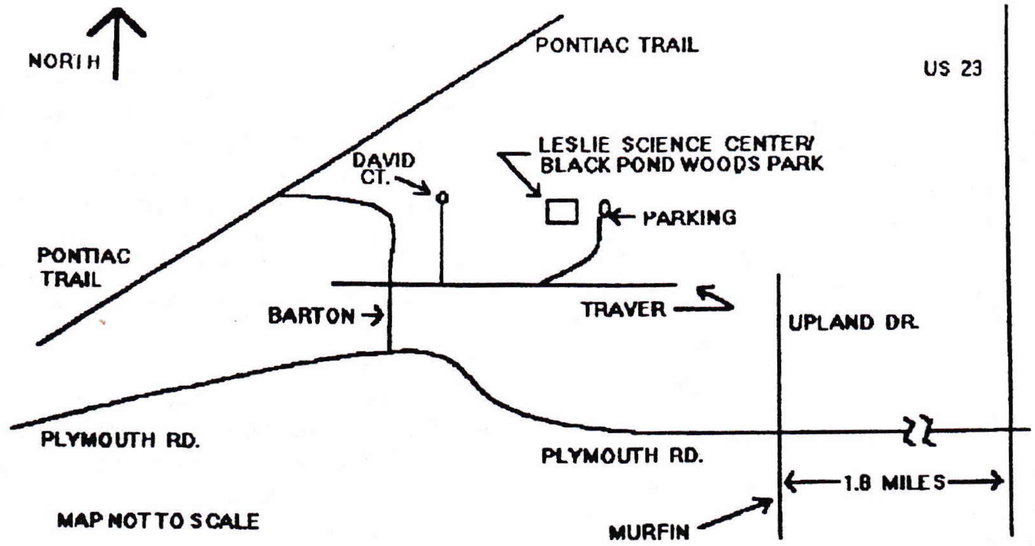
REFLECTIONS



REFLECTIONS

June 1994

Above is a map to the open house at the Leslie Science Center. We will hold two open houses there June 18 and June25. from 9:00 PM to 1:00 Am   Bring your scope, binocs and wisdom. We are expecting a good showing of the general public. Call Bill Rasguanas for more info at (313) 995-0934

Keith Bozin
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 Physics and Astronomy building (Dennison Hall, Room 807). Meetings begin at 7:30 PM and are open to the public. Public star parties are also held twice a month, at he University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; map on page 7) on Saturdays before and after the new moon; the star party is cancelled if it's cloudy or below 10°F at sunset. For further information, call Bill Razguanas @ (313) 995-0934

This Month

June 4 - Open House at Peach Mountain Observatory.
June 11- Open House at Peach Mountain Observatory.
June 17 - Meeting 807 Dennison Hall
Videos from the 1994 Texas star party and a trip to the University of Arizona's mirror grinding laboratory.
June 18 - Open House/Demo at Leslie Science Center.
Starts 9:00 PM end 1:00 Am
June 25 - Open House/Demo at Leslie Science Center.
Starts 9:00 PM end 1:00 Am
See inside for map and further details. Bring your scopes out and help spread the wonders of tthe night sky. We are expecting a decent turnout of visitors. All help possible is desired.
June 26 Officers meeting 3:00 PM @ Kurt Hilligs home.
All are welcome to join and provide input on future speakers or meeting topics. Contact Bill Rasgunas for further info.

Next Month

July 1 - Computer subgroup at Roger Tanners
call Roger at (313) 981-0134 for directions
July 2 - Open House at Peach Mountain Observatory.
July 9- Open House at Peach Mountain Observatory.
Both Saturn and Jupiter are prime observing targets. Come up to the McMath and look at Jupiter before fragments of comet Shoemaker/Levy impact it and blow it to smithereens.
July 15 - Meeting 807 Dennison hall

From the Sales Department

Doug Scobel still has some shirts left. Anyone interested in purchasing one or bringing them out to an open house please contact Doug.

THIS IS EASY

by Chris Sarnecki

Are you are a working stiff and have to get up early the next day to earn your keep, and still want to do a little observing on the never ending evening twilights around the summer solstice? I suggest you do your observing before the end of twilight. Here is an observing run just in time for our scheduled public star party at Leslie Science Center in Ann Arbor on June 18th/25th. Below is a list of twilight celestial targets along with some very basic information you can pass along to the public.

SUN - Sets about 9:15 EDT, end of astronomical twilight is over 2 hours later ! June 24th it is the latest twilight of the year.

MOON - On the 18th the Moon is two days pass first quarter and 75 % illuminated. On the 25th it is two days past full, 92% illuminated, and rises at about 11:00 EDT. I have found viewing the Moon through a telescope during early twilight is less straining to the eyeballs.

