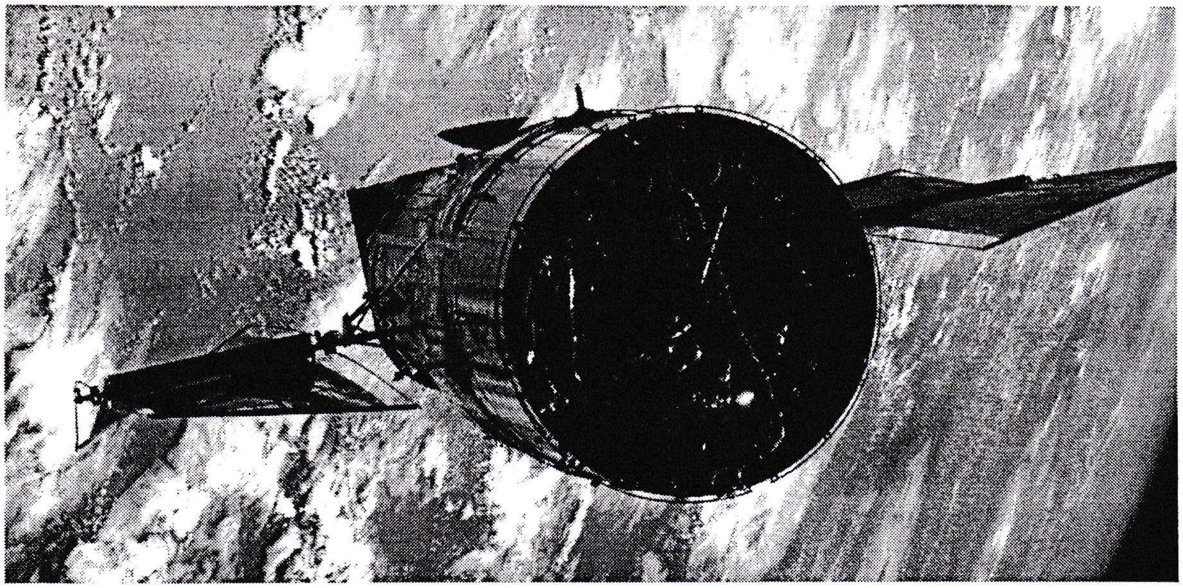
O. Sarnacki

REFLECTIONS



December 1993

The Hubble Space Telescope as seen from the Space Shuttle shortly before retrieving it for it's first in-orbit maintenance. As of press time, all repairs had been accomplished successfully, including new solar panels (note the twist in the original panel on the left above) and gyroscopes, corrective optics and a computer upgrade (from an 80286 to an 80386).

Kurt Hillig
Editor

Of the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Detroit Observatory at the corner of Observatory and Ann Streets in Ann Arbor. Meetings begin at 7:30 PM and are open to the public. Public star parties are also held twice a month, at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; map on page 7) on the Saturdays before and after the new moon; the star party is cancelled if it's cloudy at sunset. For further information, call Stuart Cohen at 665-0131.

This Month:

December 11 - Public Open House at the **Peach Mountain Observatory**. Saturn's getting pretty hard to see, but Andromeda's dead overhead in the early evening, and the Irish Hunter (you know, O'Ryan) is on the prowl!

December 17 - Meeting at the **Detroit Observatory** in **Ann Arbor**. Once again, it's time for the world-renowned Dr. (Hon.) Fred Schebor, and his multi-media extravaganza — the Artsy-Meaningless Show! You've got to see and hear it to believe it!

December 18 - Public Open House at the **Peach Mountain Observatory**. We got clouded out last month. We got clouded out in October. We got clouded out in September. What do you think the odds are this time? Who cares, come out anyway!

December 25 - UFO Night! Watch out for aliens with glowing noses....

Cheaper than Truth!

So you went and took out a second mortgage just so you could buy the latest in computer-controlled telescopes, and to pay back the loan you've gotta rent out CPU time on it to Lawrence Livermore for their H-bomb simulations, and the damned thing doesn't even have an infrared remote! It's got this dumb little hand-held box with a cable hanging from it, and a wimpy little hook made from aper clip that just loves to fall off from whatever it's hung on. Well, you could weld some Vise-Grips™ to the tripod to keep it in place, or, if you're C.T.T., just replace that hook with a key ring! The ring will still hang over any convenient bolt or screw head, it's a lot harder to knock off, it's quieter than Velcro, and you'll always know where your car keys are too!

Next Month and Beyond:

January 3 - Computer Subgroup Meeting at **Doug Nelle's** house (a Monday – note the date). We'll be preparing for our TV debut in May, as we plan to televise the solar eclipse. Also, more on CCD cameras, and with luck some new shareware to play with. We're open to everyone – you don't have to be a computer nerd to come! Call Doug at 996-8784 for directions.

January 7 - Deadline for Newsletter Submissions!

January 8 - Public Open House at the **Peach Mountain Observatory**.

January 15 - Public Open House at **Peach Mountain**.

January 21 - Meeting at the **Detroit Observatory**. William Durrant, on "Particles in Space" .

February 1 - Computer Subgroup Meeting. location TBA

A Word or Two from the Editor....

