

Event Horizon

February 1999

Volume 6 Issue 4

Mere Mir Mirror Math

Thankfully, technical difficulties scuttled the deployment of a giant "space mirror" from the Mir space station on Feb 3^d. This rather zany idea involved a 25m diameter metallized-mylar structure which would be oriented to direct sunlight - when it was actually in sunlight itself!

It is easy to confirm rough estimates of its brightness with a few background facts. The Mir space station orbits at an altitude of 350 km or 350,000 m. With a diameter of 25m and when overhead, the largest axis would subtend an angle of $206265 * 25 / 350,000 = 15$ arcsec. This is the size of the region of the Sun's surface which could be reflected in the mirror as seen from the Earth's surface. Since the Sun

has an angular diameter of 1800 arcsec (or half a degree of arc), the fraction of the Sun's rays seen on the ground would be at most $(15 / 18000)^2$ or, said differently, one part in 14,400. The Sun has a magnitude of -26.5 (that is, BRIGHT!). The mirror would therefore have a brightness of $-26.5 + 2.5 \log_{10}(14,400) = -16.1$. This is roughly 4 magnitudes brighter than the full moon - all in that 15 arcsec region on the sky. This gives new meaning to the lyric about wearing your sunglasses at night! According to this calculation, it could be up to 40 times brighter than the full moon.

Of course, there are a number of things that take the brightness down a few notches: reflectivity of the coating (liable to be about 70-80%), being downrange - Mir can be seen quite a distance off the zenith, and the projected area of the oriented mirror - which MUST be tilted to redirect sunlight, presumably at about 45 degrees. All of these factors will conspire to lower the total brightness into the published range of about 10 times the brightness of the full moon.

What about the size of the solar image on the Earth's surface produced by this beautiful reflecting pinhole? It is just the diameter of the solar disk in radians (about 1/115) times the altitude of 350 km which equals about 3 km. If we are feeling generous, we will say that it isn't a very high quality mirror and therefore the image will be somewhat spread out - and consequently dimmer as seen from a given place on the ground.

The whole thing doesn't sound very practical - and isn't.

Low-earth orbit is not a good place to reflect sunlight from since most of the time both the ground and the satellite are either in darkness or in light at the same time. Supposedly the whole enterprise is justified by being able to combat the long Russian winters with some extra sunlight. However, winter is the time when the period when the ground is in darkness and Mir is in sunlight for the shortest period of time!!

Doug Welch

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Chair's Report

It is unfortunate that we had to cancel last month's general meeting. Considering the severity of the weather we had little choice though. The good news is that our speaker, Dr. Melinda Weil, has kindly agreed to reschedule her talk to the March general meeting. While on the topic of upcoming meetings, we will be holding a members' night in either April or May. This is your chance to show off your slides, tell us about your telescope or perhaps a project that you are working on. Ann Tekatch will be making one of the presentations, which will be all about reading star charts. You won't want to miss this especially if you are a beginner since knowing how to use star charts is crucial to successful observing.

I have two more astronomy related web sites for you to check out this month. The first is a source of a huge number



of images listed by NGC number at <http://www.aspsky.org/html/resources/ngc.html>. I have tried to find images of particular objects on the web and had to search through many useless links before finding what I wanted. It's nice to go to just one site for so many of those images. For those of you who have the software program ECU it's a great source of pictures for your "images" directory. The next site located at <http://www.blackskies.com/index1.html> is a must for anyone who is interested in planetary nebulae. There are images and sketches, a database of 1,143 objects, 400+ observing reports, information on nebula filters, observing tips, and a page of astronomy links that contains both links to other planetary nebula sites, and general astronomy sites. This is a site that you really shouldn't miss.

Stewart Attlesey
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Editor's Report

Thank you for all the articles that were sent in this month. There are many great articles and I am sure everyone will thoroughly enjoy reading this issue of *Event Horizon*. If you want to get into observing variable stars be sure to read the information on pages 6 and 7.

Remember to read the **calendar of events** on page 8 to find out when everything is happening in February and March. Please note that the February meeting of **HAA** is **not** the third Tuesday of the month this time.

Also, you may want to make special note of the **cosmology meeting** on February 27th. It's going to be quite interesting. The ad on page 10 explains the meeting further.

The deadline for submitting articles and pictures for the next newsletter is Friday, March 5th.