JUPITER - Jupiter, sharing the same part of the sky with the Moon on the 18th, transits the sky after 9:00 pm. Look for the four Galilean satellites on the east side of the planet on that date.

VENUS - Shining bright at mag -4.0 Venus can be found low in the northwest.

SOLAR SYSTEM - Line up the planets Jupiter, Venus and the one you are standing on. What you have created is the elliptic or the plane of the Solar System. Now imagin were the Sun is and visualize the Solar System in your mind starting with the Sun and moving out in to space with each planet.

SUMMER TRIANGLE - As twilight unfolds look for the bright asterism formed by the bright stars Vega, Deneb and Altar.

CONSTELLATIONS - it is easier to identify the major constellations when just the brightest stars are in the sky for inexperienced observers. I cannot tell you how many times I have hear someone point out a bright constellation during evening twilight.

STELAR TEMPERATURES - The following bright colored stars tell us about the surface temperature of stars. From coolest to hotest: (I told you this was easy)

Antares, Alpha Scorpii, red in color, has a surface temperature of 3500 K. Also, check out Mu Cephei or the "Garnet Star". This star has the strongest red color of any red supergiant in the sky.

Arcturus, Alpha Bootis, is yellow-orange in color and has a temperature in the range of 4000 K.

Sun, (Alpha Solar System ?), is a yellow star, but don't look at it to confirm this feature. The Sun has a surface temperature of about 5500 K.

Altar, Alpha Aquilae, yellow-white in color is in the 7000 K range.

Megrez, Delta Ursae Majoris, a white colored star is in the 9000 K temperature range.

Megrez is the star that connects the bowl and the handle of the Big Dipper.

Regulus, Alpha Leonis, is blue-white in color and has a surface temperature of about 15000 K.

Blue stars are the hotest stars. At first I couldn't think of a star in the Spring/summer sky that fit in this category, so I went outside and looked up and what did I see but... Spica, Alpha Virginis, a blue star with a temperature at about 20,000 K. This star is realy BLUE. Confirming stellar temperatures is a subtle art. Do not expect to confirm this beyond the bright stars since the eye does not distinguish colors for faint objects .

BINARY STARS - As the sky begins to darken but it is still to light to search for faint fuzzies it is fun to observe double stars. Below is a list of some fine doubles in the summer sky.

Mizor/Alcor, Zeta Ursa Majoris - One of the best optical doubles is acutally a triple system in binoculars or small telescopes.

Cor Caroli, Alpha Canum Venaticorum (that's Canes Venatici) - A nice bright and dim pair.

"Cats eyes", Upsilon Draconis - I don't know if that is the correct name but that is what I call this pair of identical 4.9 mag white stars located in the head of the dragon.

Double/double, Epsilon Lyrae - In telescopes at higher magnification four stars are seen in this quadruple system.

Rasalgethi, Alpha Herculis - (I think this name can only be pronounced correctly by someone who speaks fluent Arabic) means "head of the kneeling one" and is an pretty orange and blue double.

Albiero, Beta Cygni - Called the Maze and Blue star by the locals for obvious reasons. I always save this one for last because the colors are so vibrant no other binary can compeate with this one in the public's eye.

SATELLITES - "Look - That star is moving!" How often have you heard that?

End your twilight observing run with a bang. Go back to Venus which sets about 25 minutes after the end of astronomical twilight and just east along the eliptic look for the open star cluster M44, The Beehive in Cancer. This cluster looks great on a Summers evening low on the western horizon through both binoculars or a telescope.

Well, it is really getting dark now and 1 think 1 will go looking for that comet. It is interesting the things you can see before it is truly dark. The evening is just getting started and I feel like I have already accomplished a good night's observing.

HUBBLE CONFIRMS EXISTENCE OF MASSIVE BLACK HOLE AT HEART OF ACTIVE GALAXY MAY 25, 1994

Astronomers using NASA's Hubble Space Telescope have found seemingly conclusive evidence for a massive black hole in the center of the giant elliptical galaxy M87, located 50 million light years away in the constellation Virgo. Earlier observations suggested the black hole was present, but were not decisive.

This observation provides very strong support for the existence of gravitationally collapsed objects, which were predicted 80 years ago by Albert Einstein's general theory of relativity.

"If it isn't a black hole, then I don't know what it is," says Dr. Holland Ford of the Space Telescope Science Institute and The Johns Hopkins University in Baltimore, Maryland.

"A massive black hole is actually the conservative explanation for what we see in M87. If it's not a black hole, it must be smething even harder to understand with our present theories of astrophysics," adds fellow investigator Dr. Richard Harms of the Applied Research Corp. in Landover, Maryland.

The discovery is based on velocity measurements of a whirlpool of hot gas that is orbiting around the black hole in the form of a disk. The presence of the disk, discovered in recent Hubble images, allows for an unprecedented, precise measurement of the mass of the object at the hub of the disk.