Well, another year has almost come to an end, and in a few months it will be time for elections – and, perhaps, the passing of the reins to a new editor. While I'm not very eager to give this up, I'm also starting to have some problems with my (naturally) right hand (I call it "MacThumb"), and it's hard for me to keep this going. So, unless Advil or surgery (or maybe just time)start working soon, I will likely retire, at least for a while. And so I wax philosophical as I see the end approach. And, when you get right down to it it's been a very rewarding job despite the frustrations – and I greatly appreciate all the nice comments! And I guess it's good I'm running out of space now or I'd start getting maudlin – but hey, you know what I mean anyway.... MC & HNY!

Novae and Supernovae: How Dangerous Are They?

by Michael Richmond, Princeton University
and the sci.astro news group

Q. What is the nearest star which could conceivably become a nova, a type I supernova, or a type II supernova?

A. Usually Betelgeuse is taken as the best bet for the closest type II supernova, although eta Carina is sometimes modeled as a massive star losing mass (it's a peculiar variable star) that may undergo core collapse within the next 20 to 30 thousand years.

The biggest problem with the standard paradigm for type Ia (i.e a white dwarf that accretes the proper amount of material at the proper rate until it grows to near the Chandrasekehar mass, at which point it ignites carbon burning near the center), is that no one has ever observed a definitive progenitor system. So a guess as to the closest one is just that, a guess.

The same binary accretion scenario applies to classical novae, although at smaller accretion rates. Here, however, the progenitor systems have been seen; the first definitive studies being done by Merle Walker (1956, 1958) and Bob Kraft (1959), both of whom studied nova dq Herculis. I believe, but might be mistaken, that this is the closest known classical novae system.

Q. What is the "blast radius" for a nova or supernova? We're talking about a wide range of energies, but what would be considered a safe distance? A thousand AU? 1 light year? 10 light years? And what should worry you most, the radiation or the shock wave?

A. Since this topic seems to come up every year or so, I decided to try to work out some of the dangers quantitatively. Let me list the various sources of danger I've considered.

1. Optical and near-optical light
2. X-rays from the explosion itself
3. X-rays from the supernova remnant
4. Gamma rays*
5. Neutrinos
6. Energetic particles*

I haven't been able to find much information on those items marked with a "*", but I'll tell you what I know. My current best guess is that items 2 and/or 4, energetic photons, are the most dangerous to those nearby.

1. Optical and near-optical light

After a very brief (but significant? I don't think we know enough to say for sure) "flash", the optical output of SNe rises over a period of several weeks, peaks for a few days (for types Ia, Ib) to a few months (for type II), then fades relatively slowly. The absolute magnitudes of of supernovae at peak, like everything else, vary according to the astronomer who answers the question :-), but rough values for the distances where they'd equal the Sun in brightness are:

Object	peak M(V)	distance
Sun	-26.8	1 AU
type Ia	-19.6	0.04 pc
type II	≥-18.5	≤0.02 pc

SNe must be very close to affect the Earth via optical photons.

2. X-rays from the explosion

I could find data for X-rays from type II SNe only, but I'll make estimates for Ia as well. Satellites detected ≤ 8×10^{-11} erg/(cm^2-s) in the 6-28 keV range from SN 1987A (which was probably less luminous than most). I'd guess that over the entire X-ray range, about 8×10^{-10} erg/(cm^2-s) would be observed from SN 1987A.

The Sun, on the other hand, during a large flare, emits around 0.35 erg/(cm^2-s) in the same X-ray band. In order to produce the same X-ray flux as a large solar flare, then, SN 1987A would have to be closer by $\sqrt{(0.35/[800\times10^{-12}])}$, or at a distance of ~2 pc.

David Palmer estimates that a type Ia SN should produce about 200 times as much X-ray flux as a type II (albeit for a shorter time), so a Ia SN at ~30pc would give us the equivalent of a strong solar flare for several weeks.

I suspect that X-rays (and gamma-rays, see below) are the most deadly of a nearby SN's effects.

3. X-rays from the supernova remnant

As material in the ejecta slams into the surrounding interstellar medium, it produces shock waves that can heat material up to millions of degrees and produce X-rays. For example, the SNR Cas A, at a distance of about 3kpc, has a flux of something like 5×10^{-15} erg/(cm^2-s) according to X-ray satellites (I had to assume a lot about the size and efficiency of the instruments here, so I'm probably way off, but it won't matter). Comparing again with the flux from a solar flare, we find that Cas A would have to be located less than 0.001 pc from the Earth to produce the same flux. Now, this flux would be very long-lasting, but even so, is clearly less important than the X-rays produced in the explosion.

4. Gamma-rays from the explosion (much based on words of wisdom from David Palmer - thanks, Dave!)

One way to estimate the effect of SNe in gamma-rays is to compare the amount of power they produce in gamma-rays alone with that from the Sun at all wavelengths, and the distance at which they equal the Sun in output:

Object	power	distance
Sun	10^{33} erg/s	1 AU
SN II	10^{39} erg/s	1200 AU
SN Ia	2×10^{41} erg/s	17000 AU

In other words, a Ia SN's gamma and X-ray output matches the Sun's total radiation output at about 0.08 pc.

