REFLECTIONS

WANTED: Articles (and photographs) for this newsletter!

(Remember: if it does not get printed in Reflections, it could end up on an orbiting billboard instead! Your choice.)

REFLECTIONS

September 1994

Douglas Warshow Editor

Of the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of 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 the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; map on page X) 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, Bill Razgunas at (313) 995-0934.

This Month

September 3—Open house at Peach Mountain.

September 10—Your choice of the following:
1) Astrofest.
2) Island Lake star party in Brighton. Please call Greg Bunett at (810) 468-7953 for details.
3) Open house at Peach Mountain.

September 16—-Meeting at 807 Dennison Hall. Tom Ryan and John Causland will present, "All About Telescopes: Types, Styles, and What to Buy."

September 17—-Moonwalk at Stinchfield Woods (co-sponsored by the ULA). Call Bill Razgunas if you plan to attend (see above for phone #).

Next Month

October 1——Computer Subgroup Meeting. Location and time TBA at the September meeting.

October 15—-Leslie Science Center open house.

October 21—-Meeting at 807 Dennison Hall. We will have a "Report on Astrofest" from CLASSIFIED.

October 22—-Leslie Science Center open house (rain date).

The McMath 24" F/4 Newtonian

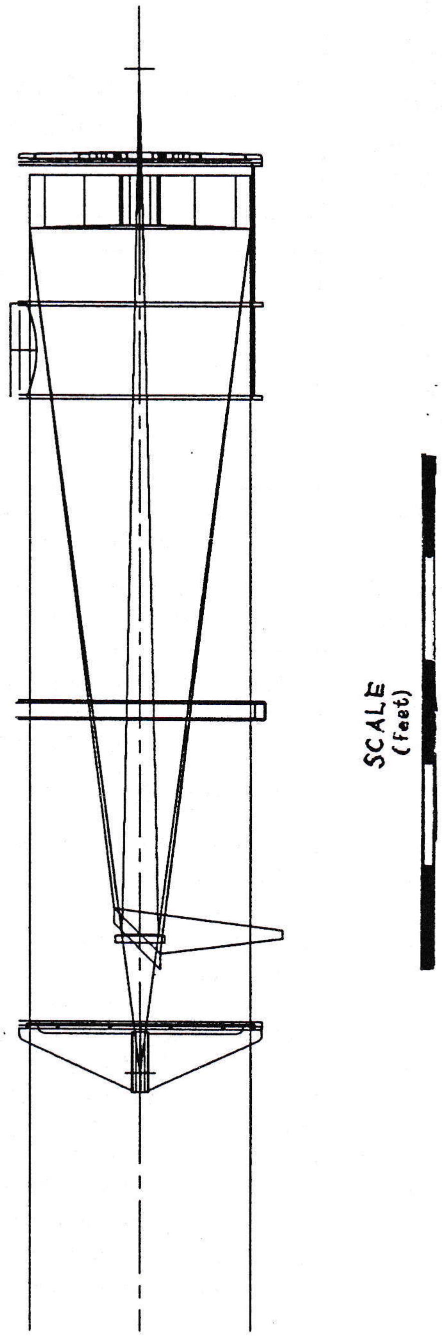
by Tom Ryan

More and more people are using the 24" telescope at Peach Mountain for photography and CCD imaging. They find that the plate scale at f/25, which is 600", rivals that of the 200" telescope at Mt. Palomar, (at a focal length of 660"). As anyone who has looked through the 24" knows, this gives incredible views of the planets, planetary nebulae, M-13, and the moon. This extremely long focal ratio provides a good match between the Airy disk and the resolution of fast film and inexpensive CCD pixels, and is probably why this particular f-ratio was chosen. However, objects that subtend more than 15 minutes of arc don't fare so well, since they don't fit in the field of view.

There have been several proposals over the years for reducing the focal ratio. About eight years ago, some club members suggested we make a new secondary mirror to bring the f-ratio down to about f/16. This may not sound like a big change, but exposure times increase as the square of the f-ratio, so changing the ratio from 25 to 16 would reduce exposure times to 0.41 of their previous length. Unfortunately, there is no inexpensive way to make and test a convex hyperbolic secondary, so this project stalled.

More recently, Mark Cray has experimented with achromatic objectives and camera lenses to make focal reducers of increasing power and effectiveness. These have made a tremendous difference for visual observing. He estimates that he can get down to about f/6 or so, and the pictures that he has taken with a focal reducer and ASA 1600 color film are truly amazing. There are, however, some limitations to this method. The field of view cannot be increased indefinitely, because only so much light will fit through the baffle tube. As the light passes through more and more positive lenses, contrast is lost and the image plane becomes increasingly forward-curving.

Why not use the prime focus of the primary? The primary is a 24" f/4, for a recording speed increase of 39 times over the f/25 configuration. Of course, the telescope couldn't be used for visual observing (you won't find me twelve feet in the air on a step ladder in the dark), but it could be converted to photographic and CCD work by temporarily removing the Cassegrain secondary and placing a camera at the prime focus. Unfortunately, the prime focus is right in the middle of the spider vanes, as you can see from the illustration. Still, it would work if we replaced the Cass secondary holder with a Newtonian diagonal. We could even use the same focusing mechanism. Now all we need is a 5"x7" diagonal, a camera holder, and a little more lead weight to balance everything.□



Daily comet ephemerides for the period:
0 h UT(Universal Time).
by Jost Jahn

(1994o1 is the second part of 1994o!)