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HAMILTON AMATEUR ASTRONOMERS

Event Horizon is a publication of the Hamilton Amateur Astronomers (HAA).

The HAA is an amateur astronomy club dedicated to the promotion and enjoyment of astronomy for people of all ages and experience levels

The cost of the subscription is included in the \$15 individual or \$20 family membership fee for the year. Event Horizon is published a minimum of 10 times a year.

HAA Council

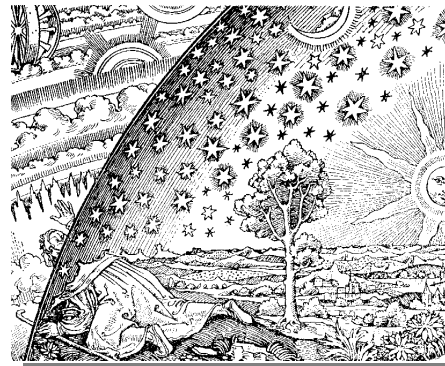
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Constellation of the Month - Ursa Major

- Margaret Walton

In December 1995 the Hubble Space Telescope pointed its camera at a seemingly empty spot in Ursa Major. The field was devoid of bright nearby galaxies, stars, known nearby clusters and bright radio sources. The camera imaged the area for 10 consecutive days. The result is the famous Hubble Deep Field, an image filled with galaxies of incredible shapes and sizes. While our observing scopes can't see those galaxies, there are many objects we CAN see in this constellation.

Ursa Major has been identified as a bear by almost every group, not only the Greeks and the Romans, but the Iroquois and Algonquin tribes of North America as well. The Greeks tell

the story this way. Zeus and his lover Callisto had a son, whom Callisto named Arcas. Zeus' wife Hera was jealous and turned Callisto into a bear. Years later, when Arcas was grown, Callisto saw him hunting in the forest. Forgetting she was a bear, she rushed to greet him. Seeing only a bear about to kill him, he drew his bow to shoot her. Zeus was watching, grabbed Callisto by the tail and flung her into the heavens, where she became Ursa Major. Wanting mother and son together, he changed his son into a bear as well, grabbed his tail and threw him into the heavens, forming Ursa Minor.

Ursa Major contains one of the most recognized star patterns, or asterisms, in the sky - the Plough, or The Big Dipper. The Big Dipper is used as a pointer to other stars and constellations,

the most notable being Polaris, the North Star in the constellation Ursa Minor. The early Britons saw The Big Dipper as King Arthur's Chariot. Many other cultures such as the Irish, Danish, Teutons, Vikings and Polish also identified it as a chariot or wagon.