In somewhat more detail: both X-rays and Gamma-rays from SN 1987A were due to the decay of radionucleides, primarily ^{56}Co from the ^{56}Ni->^{56}Co->^{56}Fe decay chain. Gamma rays, primarily at 0.847 and 1.238 MeV were downgraded by Compton scattering in the envelope (keeping the envelope hot and luminous) and then emerged at lower energies in the X-ray and gamma-ray range. The unscattered photons at 0.847 and 1.238 were also seen.

The maximum X and Gamma emission from SN 1987A occurred around day 300, and was approximately 10% of the total luminosity of the supernova (i.e. 90% of the gamma energy was lost to scattering and absorption). This maximum was 0.01 MeV/(cm^2-s) ~ 0.02 photons/(cm^2-s).

A type Ia supernova produces about ten times as much radionucleide as a Type II (SN 1987A-like) supernova (~0.7 solar masses ^{56}Ni vs. 0.07 solar masses). It is also much thinner, with only 1.4 M_{solar} of material vs. 15 M_{solar}, and so it should reach maximum gamma-ray brightness in a few weeks, rather than ~1 year, which means the nucleides have decayed less at maximum (77 day half-life for ^{56}Co), and so would be a factor of ~10-20 stronger. I also expect that, at maximum, a greater fraction of the gamma-rays should escape, so call it 200 times stronger than the peak flux from a type II: about 2.0 MeV/(cm^2-s) ~ 4.0 photons/(cm^2-s).

Unfortunately, I don't have the numbers for the Sun's flux in gamma-rays, so I can't go any further with these numbers. :-(

5. Neutrinos

The neutrino flux from SN 1987A was about 5×10^{10} cm^{-2} in a burst of a few seconds, which is similar to that from the Sun ($6.5\times10^{10}/(cm^2\text{-}s)$)! The calculation below is due to Robert W. Spiker, U. of Virginia:

> This was part of a question on my Ph.D. qual exams two years ago. Here's how I did it: The total energy released in a SN in neutrinos is $E_{nu} \approx 10^{53}$ ergs [this is about 99% of the total energy released! - Ed.]. The cross section for interaction is $\Sigma = 10^{-44}$ cm^2. The minimum lethal dose is 1000 rads, i.e. 10^5 ergs of energy absorbed per gram of body weight. This gives 8×10^9 ergs absorbed by an 80 kg body in order to die a horrible death.
>
> Now the energy absorbed equals the energy passing thru times the cross section times the path length times the number density of the absorbing body. I figure the typical body presents 1 square meter of area and has a path length of 30 cm (so we can look at the pretty star as it blows). Number density of the body I chose to be 1 $g\,cm^{-3} / 6\,m_H$; that is, density equal to water (we float) and mean atomic weight of about 6 (we're mostly H but I figured we have lots of C, N, and O).
>
> The energy passing thru equals the"flux" times the area: 10^{53} ergs / $(4 \pi d^2) \times 1\ m^2$, so the distance d needed to absorb a lethal dose is $d^2 = (E_{nu}\ A \Sigma n l) / (4 \pi E_{lethal})$, which if you plug in as I did comes to 1 AU.

I think it's safe to say that the neutrino dangers are small.

6. Cosmic-ray particles

This possiblilty is one that may be important, but I just don't know enough to calculate how important. Here's what I could find:

The solar wind, at the distance of the Earth, has a density of about 9 protons/cm^3, velocity ~470 km/s (and the particles have a temperature around 10^5 K). Let me take as a measure of the impact on the Earth's atmosphere the product of density ρ and velocity squared (v^2): 2×10^{16} in cgs units (protons/cm-s^2). Now, let me consider the material in the expanding shell of ejecta from a type II SN; assume a total mass of 5M(solar), an expansion velocity of 5,000 km/s and a shell thickness of 0.01 times its radius (I'll bet that the real thickness is greater, but this increases the impact). Then, assuming that the shell expands uniformly and ignoring all the material swept up in its path (which really is significant over scales of $\geq$ 1pc), I find

shell radius	time since explosion	ρ	$\rho \times v^2$
1 pc	200 yr	30 cm^{-3}	7×10^{18}
10 pc	2000 yr	0.03 cm^{-3}	7×10^{15}

So, this vastly over-simplified model predicts that the ejecta material will be comparable to the solar wind at a distance of a few parsecs. Again, I have no idea how much stronger the "SN wind" must be than the solar wind for it to pose a danger.

However, I've left out the issue of the energy of the particles. It has been hypothesized that SN remnants are sites of cosmic-ray acceleration, which could produce a smaller population of much more energetic particles than in the typical ejecta shell. Those very-high-energy particles could have a significant impact despite their small numbers. Since I know zero about acceleration mechanisms, or the effect of the energy of cosmic-ray particles on their interaction with the Earth's atmosphere, I'll just stop here.

Conclusion: I suspect that a type II explosion must be within a few parsecs of the Earth, certainly less than 30pc, to pose a danger to life on Earth. I suspect that a type Ia explostion, while brighter optically, would have to be still closer. My guess is that the X-ray and gamma-ray radiation are the most important at large distances.