A black hole is an object that is so massive yet compact nothing can escape its gravitational pull, not even light. The object at the center of M87 fits that description. It weights as much as three billion suns, but is concentrated into a space no larger than our solar system.

Now that astronomers have seen the signature of the tremendous gravitational field at the center of M87, it is clear that the region contains only a fraction of the number of stars that would be necessary to create such a powerful attraction. There must be something else there that cannot be seen.

Ford and Harms were astounded by the M87 images taken with the telescope's Wide Field Planetary Camera-2 (in PC mode) on Feb. 27. They hadn't anticipated seeing such clear evidence of a gaseous disk in the center of M87.

"It's just totally unexpected to see the spiral-like structure in the center of an elliptical galaxy," Ford says.

Ford and Harms used HST's Faint Object Spectrograph to measure the speeds of orbiting gas on either side of the disk from regions located about 60 light-years from the black hole at the center.

They calculated that the disk of hot (about 10,000 Kelvin), ionized gas is rotating at tremendous speeds around a central object that is extremely massive but extraordinarily compact -- a black hole.

"Once you get that measurement, all you need is straightforward Newtonian physics to calculate the mass of the central object that's making the disk spin," says Harms.

The measurement was made by studying how the light from the disk is blueshifted and redshifted -- as one side of the disk spins toward us and the other side spins away from us. The gas on one side of the disk is speeding away from Earth, at a speed of about 1.2 million miles per hour (550 kilometers per second). The gas on the other side of the disk is whipping around at the same speed, but in the opposite direction, as it approaches viewers on Earth.

"Now, it all knits together," Ford said. "We see a disk-like structure that appears to have spiral structure, and it's rotating. One side is approaching, and the other is receding."

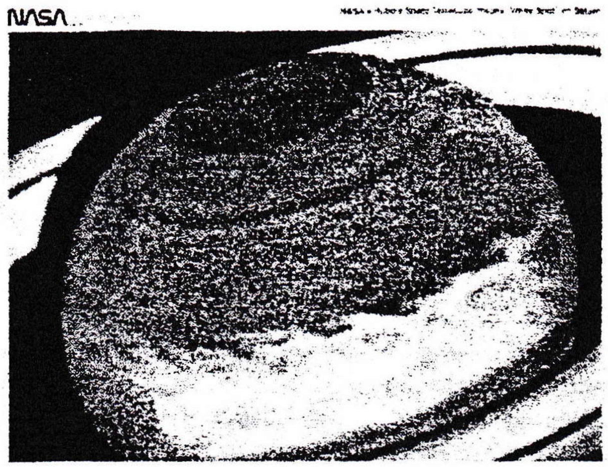
The cloud of gas is composed mostly of hydrogen. The hydrogen atoms have been ionized, or stripped of their single electron, possibly by radiation originating near the black hole.

Over the next few months, they will attempt to peer even closer to the center, where the disk should be spinning at even higher speeds, improving the measurement of the black hole's mass.

M87: A NEARBY ACTIVE GALAXY

Since observations as early as 1917, astronomers have suspected that unusual activity was taking place in the center of M87. They discovered a long finger of energy emanating from the nucleus. Investigations using radio telescopes in the 1950s detected large emissions of energy from the galaxy. This made it clear that the bright optical jet and radio source were the result of energy released by something in the center of the galaxy.

In high resolution images, the jet appears as a string of knots (some as small as ten light-years across) within a widening cone extending out from M87's core. A massive black hole had been the suspected "engine" for generating the enormous energies that power the jet. The gravitational energy is released by gas falling into the black hole, producing a beam or jet of electrons spiraling outward at nearly the speed of light.

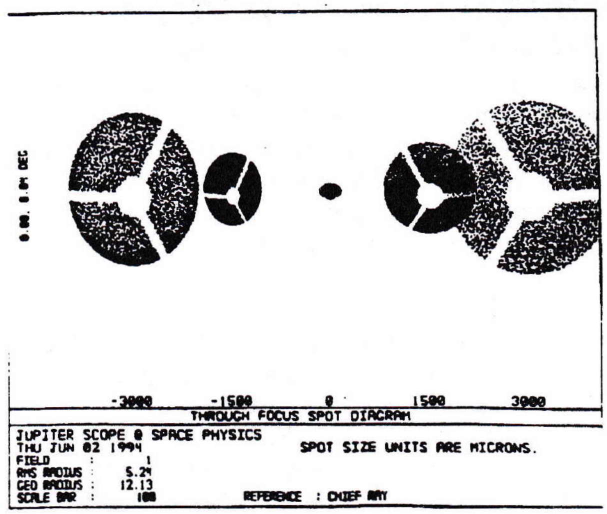


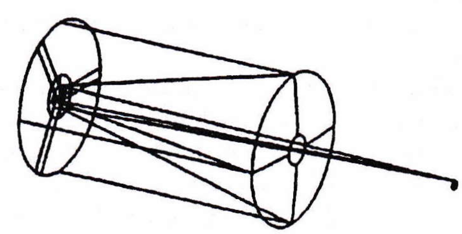
COMPUTER SUBGROUP MEETING - JUNE 1 REPORT
by Tom Ryan