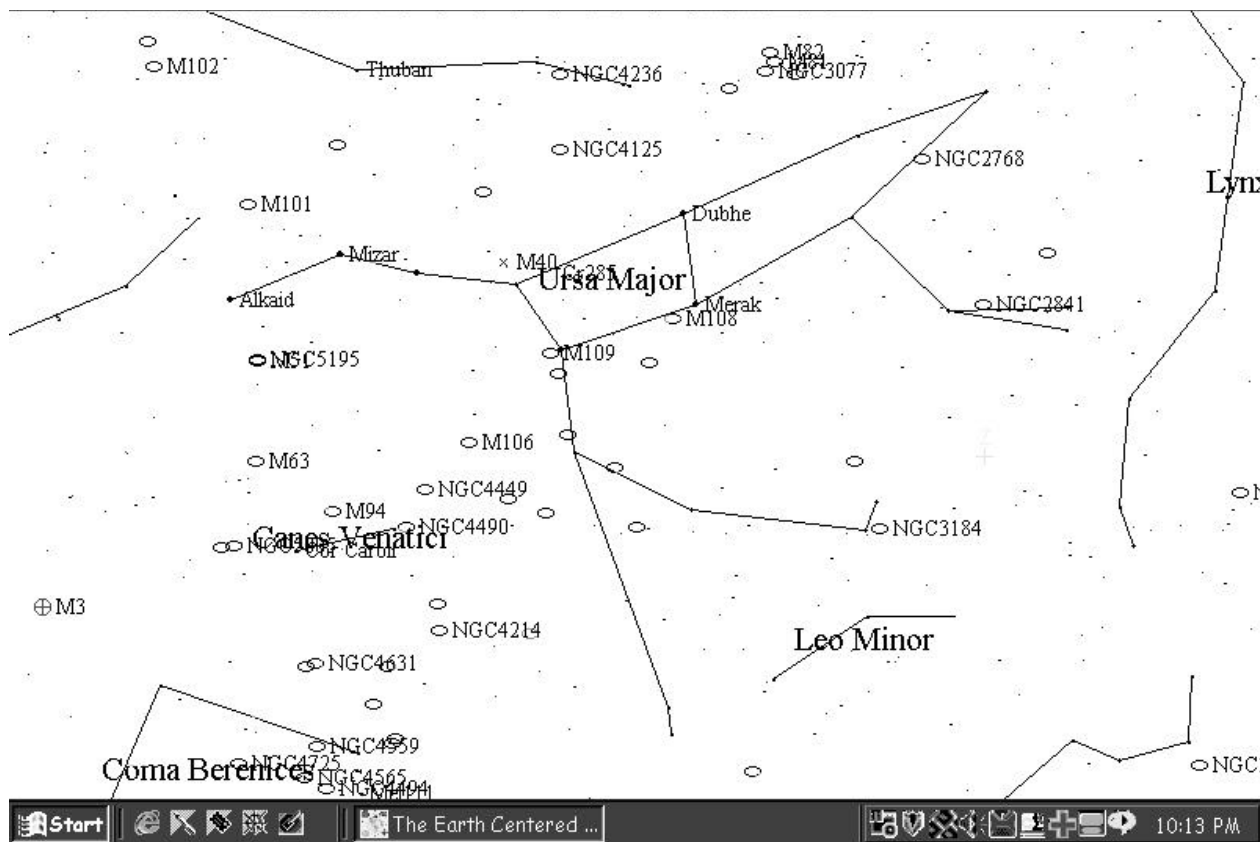
While Ursa Major never sets at our latitude, its midnight culmination is in March.

Objects to See

M40: This asterism is a double star of magnitude 8.

M81 (NGC3031): Bode's Nebula. Very large, bright, elongated galaxy with a bright nucleus. It has a magnitude of 8.4 and as per the NGC is a (!) remarkable object. It is separated from M81 by .5 degrees.

(Continued on page 4)



Constellation of the Month - Ursa Major

(Continued from page 3)

M82 (NGC3034): Cigar Galaxy. This is the smallest of the Messier Galaxies and is a very bright, large elongated galaxy.

M97 (NGC3587): Owl Nebula. As per the NGC, this is a (!!) remarkable object. Gaps in the nebula form the owl's 'eyes'. It is a very bright, large round nebula with a magnitude of 9.9.

M101 (NGC5457): This is a bright, large face-on galaxy with faint spiral arms. Its magnitude is 7.7. This is possible the same object as M102.

M109 (NGC3992): Bright, large elongated galaxy with spiral arms. Magnitude is 9.8.

IC2574: Coddington's Nebula. This is a very large, very faint galaxy with a magnitude of 10.6. It is in the M81 Galaxy Group and has a stellar group at one end.

NGC2681: This is a very bright, very large galaxy with a bright nucleus. Magnitude is 10.3.

NGC2768: A bright, large elongated galaxy with a bright nucleus. Magnitude is 10.0.

NGC2841: A bright, large elongated galaxy with spiral arms and a bright nucleus. Magnitude is 9.3.

NGC3077: This galaxy is located near the M81 galaxy group and is a bright, large round galaxy with a magnitude of 9.9.

NGC3184: Bright, large round galaxy with two main arms. Magnitude is 9.8.

NGC3198: A bright, large, elongated galaxy with several

arms. Magnitude is 10.4.

NGC3631: Bright, large round galaxy with two straight large arms. Magnitude is 10.4.

NGC3675: Bright, large elongated galaxy with two main arms. Magnitude is 10.2.

NGC3726: This Seyfert galaxy is bright, large and elongated with several arms. Magnitude is 10.4.

NGC3893: Bright, large round galaxy with two main arms. It forms a pair with NGC3896. Magnitude is 10.5.

NGC3938: This is a face-on spiral galaxy. It is bright, large and round with several bright arms. Magnitude is 10.4.

NGC3941: Bright, large round galaxy with a magnitude of 10.3.

NGC3953: This spiral galaxy is bright, large and elongated. It has many arms and a small nucleus. Its magnitude is 10.1.

NGC4051: This Seyfert galaxy is bright and very large with two spiral arms. Magnitude is 10.3.