The Chaotic Rotation of Hyperion

Phil Stooke (stooke@sscl.uwo.ca)
Social Science Computing Laboratory,
University of Western Ontario

Q. I've heard that there's a moon of one of the outer planets whose motion is so perturbed by the other moons nearby that its orientation can't be predicted more than a few hours in advance. What's the story?

A. The satellite with the chaotic rotation is Hyperion, around Saturn. It is very irregular in shape, and its rotation is disturbed by the large and (at times) nearby satellite Titan. As to it being impossible to predict its orientation "several hours in advance" - this is a gross exaggeration. The rotational period appears to be very slow – about 13 days (first found by Thomas and Veverka at Cornell) – and it is not currently possible to predict its orientation more than a few months in advance. It may vary chaotically, but the best guess now seems to be that it varies within relatively narrow limits.

I have recently reviewed all Voyager 2 images of Hyperion. There is evidence for 13-day rotation - the subject of a paper I am preparing - and my aim is to give a reasonable estimate of the rotation state at the time of the Voyager 2 flyby, using the pole and rotation period as the basis for a digital shape model of Hyperion and a detailed map and geological study. I expect the results to be published by about April next year. By the way - as with Phobos, Epimetheus and Gaspra, there are grooves on Hyperion!

Heard Any Good Galaxies Lately?

by Frederick Schebor

Ok, so you are studying operatic singing and piano in college, but you can't stop dabbling in radio astronomy. What do you do? Well if you are Fiorella Terenzi you combine the two, but first you get a Ph.D. in astrophysics. Then you convert radiation from deep space into something we recognize as sound and in the process create a new sub-field of astronomy called Acoustic Astronomy. Finally, you find a record company to mass produce the result.

Music From the Galaxies is Dr. Fiorella Terenzi's first release (Island Records 422-848 768-2). On this CD, Dr. Terenzi features radio signals emitted by galaxy UGC 6697. Located in Abell 1367, UGC 6697 is one of the highest radio luminosity spiral galaxies. It is approximately 180 million light-years from Earth.

Since the "voices" of the galaxies range from 10^9 to 10^{12} Hz, the challenge is to mathematically convert these incredibly high frequencies into the range of our hearing. To perform the conversion, along with other editing, Dr. Terenzi used a sound synthesis program called Cmusic at the Center for Music Experiment, University of California.

With "tune" names such as Sidereal Breath, Plasma Waves and Radio Core, one reviewer described the CD as "40 minutes of hypnotizing bleeps that sound like a cross between New Age music and light rock played underwater." I myself give it a 10. Although you can't dance to it, and playing it before friends usually results in "What in the $#&%@* is that noise?", I find it pleasing to hear an immense object more than 1,000 billion billion miles away used as a musical instrument.

If you would you like to hear the "music" for yourself, bring a high quality C90 cassette to the December meeting. I'll record it for you and return the cassette at the January meeting.

Computer Subgroup Report

by Roger Tanner

The subgroup meeting was at my house on December 1, with about 6 people present. The first topic was planning for the upcoming annular solar eclipse on May 10, 1994 and implementing Stuart Cohen's idea to show the eclipse to several schools through live video. After much discussion, led by Doug Nelle, it appears that the best setup might be using Kurt Hillig's portable 4" Schmidt-Cass and a solar filter to image the sun on to a CCD video camera head. The camera output would be recorded and also (hopefully) cabled into the video studio at either the Toledo or Ann Arbor School. The two school systems have a cooperative video production agreement, so this signal can be fed to both school systems. The eclipse is at about one o'clock in the afternoon, and we hope to cable-cast it live. Annularity will last about 6 minutes in Toledo but will be be very short in Ann Arbor, since Ann Arbor is right on the edge of annularity.

Several problems need to be solved; the first is how to connect the camera to the scope. The back of the scope has a thread somewhat larger than a T thread, and the front of the camera has a C mount which is the standard for video camera lenses. The conclusion of the discussion was that either Doug or Kurt might have the adapters needed, or Kurt would make one up. [If you know the specs for SCT, T- and C-mount threads, please contact Kurt! - Ed.] The other problem is that the image would be too large for the image chip. Kurt's CCD camera has about a 6.5 mm wide chip . At the 1000 mm focal length of his scope, this covers a field 22 arc minutes across. We discussed using a 1/2x focal reducer I have to raise this to 44 minutes, which would give some leeway on centering. The focal reducer has T thread on each side. So we need a Scope thread to T thread adapter then a T to C mount adapter. Doug felt confident about finding a T to C adapter and Kurt felt he could handle making the other adapter.