The June meeting of the computer subgroup was held at Tom Ryan's house. The two major topics discussed were optical design software and CCD image processing software. Tom also displayed his latest acquisition (which can be turned into a telescope) from the junkyard.

Lowbrows Mark Vincent and John Potts started the meeting by saying that they are part of a group of researchers at the Space Physics building who are designing a rocket-borne ultraviolet spectroscope to investigate Jupiter's upper atmosphere. Mark is currently aligning the optics of the 14" Dall-Kirkham telescope which feeds light to the spectroscope, and he is seeing a lot of astigmatism at the focus. He wondered if it was possible to misalign the optics of a Dall-Kirkham in such a way as to produce some spot diagrams which he had brought with him. He had examined the image before and after focus, and had drawn the results on a piece of paper.

The telescope had originally been designed with Beam 4, and Mark had the specs loaded in his 486 laptop. While we transferred the telescope's data to the ZEMAX program on Tom's creaking 386-20, Mark talked about how hard it was to get Beam 4 to do what he wanted. John agreed, saying that while Beam 4's advocates claimed it could do anything, his reading the manual eight times had not revealed how to get it to do these things. Mark mentioned problems with modeling such things as three secondary support vanes 1" thick, the inability of Beam 4 to automatically find off-axis images (shades of TDESIGN!), and the necessity of entering every ray to





be traced using the dreaded (gasp!) direction cosines

. By now the design was in ZEMAX (see insert), and we were ready to misalign the system. We offset the secondary, tilted the primary, set up some off-axis stars, and had the program display the through-focus images of the stars at the five image planes that Mark had measured. No astigmatism. Mark said that this confirmed that the problem was not one of alignment, but that the mirror cell was distorting the mirror into a potato chip shape.

The total elapsed time to do this was about 20 minutes. Mark said he had worked on this problem for a week using Beam 4 and still didn't have an answer. Tom ungraciously pointed out that, while Beam 4 costs $889 and ZEMAX costs $1500, if they paid Mark $100/day, then for the same amount of money, he could have had both ZEMAX and a solution. Roger Tanner said that students at certain ZEMAX-recognized schools get a 25 % discount off the purchase price. So a note to all you students out there; get it while you can.

The discussion then moved on to CCD imaging. Roger Tanner showed some pictures he had taken at the Texas Star Party, using the Richard Berry T245 Cookbook camera, and his 17.5" f/4.5 reflector. When they appeared on the screen, everyone was absolutely floored. These pictures looked like pictures I had seen on observatory walls, taken by the world's largest telescopes. A picture would appear on the screen, and Roger would say something like "M 51. Three hundred seconds." The picture looked like the cover of CCD Astronomy. He showed a ten minute exposure of comet Shoemaker-Levi, the comet fragments that will strike Jupiter. Pointing to a medium bright star, he said "This star is 18.5 magnitude, so the brightest comet fragment must be about 19th magnitude". Roger had taken a series of exposures of the comet, and we watched as successive images swept the comet past a faint spiral galaxy

. Roger had taken a number of shots of other objects. To give the reader an idea of good targets, and the time necessary for Roger to record them, the following list is reproduced:

OBJECT	EXPOSURE,SEC
NGC 4565	480
Shoemaker-Levi	600
M51	240
M 66	240
NGC 4038	2x40
M 17 Omega Nebula	30
M 28 globular	30
M 16 Eagle Neb.	120
M 27 Dumb-bell Neb.	120

Compare these times to standard photography. Look for these pictures in upcoming issues of Sky and Tel or CCD Astronomy

. Tom asked what kind of software was necessary to produce images like these. Roger said he used the software that came with the CCD Camera book, but the comet wasn't visible in the pictures this software produced. To extract more information from the images, Roger used the successor to Pixfix, called Superfix. This enabled him to electronically isolate a narrow band of the image with similar brightnesses, and 'stretch' this band out to a full range of brightnesses between black and white. In this way, faint and low contrast objects can be made visible. Roger added that, since over exposure can make bright stars seem to drip off the picture, he sometimes uses Photostyler to cosmetically touch up an image. This type of image manipulation should be used with care, though. The scientific value of an image can be destroyed by a single smiley face added to Saturn, especially if it includes an extended arm clutching a Pina Colada.