NGC4605: Bright, large elongated galaxy with a magnitude of 10.3.

NGC5322: Bright large galaxy with a magnitude of 10.0.



**Astro Quiz:
Size Does Matter**

*Denise Kaisler
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What's the difference between a planet and a moon? Well if you're talking about terrestrial planets, the answer is : not a whole lot. Below is a list of planets and satellites. See if you can put them in order of size, from largest to smallest.

- ___ Mars
- ___ Uranus
- ___ The Moon
- ___ Ganymede
- ___ Mercury
- ___ Neptune
- ___ Titan
- ___ Venus
- ___ Europa
- ___ Earth
- ___ Pluto

Answer below:



- Uranus
- Neptune
- Earth
- Venus
- Mars
- Titan
- Mercury
- Ganymede
- The Moon
- Europa
- Pluto

The Legend of I-Hsing

adapted by Denise Kaisler

I-Hsing was a great astronomer of the Tang dynasty (600-900 A.D.) who came from very poor circumstances. In his youth, his neighbor Wang-Liao, did him many great favours. Wang-Liao was so generous that I-Hsing swore to help him, however he might.

Many years later, Wang-Liao was imprisoned for having killed a man. I-Hsing traveled a great way to visit his former benefactor.

"I-Hsing," pleaded the condemned man, "you have risen high in the Emperor's court because of your great learning. The Emperor himself finds favor with you. Can you not aid me?"

But I-Hsing was not moved. "I can get you gold and silver aplenty, but I cannot change the law," he said.

At that, Wang-Liao's anger burst forth "What good was it to me that I ever knew you!"

I-Hsing left the prison, but with a heavy heart. For many days afterwards he thought about this grave situation. He was deeply indebted to Wang-Liao and was well aware of his own oath. But to ask the Emperor to pardon a condemned murder? How was it possible?

At last, I-Hsing came up with a plan. He summoned two of his most loyal servants to a room of his house, where there was nothing but a large iron pot.

"I have a task for you which is of greatest importance. Hear me well, and do not fail me, or you shall receive the harshest punishment. Now take this bag and go to the ruined garden, beyond the palace walls. There, you must hide yourselves from noon to until midnight. Listen closely now. If something should appear that numbers seven, you must take it with you and store it in this pot. Mind you get all seven! If even one is lost, we are undone."

Though it was an exceedingly strange request, the servants did as they were told.

It came as a great surprise to them when, at six o' clock in the evening, a herd of seven pigs wandered past their hiding place. Immediately the two sprang out and ran after the pigs. Now, as anyone knows it is a great labour to catch and hold seven, squealing, struggling pigs, but the servants did not wish to be punished. When the animals had been dragged home and stored in the pot, the servants ran to fetch I-Hsing, who covered the pot with a lid and wrote Sanskrit symbols upon it in red.

That very evening, I-Hsing was summoned by the Emperor himself. The Son of Heaven was pacing back and forth, clearly in a state of great agitation.

"I've just received a message from the head of the Astronomical Bureau," he said. "They have informed me that the Great Bear is missing from its usual place in the sky! Oh, I-Hsing, what can it

mean?"

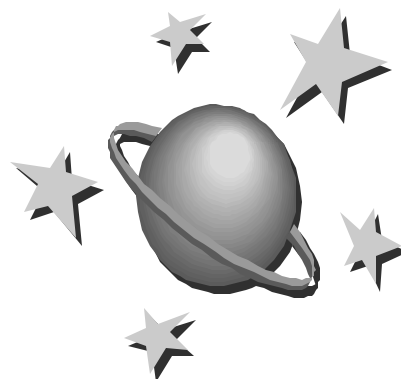
I-Hsing replied, "This sort of thing has happened before. In the Later Wei dynasty they even lost the planet Mars. But there are no previous records of the disappearance of the Great Bear. Heaven must be giving your Majesty warning of an impending disaster."

"I knew it! The Emperor exclaimed. "But tell me, what can be done?"

"Your Majesty, a display of virtue by the Son of Heaven can surely influence the stars. It is my opinion that a decision in favor of life, rather than death, would affect them most."