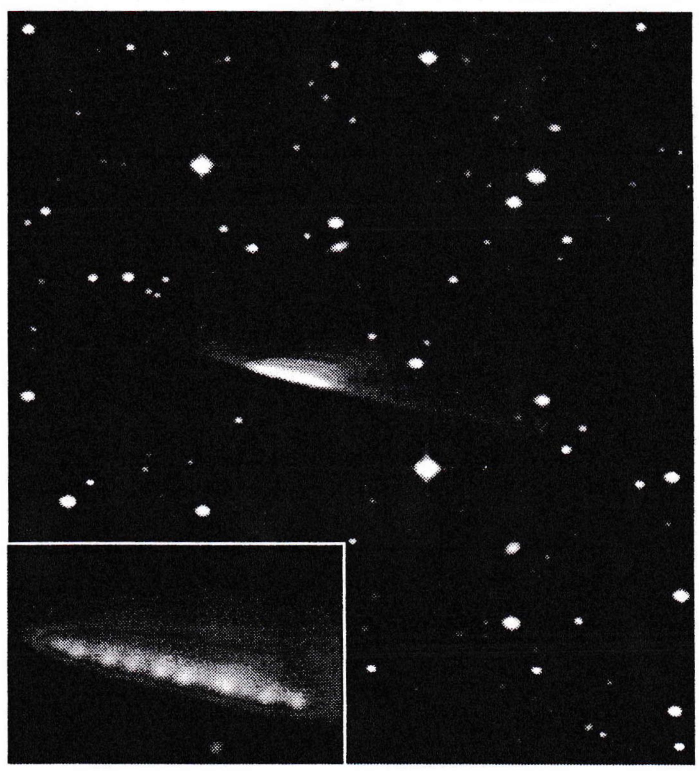
The other idea for the eclipse broadcast is to have a scope with a hydrogen alpha filter on it to show the prominences on the surface of the sun. First we need to find someone with a hydrogen alpha filter who is willing to bring it to wherever we are going to set up. Hydrogen alpha filters are pretty expensive (> $1000) and not many amateurs have them. Doug thought he could borrow another video camera from work for this. The next problem would be coupling a scope, filter and camera together. Afocal projection was discussed, which is where the scope is set up with the filter and eyepiece as if for visual use, and the camera is pointed into the eyepiece and set to focus at infinity. While this works, it typically gives high magnification, probably too much for the camera. Still, the first step is find someone with a filter. I am asking around in the Warren club, and if I have no luck there the next step is to ask Norbert Vance from the Eastern Michigan University club.

The next topic was the upcoming CCD camera kit by Willmann Bell and University Optics. I talked to Jan Siefrieg (sp?) of University Optics and he indicated he is preparing several parts kits including one which has everything except the Willmann Bell parts, the CCD chip and the cooler. This will make it much easier to build the camera. He doesn't have all of the parts sourced yet so he doesn't have all of the prices. He can't sell any parts until the Willmann Bell ad appears in the February issue of Sky and Telescope, which I typically receive in the first week in January. He may also be able to sell the book with software and the printed circuit boards. I also got some suggested prices for CCD chips from Texas Instruments. The chip used in the base camera (the TC245) costs $100 in the highest noise version. The lowest noise version, which has about half the noise level and 2/3 the number of defective pixels is $454. I also asked about the larger chips and was surprised that the TC215 (a 1000 x 1018 pixel chip) is available in an intermediate quality level for a mere $2250! I had last seen these chips listed for $6000 or more.

I also did some field calculations for the camera and found that the Peach Mountain 24" has nearly the ideal focal length for planetary imaging. At a 600" focal length, the field (with the TC245 chip) is 1.07 x 1.43 arc minutes, with a resolution of .265 x .22 arc seconds. This is the recommended resolution for planetary imaging, and this is what Don Parker uses to take his stunning images. Typically, the atmospheric turbulence limits you to several arc seconds of resolution. To get around this, Don takes several hundred pictures a night, and he gets several where he catches a moment of good seeing. One idea to do this automatically is to have the camera continuously take short images, say .1 sec exposures, and have the computer check the row of pixels which run across the edge of the planet. By checking the gradient or sharpness of the image at the edge of the planetary disc, you could have the computer monitor the seeing continuously and only take an exposure during moments of good seeing.

I also calculated the fields for several more typical focal lengths to give people an idea of the area covered by the TC245 chip. At a 78" (1991 mm) focal length the field is 8.23 x 11.04 arc minutes. At 45" (1143 mm) the field is 14.3 x 19.3 arc minutes. A 300 mm telephoto lenses would give 54.6 x 73.6 arc minutes. A quick perusal of the Messier catalog shows most objects are smaller than 20 minutes, which means a 30" to 45" telescope would give good fields for these deep sky objects. Alternatively, you could use an 80" focal length with a 1/2x focal reducer. Most focal reducers produce vignetting and don't fully illuminate a 35 mm film frame, but with the small size of the CCD chips this usually isn't a problem. For some of the smaller objects like the Ring Nebula (M57) 80" is just fine and 160" (say with a 2x barlow) would be even better.

So far I have been contacted by about 5 people who are interested in building this CCD camera kit. If you're interested, let me know!



Some recent images of Comet Shoemaker-Levy 9, showing 12 or more of its fragments.

The Space Telescope Science Institute
(Operated by AURA, Inc. for NASA)
and
The Astronomical Society of the Pacific

jointly announce the pre-production sale of the Compressed Digitized Sky Survey on CD-ROMs, including the SERC J-band survey of the southern sky, and the Palomar E-band survey of the northern sky. **This is one of the most important new research tools in astronomy.**

The cost of the entire 101 CD set will be $2900 if ordered prior to Feb. 15, 1994. After Feb. 15th the price will be $3500. The digitized data scale is 1.7 arcsec per pixel. The southern SERC survey plate limit is about mag. 21.5; the northern Palomar survey plate limit is about mag. 20.5. A full description of the data and software will be published in upcoming issues of the STScI and AAS Newsletters.