Other software that Roger has used is Imagine-32 ("Best histogram in the business") and SkyPro ("Good features for the price").

While it wasn't discussed explicitly, this software has some hardware requirements. Roger recommends a fast telescope of about 100" focal length for short exposures and proper plate scale. Plate scale is based on both matching the CCD imaging area to the size of common objects, and matching the pixel size to atmospheric seeing. The telescope should have slow motions on both axis, and a remotely driven fine focusing mechanism. It needs to have a means of guiding an exposure. After experimenting with an off axis guider, Roger now uses a piggyback scope with adjustable offsets

. Thoughts of fast scopes and colder CCD's has led Roger to begin planning his next scope. (I see a man waving a power tool and shouting "More power!"). He said he's considering a primary with a double arch shape on his 30 - 36 inch mirror to save weight. Tom dug out some articles he had on lightweighted mirror blanks, including the double arch design, and the shape's lessened resistance to astigmatism. Mark stated that his astigmatic Dall-Kirkham had a primary with a double arch shape, and the meeting, having come full circle, ended.

Does this group have synergy, or what?

The July Computer Subgroup meeting will be held at Roger Tanner's house, on July 1. Be there, or you'll miss it.

New times and Dates for Shoemaker/Levy impacts

Predictions as of 1994 June 3
Date of last astrometric data in these solutions: 1994 June 1
{This is a shorter version of our earlier table; we plan to issue this version more frequently than the full version.}
The predictions for all fragments except Q2 are based on independent orbit solutions; the orbit reference identifier is given in the rightmost column.
The orbit solution for fragment Q2 was obtained by applying a disruption model to the orbit for Q1, and using astrometric measurements of Q2 relative to Q1.
Immediately to the right of the predicted impact times, we give the 1-sigma uncertainties in those times for all fragments except Q2. We have made an effort to make these uncertainties realistic: they are not formal uncertainty values. NOTE: To obtain a 95% confidence level, one should use a +/- 2 sigma window around the predicted impact time. The uncertainties for fragment Q2 have not been quantified, but are probably comparable to those for P2.

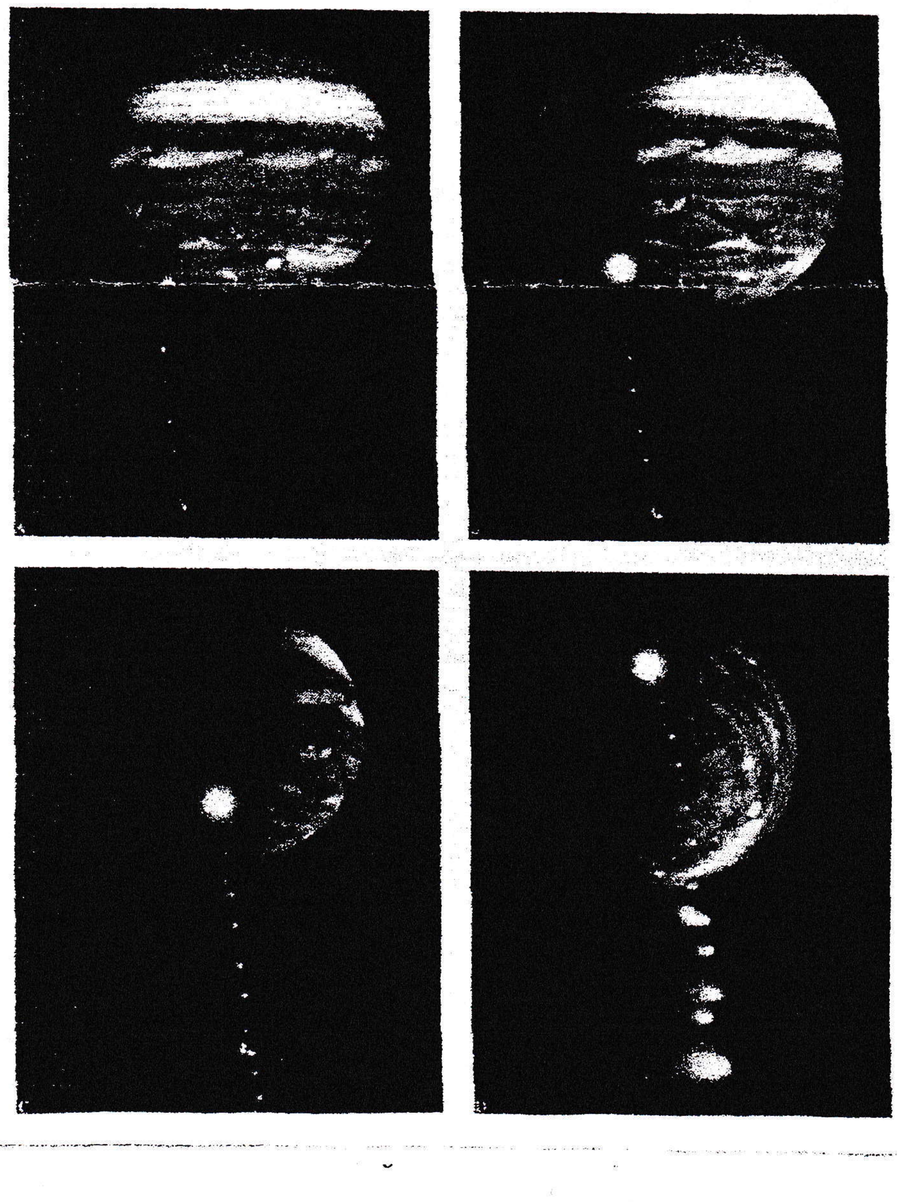
The dynamical model used for the predictions includes perturbations due to the Sun, planets, Galilean satellites and the oblateness of Jupiter. The planetary ephemeris used was DE245.