And so it came to pass that the Emperor issued a general amnesty and all prisoners were freed. Later, the seven stars of the Great Bear reappeared in the heavens. And when the pot which had contained the pigs was opened, it was found to be empty.

from Joseph Needham's Science and Civilization in China, v3. pg 282



AAVSO ALERT NOTICE 253 (January 28, 1999)

**SPECIAL and UNIQUE
OPTICAL MONITORING
REQUEST: 1522+45 GRB
990123-GAMMA-RAY BURSTER
EVENT WITH BRIGHT
OPTICAL COUNTERPART**

We have been informed by the Central Bureau for Astronomical Telegrams (IAU Circulars 7094, 7095, 7100), Dr. Howard Bond, Space Telescope Science Institute, and Dr. Chryssa Kouveliotou, NASA Marshall Space Flight Center and BATSE Team member, that a gamma-ray burst accompanied by an unprecedentedly bright optical flash has been detected by the Burst and Transient Source Experiment (BATSE) instrument aboard the Compton Gamma Ray Observatory satellite on January 23.40764 UT, and by the Gamma Ray Burst Monitor instrument aboard the BeppoSAX satellite on January 23.40780 UT. The BeppoSAX Wide Field Camera 1 also detected the burst and observed the x-ray counterpart.

Interested astronomers were immediately alerted via BATSE's Gamma Ray Burst Coordinates Network. C. W. Akerlof and T. A. McKay, University of Michigan, report on behalf of the Robotic Optical Transient Search Experiment (ROTSE) collaboration (Michigan/Los Alamos National Laboratory/Lawrence Livermore National Laboratory) that within 30 seconds, the ROTSE-I telephoto camera array at Los Alamos, NM, which uses an unfiltered broadband CCD, was observing the location of the gamma-ray burst, and it observed a very bright, rapidly-fading object. Six observations made between January 23.407851 and January 23.414677 (approximately 10 minutes) showed the object brighten from V magnitude 11.82 to 8.95 and then fade to 14.53. Images of these six observations may be seen at <http://www.umich.edu/~rotse/gifs/grb990123/990123.gif>.

Additional observations of the immediate region around this event, obtained by numerous astronomers at several institutions (see IAU Circulars 7094, 7095, 7096, 7098, 7099, 7100), indicate that the optical counterpart of the gamma-ray burst continued to fade very quickly, reaching R magnitude approximately 18 in less than 4 hours and fainter than R magnitude 19 in less than another 5 hours, and fainter than R magnitude 21 in another 24 hours.

The position of the optical counterpart was reported by S. C. Odewahn, J. S. Bloom, and S. R. Kulkarni, California Institute of Technology, on behalf of the Caltech-NRAO-CARA GRB Collaboration (IAU Circular 7094) as:

R.A. = 15h 25m 30.5s
Decl. = +44 degrees 46' 00" (2000)

This event is potentially a very important one for our observers because the bright optical flash may occur again once or several times, and so the area should be monitored. As Dr. Bond explains, "...An exciting aspect of this object is the suggestion by S.G. Djorgovski et al. that GRB 990123 was gravitationally lensed (which might account for the extraordinary apparent luminosity). This raises the possibility, emphasized by E. Turner, that the gamma-ray and optical bursts may recur in the next few days to months, due to lensing time delays along different paths to the Earth. It would thus be very worthwhile for AAVSO members to monitor this position constantly, even with small telescopes or binoculars, to search for such repeated optical transients, which could in principle even reach to brighter than 8th magnitude for a few seconds. Precise times, magnitude estimates, and other details should be determined for any flashes that are seen."

All AAVSO observers - visual observers, photoelectric photometrists, and CCD photometrists - are strongly urged to monitor this location as much as possible over the coming months, and to report any sudden brightening to AAVSO Headquarters immediately. If you see any brightening at the position of GRB 990123, please monitor it constantly and report the timing of your observations very accurately, to the fourth decimal of the J.D. We recommend that you have a tape recorder at hand when you are observing and record your observations into the tape recorder, for the sake of speed.

Accompanying is an AAVSO preliminary "d" scale chart prepared by C. Scovill using Tycho photometry, and approximate V magnitudes derived from USNO A2.0 magnitudes via the vsnet chart for this object.

Anyone interested in being alerted by the Gamma Ray Burst Coordinates Network should write to Dr. Scott Barthelmy at scott@milkyway.gsfc.nasa.gov.