Manufacture of the first 61 CDs from the SERC survey will occur as soon as sufficient presale payments have been received; distribution will follow immediately. The remaining 40 CDs from the POSS E-band survey will be produced and distributed by early 1995. We're sorry, but separate purchase of the north and south sets is NOT possible.

Orders by check or purchase order should be sent to:

ASTRONOMICAL SOCIETY OF THE PACIFIC
DEPT. 10X
390 ASHTON AVE.
SAN FRANCISCO, CA 94112-1787 U.S.A.

Visa or Mastercard orders will also be accepted by phone by calling (415) 337-2624 between 9AM and 3PM PST from Monday through Friday only. Alternatively, credit card orders may be FAXed to (415) 337-5205; be sure to include expiration date and authorizing signature.

Please order now to avoid delays in production and distribution, and to obtain the price discount.

The images on the CDs have been compressed by a factor of about 10 and are nearly indistinguishable in quality from the original digitized scans. The CD sets also contain image decompression software that can be installed and operated on machines running the UNIX or VMS operating systems. All CDs are formatted according to the ISO 9660 standard. An astrometric calibration database is provided. If the number of CD set orders is sufficient, a photometric calibration database will also be shipped to all subscribers in late 1995.

The 1994 Winter Star Party

WSP '94 runs from Monday, Feb. 7 through Sunday, 13 on West Summerland Key, Florida, at mile marker 34.5 (Key people live in a funny linear universe where you only need one dimension, the mile marker on US 1, to define your position.) This is about 30 miles from Key West. This is a nice warm place to go, especially in February, and is blessed with pretty dark skies and occasional sub-arc second seeing. It is as far south as you can get in the continental United States, at only 24.6 degrees north latitude. And, since you are looking out over the ocean with truly 0 degree horizons, you can see (on a clear night) objects down to about -60 degrees declination! You can get more information by calling Bob and Sharon Grant, after 6:30 PM EST on weekdays or anytime weekends, at 305-595-8778. A full week there costs $66 to camp or to sleep in the chickees (sort of like a screened porch). They usually fill up early, so if you are thinking of going call immediately. Roger Tanner and Brian Close are already registered, so you're guaranteed to see at least one friendly face there (you get to decide which one is friendly).

Strictly Commercial - Part II
A word from the Treasurer

There is good news and bad news. The good news is that the T-shirts and sweatshirts have been ordered. The bad news is that they will not all be available at this month's meeting. The galaxy design requires special computerized equipment that J. J. Jinkleheimer (the shirt printing company) is currently in the process of installing. My guess is that they won't be available until January some time. If I get shirts with the silhouette design in time, I'll bring them with me to the meeting.

Also, I have LOTS of calendars left - more than half of them actually. We need to sell about thirty more just to break even with what we paid for them. If you haven't gotten yours yet, or if you need a few for late minute Christmas/holiday gifts, bring your $$ to the meeting - I'll have a good supply with me (of calendars, not money). You should also consider selling them at work - just put one up on display and it'll practically sell itself, with the price being a couple dollars off what one would pay at a bookstore. (I've sold seven this way so far.) And, the extra dollar ($9.00 instead of $8.00) means more money for the club!