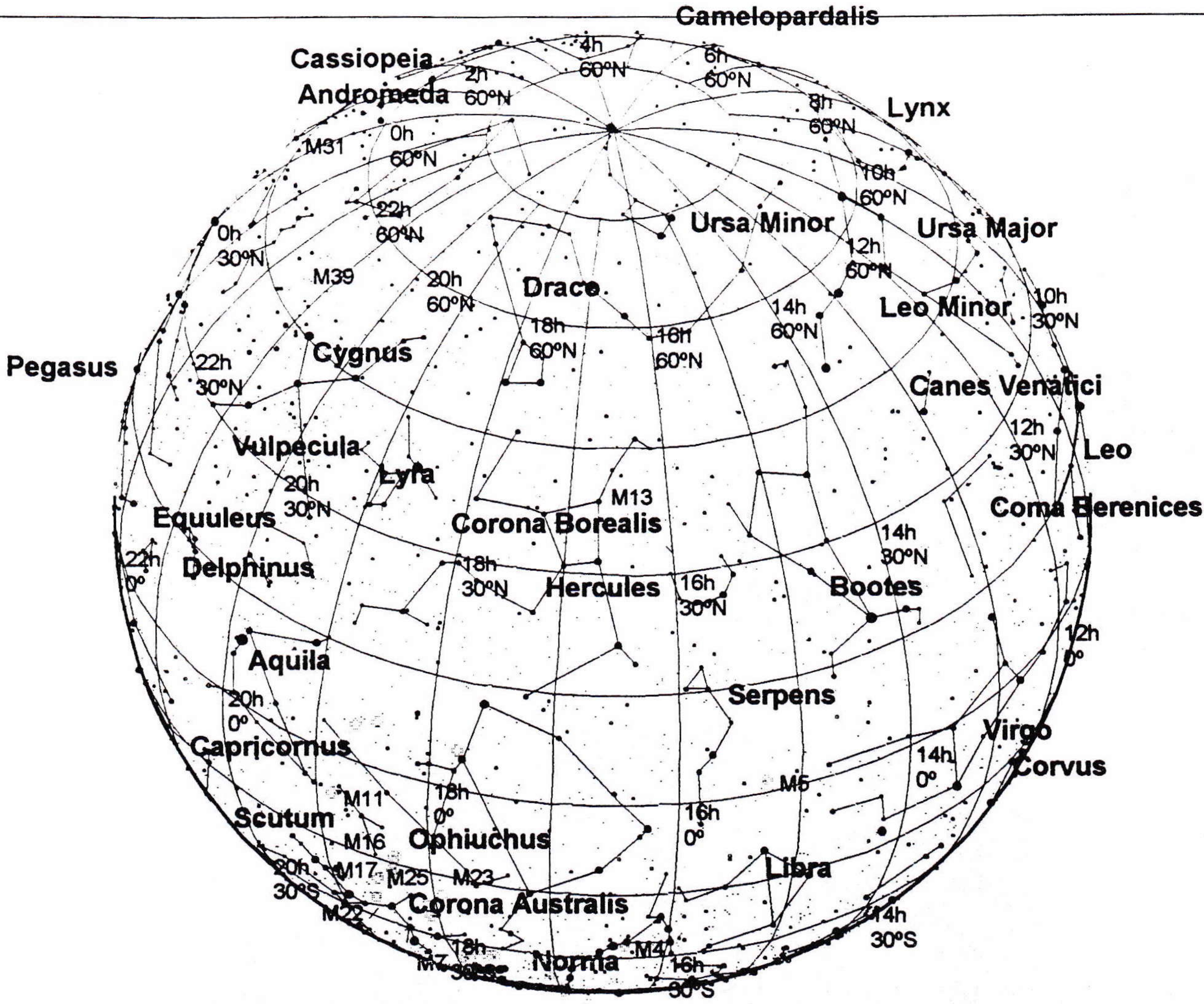
Fragment	Impact Date/Time July (UT) h--m	1-sig Unc. (min)	Jovicentric Lat. (deg)	Jovicentric Long. (deg)	Meridian Angle (deg)	Angle E-J-F (deg)	Orbit Ref.
A = 21	16 19:55	26	-43.23	176	63.56	99.35	A10
B = 20	17 03:07	23	-43.45	77	63.67	99.22	B11
C = 19	17 06:59	24	-43.33	217	64.53	98.64	C8
D = 18	17 11:18	28	-43.34	14	63.49	99.36	D9
E = 17	17 15:30	17	-43.70	164	66.13	97.41	E25
F = 16	18 00:40	23	-43.79	139	64.17	98.77	F16
G = 15	18 07:52	16	-43.80	37	66.99	96.77	G25
H = 14	18 19:47	16	-43.86	109	67.32	96.52	H23
K = 12	19 10:39	16	-43.96	287	68.15	95.90	K24
L = 11	19 22:40	16	-44.07	2	68.95	95.31	L25
N = 9	20 10:21	26	-44.59	67	67.13	96.49	N12
P2= 8b	20 15:27	25	-44.82	253	66.46	96.91	P11
Q2= 7b	20 19:49		-44.48	48	69.27	95.00	
Q1= 7a	20 20:16	15	-44.20	64	69.69	94.75	Q27
R = 6	21 05:59	19	-44.27	57	70.24	94.34	R22
S = 5	21 15:46	17	-44.26	51	70.76	93.97	S32
T = 4	21 18:16	44	-45.28	145	67.43	96.14	T7
U = 3	22 00:25	85	-45.19	3	71.74	93.15	U6
V = 2	22 04:06	31	-44.52	141	68.16	95.77	V8
W = 1	22 08:34	19	-44.29	299	71.32	93.57	W25