The following websites with information on this object may also be of interest to our observers:

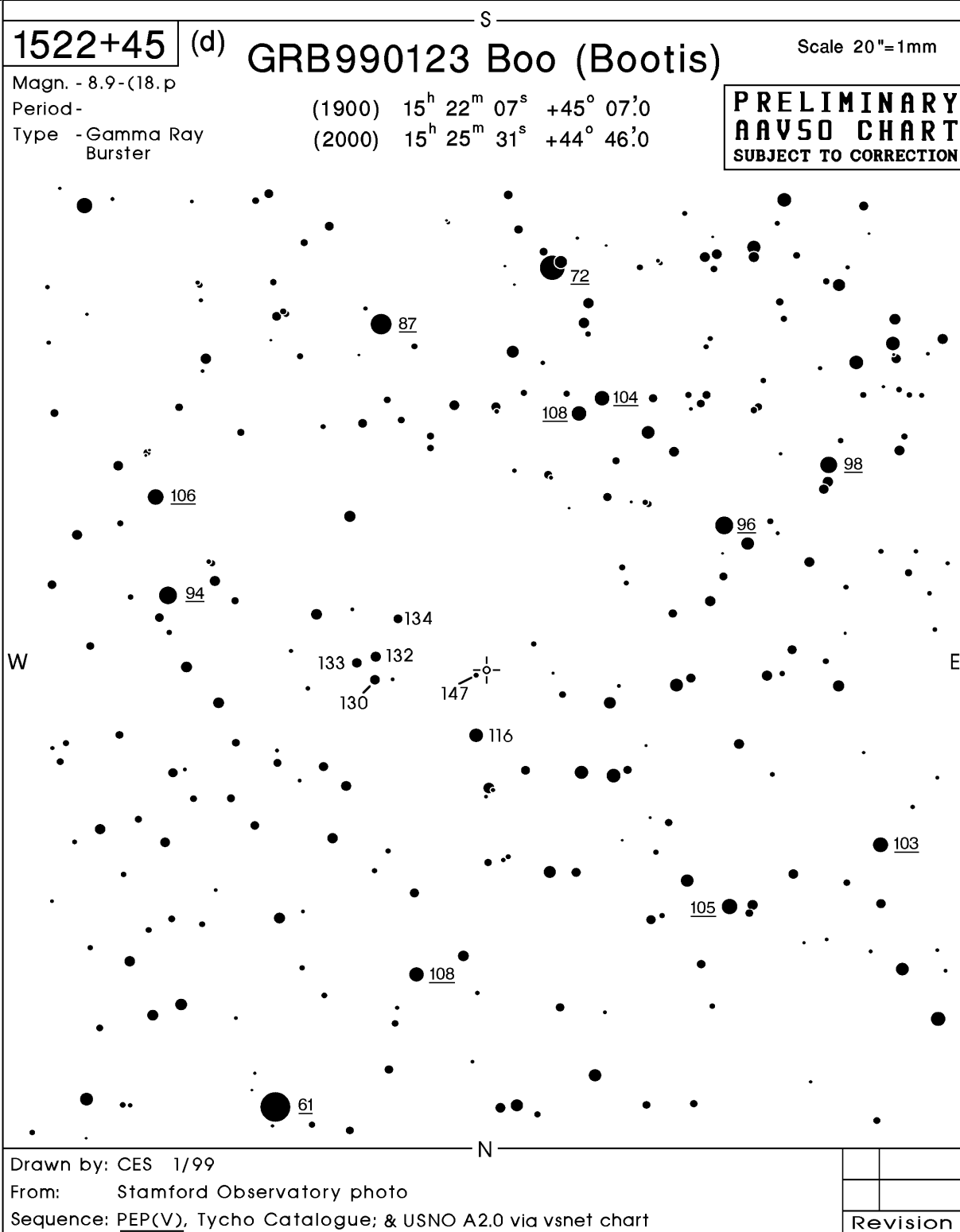
<http://science.msfc.nasa.gov>
<http://astro.caltech.edu/~jsb/GRB/grb990123.html>
http://gcn.gsfc.nasa.gov/gcn/gcn3/199_gcn3

CHARTS AVAILABLE ON AAVSO WEB AND FTP SITES

Electronic copies of the AAVSO chart of GRB 990123 mentioned in this Alert Notice are available through our web site at the following address:

<http://www.aavso.org>

All of these charts may also be obtained directly from our FTP site: <ftp://aavso.org> (198.116.78.5), in /[alerts/alert253/](ftp://aavso.org/alerts/alert253/)



The answering machine at AAVSO Headquarters is on nights and weekends for your convenience. Please call our charge-free number (888-802-STAR = 888-802-7827) to report your observations. We also encourage observers to send

observations by fax to 617-354-0665 or by e-mail through the Internet to observations@aaavso.org.