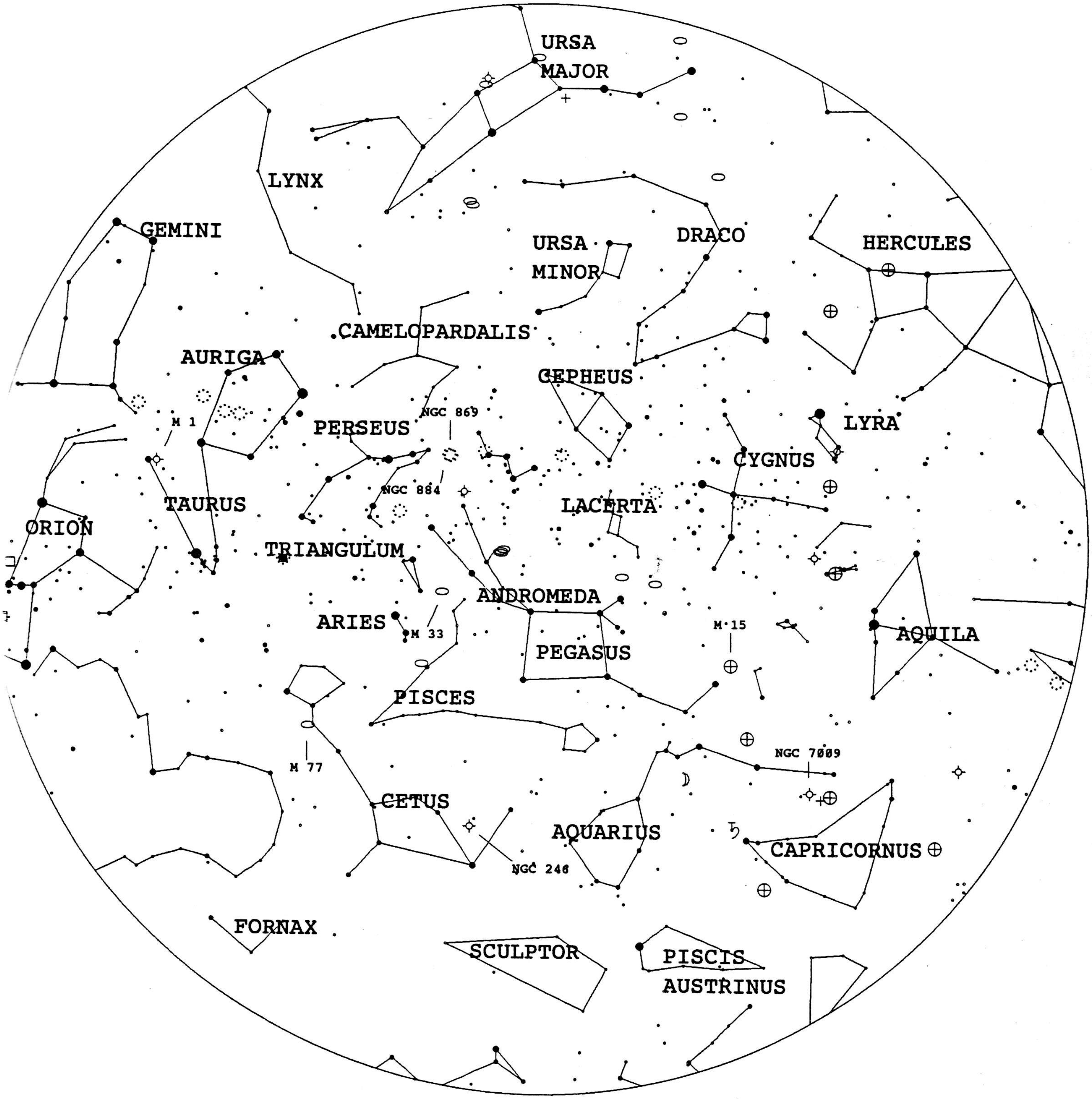
I have ordered the RASC Observer's Guides and will have them with me at the meeting for you to pick up. Bring your $$ with you if you haven't paid for it yet (you know, and more importantly I know who you are!).

Here are the answers to last month's quiz on star names. Score one point for each correct answer!

Alpheratz	α Andromedae	Sirius	α Canis Majoris	Arcturus	α Bootis
Diphda	β Ceti	Procyon	α Canis Minoris	Alphecca	α Coronae Borealis
Navi	γ Cassiopeia	Regor	γ Velorum	Atria	α Trianguli Australi
Achernar	α Eridani	Dnoces	ι Ursae Majoris	Rasalhague	α Ophiuchi
Polaris	α Ursae Minoris	Alphard	α Hydrae	Vega	α Lyrae
Acamar	θ Eridani	Regulus	α Leonis	Nunki	σ Sagittarii
Menkar	α Ceti	Denebola	β Leonis	Altair	α Aquilae
Mirfak	β Persei	Gienah	γ Corvi	Dabih	β Capricorni
Aldebaran	α Tauri	Acrux	α Crux	Peacock	α Pavonis
Rigel	β Orionis	Spica	α Virginis	Deneb	α Cygni
Capella	α Aurigae	Alkaid	η Ursae Majoris	Enif	ε Pegais
Canopus	α Carinae	Menkent	τ Centauri	Fomalhaut	α Piscis Austrini

The navigational stars Navi, Regor, and Dnoces are from reversed spellings of Ivan, Roger, and Second. All three names are derived from the names of the three astronauts who died in the Apollo I pad fire. The RASC Observer's Handbook, for what it's worth, lists the name "Talitha" for ι UMA, and the jawbreaker "Suhail al Muhlif" for γ Vel. And, note that Alpheratz is not the brightest star in Ratz!

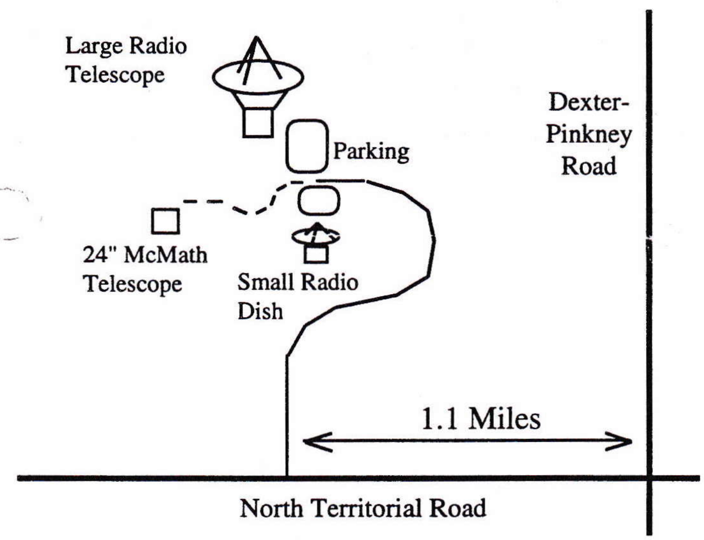
12/18/93 6:46pm EST stars to 5th mag.



