the same for both films, but the 2415 shot had ten times the details in galaxies spiral arms for instance. For red objects, the 2415 is twice as fast, and in fact had a much higher contrast on these objects.

The moral of the above story is that if you are willing to do the extra work with the hypered 2415 it is superior in many aspects. If you still want color, the Ektar 1000 unhypered is superb for galaxies, star clusters, and reflection nebula. While you won't get the detail of the 2415, the sky blue wisps of nebulosity around the Pleiades or the even bluer spiral arms wrapping around the core of the Whirlpool Galaxy is impressive with this film. About 30 minutes at f/5 will get you good results with these films, the hypered 2415 being twice as fast as the unhypered Ektar 1000.

If you want to shoot emission nebula at prime focus, your only choice will be the 2415 for reasonable exposures, but if you can go an hour or more, the Hypered Fujichrome RD100 as a negative and with no filters is superb.

Despite what you may have heard, all the good films aren't all gone today. You may have to put some extra effort into your astrophotography such as developing the film yourself or more time at the guidescope, but you can get better results today than five years back! Sure the good old Fujichrome 400 is long gone, but heck, it was grainy stuff anyhow.

ASTROPHOTOGRAPHY TIPS FROM KIM ZUSSMAN

BY JASON WARE

Readers of Astronomy, Sky & Telescope, and Deep Sky magazines have probably seen the name Kim Zussman. He is a California Astrophotographer who's photos appear in almost every issue of these magazines. I have written a few letters to Kim and would like to share a few of his words with you.

Kim now exclusively uses hypered 2415 for astrophotography. One of its advantages is the large dynamic range (about 1:10000) which allows long exposures without saturation of the emulsion. He typically takes pictures two or three hours in duration. Sky-limited exposures generally require a background density (sky fog but not hyper or developer fog) of 0.8-1.0. From his location sky fog builds up at about 0.1 density unit/hour at F/10. This means that he would need to go 8 to 10 hours to reach this density!

Kim uses a C11 prime focus at F/10. He does not uses telecompressors because of the added field curvature and aberrations they cause. I tend to agree with him. He has a Shaeffer mount with a 10.3" Byers gear which is accurate enough to let him occasionally look away from the eyepiece during long exposures. I have found that my Meade 8" LX5 is not accurate enough to do this and I must constantly look at the guide star. This leads to eye fatigue so I interrupt the exposure about every 30 minutes to take a break. Kim says he does all his exposures without breaks and his longest exposure so far is four hours.

The longer the exposure the more can go wrong. One of the biggest problems is that commercial SCT's focus by moving the primary mirror. The mirror can shift during long exposures causing focus shifts. Kim says he focuses on a bright star very near the subject and makes his final adjustment by turning the knob counter-clockwise, this pushes the mirror toward the sky to take up any backlash in the screw so the mirror doesn't later shift. Another problem is as the telescope cools a focus shift can occur. I recently ran a test with my 8" in which I found that when the scope was moved from room temperature to about 45 degree air temperature outside the scope took over an hour and a half to stabilize! When you arrive at your observing sight get the scope out first and let it begin to cool as you set up.

I sent Kim a couple of shots I did on Ektar 1000, M42 and M13. He said these objects have a wide dynamic range so they photograph well on low contrast color film. 2415 developed in D19 does not do well because of the high contrast. He said that using a low contrast developer like Technidol for 20 minutes at 68 degrees F. may work well

although he has only tried it on shots of the moon. He is currently trying unsharp masking to print D19 processed negatives with large dynamic range.

I hope these hints will help those of you who are interested in astrophotography. For more hints come to the SIGAP meetings. Clear skies and watch out for low-altitude artificial celestial objects (airplanes).

Hubble Managers Start to Survey the Damage

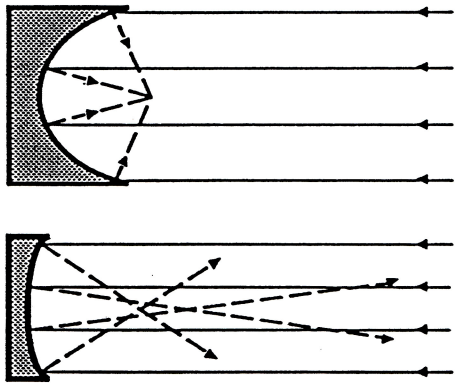
A first report on the $1.6-billion telescope's optical flaw and the prognosis for doing science

THE AWFUL RECOGNITION DAWNED during the weekend of 23–24 June, as ground controllers at NASA's Goddard Space Flight Center outside of Washington, D.C., were trying to figure out the Hubble Space Telescope's finicky refusal to come into perfect focus. Pointing the telescope at a convenient star field, they first commanded it to go completely out of focus. Then they systematically brought it back step by step—and were appalled to realize that the shifting patterns of light were revealing a textbook example of spherical aberration, an optical defect that causes every star image to be surrounded by a fuzzy halo of light.