Notes:
1. Fragments J=13 and M=10 are omitted because they have faded from view. Fragments P=8 and Q=7 each consist of multiple components. The March'94

HST image shows that P1=8a has almost completely faded away (so it too is omitted from the Table). and that P2=8b has split. We do not as yet have sufficient data to obtain independent predictions for the two components of P2=8b.

2. The impact date/time is the time the impact would be seen at the Earth (if the limb of Jupiter were not in the way); the date is the day in July 1994; the time is given as hours and minutes of Universal Time.
3. The impact latitude is Jovicentric (latitude measured at the center of Jupiter); the Jovigraphic latitudes are about 3.84 deg more negative.
4. The impact longitude is in System III, measured westwards on the planet.
5. The meridian angle is the Jovicentric longitude of impact measured from the midnight meridian towards the morning terminator. This relative longitude is known much more accurately than the absolute longitude.
6. Angle E-J-F is the Earth-Jupiter-Fragment angle at impact; values greater than 90 deg indicate a farside impact. All impacts will be just on the farside as viewed from Earth; later impacts are closer to the limb.





Projection		Horizon View		
Time	Local	Jun 17, 1994AD, 10:28pm (Night)		
	Universal	Jun 18, 1994AD, 4:28am	Julian date	2449521.6861
	Siderial	16:40.4		
Epoch	Universal	Jun 10, 1994AD, 8:28pm	Julian date	2449521.6861

Location		Earth	Centered on	
	Lon.	83°05'00"W	RA	16h39m39s
	Lat.	42°23'00"N	Dec.	37°27'49"
	Altitude	0.000 km	Azm.	181°48'25"
	Time zone	-6.00	Alt.	85°04'40"
Zoom Factor		0.340	Field of View	180°00' * 180°00'

Solar System Objects
- Mercury
- Venus
- Earth
- Mars
- Jupiter
- Saturn
- Uranus
- Neptune
- Pluto
- Moon
- Sun
- Asteroid
- Comet

Stars
- -1.6
- -1.0
- 0.0
- 1.0
- 2.0
- 3.0
- 4.0
- 5.0

Galaxies
- Elliptical
- Spiral
- Spiral bar
- Irregular
- Peculiar
- Undefined

Nebulae
- Reflection
- Planetary
- Bright
- Dark
- HII region
- Other regions

Star clusters
- Open
- Globular
- Associated with nebulosities

Quasars
- Quasars
- BL Lacertae

Markers

NEP Northern Ecliptic Pole
SEP Southern Ecliptic Pole
NCP Celestial North Pole
SCP Celestial South Pole