☞ Places:

The Detroit Observatory is in Ann Arbor, at the corner of Observatory and Ann Streets, (across from the old University of Michigan hospital and between the Alice Lloyd and Couzens dormitories on the UM campus). The Detroit Observatory is an historic building which houses a 19th century 12-inch refractor and a 6-inch transit telescope.

The Peach Mountain Observatory is the home of the University of Michigan's 25-meter radio telescope, as well as the University's McMath 24-inch telescope which is maintained and used by the Lowbrows. The observatory is located northwest of Dexter; the entrance is on North Territorial Road, 1.1 miles west of Dexter-Pinkney Road. A small maize and blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced-in areas (about 300 feet) to reach the McMath telescope building.



☞ Times:

The monthly meetings of the Lowbrows are held on the third Friday of each month at 7:30 PM at the Detroit Observatory. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.

Computer group meetings are held on the first of each month, rotating among members' houses. See the calendar on p.1 for the location of the next meeting.

Public Open House / Star Parties are held on the Saturdays before and after each new moon at the Peach Mountain Observatory. Star Parties are cancelled if the sky is cloudy at sunset – call 426-2363 to check on their status. Many members bring their telescopes; visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitos – bring insect repellant, and wear warm clothes!

☞ Dues:

Membership dues in the Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students. This entitles you to use the 24" McMath telescope (after some training). Dues can be paid to the club treasurer, Doug Scobel, at any meeting or by mail at this address:

1426 Wedgewood Dr.
Saline, MI 48176

☞ Magazines:

Members of the Lowbrow Astronomers can get a discount on these magazine subscriptions:

Sky and Telescope: $20 / year
Astronomy: $18 / year
Odyssey: $16.95 / year

For more information, contact the treasurer.

❐ Sky Map:

The sky map in this issue of *REFLECTIONS* was produced by Doug Nelle using *Deep Space 3D*, drawn for the end of twilight on the monthly meeting date.

✎ Newsletter Contributions:

Members (and non-members) are encouraged to write about any astronomy-related area in which they are interested. Call the editor (Kurt Hillig) at 663-8699(h) or 747-2867(o), or send e-mail to khillig@umich.edu, to discuss length, format, etc. Announcements and articles are due 14 days before each monthly meeting. Contributions should be mailed to:

Kurt Hillig
1718 Longshore Dr.
Ann Arbor, MI 48105.

☎ Telephone Numbers:

President:	Stuart Cohen	665-0131
Vice Pres:	Doug Nelle	996-8784
	Paul Etzler	426-1939
	Fred Schebor	426-2363
	Tom Ryan	662-4188
Treasurer:	Doug Scobel	429-4954
Observatory:	D. C. Moons	254-9439
Newsletter:	Kurt Hillig	663-8699
Membership:	Steve Musko	426-4547
Open House:	Keith Bozin	549-9525

Peach Mountain Keyholder:

Fred Schebor 426-2363

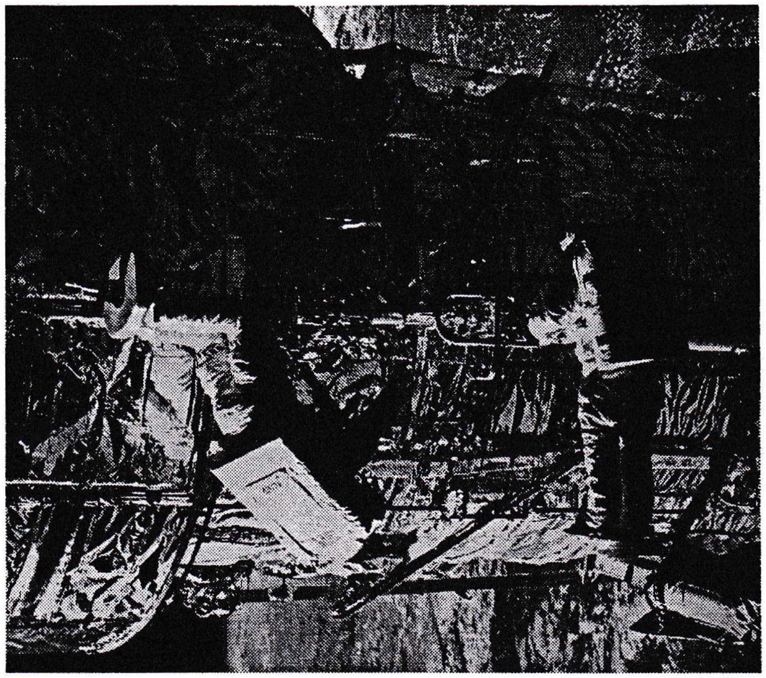
Monthly Meeting:

Fred Schebor:

The Artsy-Meaningless Multimedia Show!

Dec. 17, 1993 at 7:30 PM

At the
Detroit Observatory
in Ann Arbor



Two astronauts hard at work on the Hubble Space Telescope. Unfortunately this image came with no caption! However, it appears to be during the second spacewalk, after the old solar panels were removed. It's clear that these two have learned to accomodate themselves to the confusing visual cues encountered when they aren't both standing "heads up".

University Lowbrow Astronomers
840 Starwick
Ann Arbor, MI 48105