By 26 June, Hubble project managers were reporting the word to NASA headquarters: the defect, which is caused by incorrect curvature in one or both of the spacecraft's mirrors, cannot be fixed from the ground. It will be years before the $1.6-billion telescope can achieve the ultra high resolution images it was designed for, if ever. Voyager-like pictures of the planets, the first faint glimmer of newborn galaxies, the true size and age of the universe—all will have to wait until space shuttle astronauts can bring up a new set of cameras with corrective optics.

And, they added, NASA itself will have to own up to a human error in creating the mirrors, which were made under agency supervision by the Perkin-Elmer Corporation (now Hughes Danbury Optical Systems). It is still unclear whether the deviant curvature is in Hubble's 2.4-meter primary mirror or in the much smaller secondary mirror, which takes the starlight collected by the primary and bounces it down into the cameras and other instruments. But either way, said deputy project manager Jean Olivier during a hastily called press conference on 27 June, the distortions are too symmetric, too perfect to be a random deviation caused by the stresses of launch. "We suspect that the methods used to measure the figure of the mirror during manufacture, which are very complex, resulted in the mirror being very precisely made," he said—"but to the wrong figure."

For astronomers, of course, the first and most urgent priority was to figure out how the flaw will affect Hubble's scientific output. From a first quick survey, it seems that roughly half of what they want to do with the telescope will be unaffected. In particular, the poor focus takes nothing away from Hubble's ability to peer deep into the ultraviolet part of the spectrum, which is completely screened from the ground by Earth's atmosphere. So one of Hubble's key targets—the ultraviolet spectral signature of embryonic galaxies and intergalactic gas clouds backlit by quasars—should proceed as planned.



Aberrant behavior. *A perfect parabolic mirror will reflect every ray of starlight to a single focal point (top). But Hubble's mirror isn't perfect, the rays do not cross at a single point, and so there is no perfect focus (bottom).*

Nor will the poor focus spoil the steadiness of Hubble's images, especially now that engineers are bringing the earlier problems with spacecraft stability under control. Free from atmospheric turbulence, Space Telescope will still be able to look for the subtle back-and-forth motions that might indicate that a star has planets.

The bad news, however, is that about half the science proposals *will* be affected, most notably those that rely upon Hubble's workhorse Wide Field/Planetary Camera (WF/PC). Even with a degraded focus its images are still somewhat better than those from ground-based telescopes: it focuses about 20% of the light from a star into a bright "core" about 0.1 arc second across, with the remainder spreading out into the aberrant halo. (The best ground-based images are about 1 arc second across.) But the astronomers on the WF/PC team are having to face a brutal question: are those images *so* much better that they are worth taking precious observing time away from less-affected instruments?

Until they can obtain some trial images of real scientific targets, that's going to be a tough question to answer. But if decision is no, then the current WF/PC may never be used at all. "We don't want to use Space Telescope for non-unique science," says Edward J. Weiler, Hubble program scientist at NASA headquarters. "If that means turning WF/PC off, then so be it."

As bleak as that sounds, NASA officials and astronomers alike say they are hopeful that the imaging experiments can eventually be resurrected. NASA designed Space Telescope so that shuttle astronauts could extract its old scientific instruments and replace them with new ones as needed. Indeed, an upgraded WF/PC is already well under way at the Jet Propulsion Laboratory. In principle, says Weiler, it should be straightforward to modify the internal optics of future instruments and remove the telescope's distortion entirely. JPL engineers are now studying how to accelerate the WF/PC-2 development, and NASA headquarters, which long ago penciled in a shuttle flight to revisit Hubble in 1993, is looking for ways to reschedule it sooner.

If such a fix could be implemented, says Weiler, then the net result will not be a loss of Hubble science, but a rearrangement of that science, with most of the currently planned imaging being done after 1993. In the interim, he says, astronomers have already submitted more than enough top-quality proposals to keep Hubble busy. "Can we do unique and important science? *Yes*," he vows—"100% of the time."

Meanwhile, within a day of hearing the news, top NASA officials asked JPL director Lew Allen to chair a formal board of inquiry into the mirror fiasco. The question is obvious: How this could have happened—especially given the hundreds of people who checked and cross-checked the mirror-making process every step of the way. The curvature error, which amounts to about half a wavelength of visible light or about 1/50 the width of a human hair, would have easily been detectable by the laser interferometers used to test the mirrors. No such errors were ever seen. But then, as Olivier admits, the mirrors were only tested individually, never as a complete optical system. In principle, there was no reason to expect the assembly to introduce such an aberration. And in any case, carrying out such a test would have cost hundreds of millions of dollars. But at the moment, this seems the most logical place to start looking for the mistake. ■ M. MITCHELL WALDROP