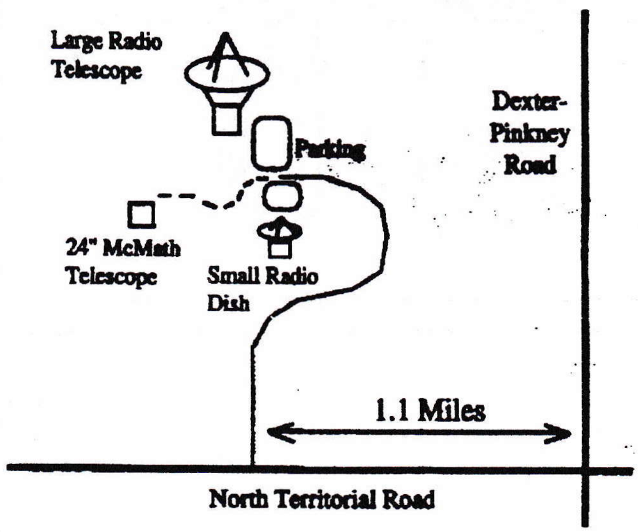
Lines

Horizon line
Celestial equator
Ecliptic

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 or the temperature is below 10êF at sunset - call 426-2363 to check on their status. Many members bring their telescopes; visitors arewelcome to do likewise. Peach Mountain gets cold atnight so dress warmly - and bring mosquito repellent!

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 or mail at this address:

Doug Scobel
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. Doug Scobel @ 429-4954

Sky Map:

The sky map in this issue of Reflections was produced by Keith Bozin using Redshift for Windows CD-ROM drawn for the end of twilight on the monthly meeting date.

News letter Contributions:

Members (and non-members) are encouraged to write about any astronomy-related area in which they are interested. Call the editor (Keith Bozin) at (810) 435-8964, or send e-mail to 72630,3402 via compuserve to discuss length, format, etc. I have a scanner and fax capabilities. Announcements and articles are due 14 days before each monthly meeting. Contributions should be mailed to:

Keith Bozin
3245 Parker Drive
Royal Oak, MI 48073-6918

Telephone Numbers:

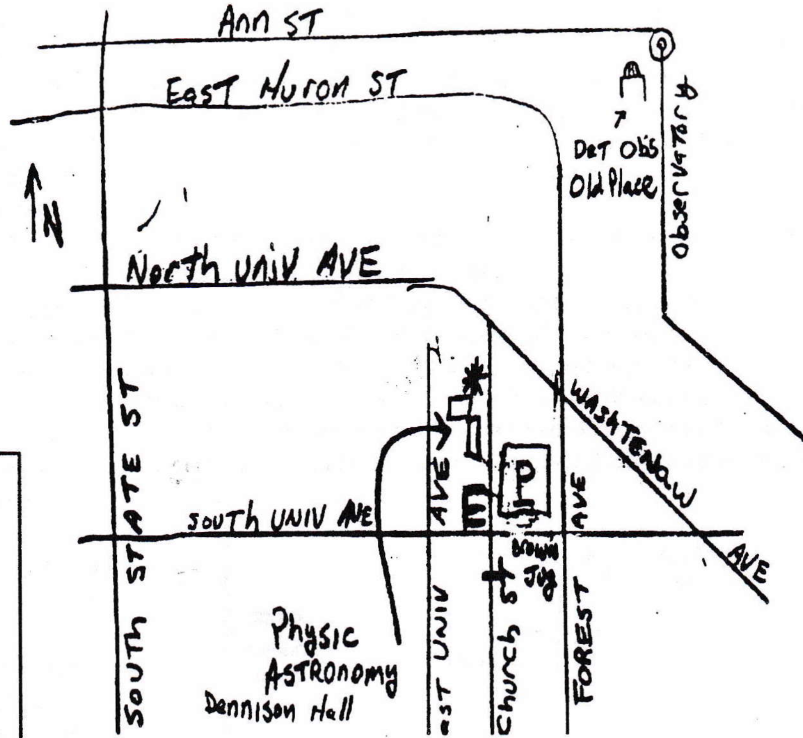
President:	Bill Razguanas	995-0934
Vice Pres:	Kurt Hillig	663-8699
	Stewart Cohen	665-0131
	Tom Ryan	662-4188
	Steve Musko	426-4547
Treasurer:	Doug Scobel	429-4954
Observatory:	Bernard Friberg	761-1875
Newsletter:	Keith Bozin	(810) 435-8964
Membership:	Doug Scobel	429-4954

Peach Mountain Keyholder:

Fred Schebor 426-2363

Monthly Meeting

Video from the 1994
Texas star party
and
A tour of the Univ of
Arizona's Mirror lab



June 17, 1994 at 7:30 PM
At
Room 807 Dennison Hall
Physics and Astronomy Bldg

University Lowbrow Astronomers
1740 David Ct.
Ann Arbor, MI 48105

Check your membership expiration date on the mailing label!