Many thanks for your valuable astronomical contributions and your efforts.

Good observing!
 Janet A. Mattei
 Director

Rob'serving Report

There isn't much going on that's exciting this month. A few close planetary conjunctions will have to do. Don't give up, though. Winter is slowly disappearing and the weather will improve and gradually warm up.

This month's Binbrook observing nights are scheduled for Feb. 13,19,20 Call Rob Roy (692-3245), Bret Culver (575-9492), or John McCloy (523-4359) at 7pm for local weather conditions and to confirm. The Binbrook Conservation Area currently has some snow and it is not plowed.

Monthly In-Sights

February

18- Venus is 1.8 deg N of thin crescent Moon.

Jupiter is 2 deg N of Moon.

22- Four bright planets are visible in the western sky for the next two weeks.

23- a VERY close conjunction of Venus only 0.2 deg N of Jupiter.

Aldebaran 0.4 deg S of Moon.

March

03- Mercury at greatest eastern elongation- 18 deg. Best evening viewing for 1999.

05- Zodiacal Light possibly visible in the west after twilight for the next 2 weeks.

The Planets

Mercury is visible in the western sky last week of Feb to first week of March.

Venus is an evening phenomenon setting at about 8:30 pm.

Mars rises at about 10:30pm in Libra. Increasing in apparent diameter to about 12".

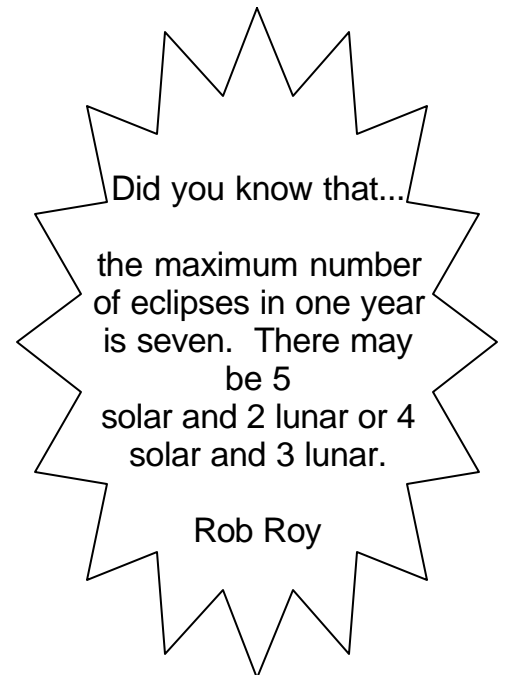
Jupiter low in the west at dusk, setting at about 8 pm.

Saturn is visible until about 10:30 pm in Pisces. Its fairly large disk and the appreciable tilt of the rings continue to make it a nice fall object! The tilt of its ring system is steadily increasing from about 15 degrees as we

look at its southern hemisphere.

Neptune & Uranus are rising in February in the dawn's twilight.

**Rob Roy,
Observing Director
rroy@idirect.com**



CALENDAR OF EVENTS

- February 12, 13, 19, 20, 8:00pm
- Tuesday, February 23, 7:00pm
- Friday, February 19, 7:30pm
- Saturday, February 27, 8pm
- Friday, March 12, 7:30pm
- March 12, 13, 19, 20, 8:00pm
- 4359.
- Tuesday, March 16, 7:00pm

BINBROOK OBSERVING NIGHTS - For confirmation or directions call Rob Roy at 692-3245 or Bret Culver 575-9492 or John McCloy 523-4359.

HAJA MEETING - McMaster Burke Science Building, room B148.

For more information contact Rosa Assalone at 540-8793.

HAA COUNCIL MEETING

COSMOLOGY DISCUSSION GROUP - In Search of the Edge (see page 10) McMaster Burke Science Building room B148.

HAA GENERAL MEETING - At the Spectator Building auditorium

BINBROOK OBSERVING NIGHTS - For confirmation or directions call Rob Roy at 692-3245 or Bret Culver 575-9492 or John McCloy 523-

HAJA MEETING - McMaster Burke Science Building, room B148.