Name of the comet [P/] Name [Pro/Fin]	R.A.(1950) h m	Decl o '	R.A.(2000) h m	Decl o '	r A.U.	d A.U.	Elo o	Magn Step	MotioPos "/h o
Friday, 1994 Sep. 16									
P/Ashbrook-Ja (1992j)	7:26.5	+33:33	7:29.8	+33:26	3.53	3.84	65	16.1	33.5/ 89
P/Kushida (1994a)	13:26.0	-10:53	13:28.6	-11:08	3.03	3.84	32	15.4	54.2/110
Mueller (1993a)	19:32.9	-53:48	19:36.9	-53:41	3.45	2.97	110	12.2	33.4/271
P/Schwassmann-Wachman	12:51.7	- 2:37	12:54.3	- 2:53	2.66	3.57	21	16.6	66.3/113
Shoemaker-Lev (1993h)	11:34	-81:25	11:36	-81:42	5.16	5.16	84	16.7	22.8/128
P/Tempel 2	4:38.0	+ 7:28	4:40.7	+ 7:34	2.26	1.81	103	16.6	19.0/114
McNaught-Russ (1993v)	16:52.8	+27:14	16:54.8	+27:10	2.74	2.73	80	14.6	62.5/132
P/Hartley 3 (1993m)	9:28.3	+11:24	9:31.0	+11:11	2.57	3.37	32	15.8	66.1/114
Takamizawa-Le (1994f)	11:37.6	+25:37	11:40.2	+25:20	2.13	3.02	23	12.7	21.6/155
Shoemaker-Lev (1994d)	0:49.8	+57:33	0:52.8	+57:50	2.03	1.36	117	16.8	167/239
P/Tuttle (1992r)	11:32.5	-33:31	11:34.9	-33:47	1.57	2.26	37	14.2	125/115
Takamizawa (1994i)	11:37.7	-21:49	11:40.2	-22:06	2.17	3.04	25	12.3	23.1/178
P/Reinmuth 2 (1993g)	1:58.9	+24:49	2:01.7	+25:03	2.00	1.17	135	15.4	10.8/338
P/Kohoutek	9:22.8	+12:55	9:25.5	+12:42	1.92	2.68	33	15.9	87.6/111
P/Tempel 1 (1993c)	16:53.4	-31:10	16:56.6	-31:15	1.67	1.45	83	11.9	100/ 99
Nakamura-Nish (1994m)	21:15.8	-25:22	21:18.7	-25:09	1.53	0.61	140	10.1	250/199
P/Wild 3 (1994b)	16:07.8	-25:31	16:10.8	-25:39	2.33	2.43	73	15.9	61.8/109
P/Harrington (1994g)	2:14.1	- 6:36	2:16.6	- 6:23	1.59	0.69	139	14.2	27.4/126
P/Brooks 2 (1994j)	3:06.9	+13:21	3:09.7	+13:33	1.85	1.09	124	13.2	32.1/101
P/Machholz 2 (1994o1)	8:37.5	+28:18	8:40.5	+28:07	0.75	0.63	48	11.2	163/141
P/Machholz 2 (1994o)	8:37.0	+28:00	8:40.0	+27:50	0.75	0.63	48	6.2	163/140
P/Shoemaker 4 (1994k)	17:03.4	-25:06	17:06.5	-25:10	2.95	2.86	85	17.0	38.7/116
P/Borrelly (1994l)	5:38.5	- 3:16	5:41.0	- 3:14	1.47	1.09	88	11.7	102/ 69
P/McNaught-Ha (1994n)	20:57.5	-42:23	21:00.8	-42:11	2.59	1.85	128	15.5	21.3/354
P/Whipple (1993n)	0:35.6	+ 3:13	0:38.1	+ 3:30	3.13	2.16	163	15.6	24.0/228
Saturday, 1994 Sep. 17									
P/Ashbrook-Ja (1992j)	7:27.6	+33:33	7:30.8	+33:27	3.53	3.83	65	16.1	33.1/ 88
P/Kushida (1994a)	13:27.4	10:60	13:30.0	-11:15	3.04	3.86	31	15.4	54.1/110
Mueller (1993a)	19:31.5	-53:48	19:35.4	-53:41	3.45	2.99	109	12.3	32.3/271
P/Schwassmann-Wachman	12:53.4	- 2:47	12:55.9	- 3:04	2.66	3.58	20	16.6	66.2/113
Shoemaker-Lev (1993h)	11:37	-81:32	11:39	-81:48	5.16	5.16	84	16.7	23.0/117
P/Tempel 2	4:38.5	+ 7:25	4:41.2	+ 7:31	2.26	1.80	104	16.6	18.1/116
McNaught-Russ (1993v)	16:54.2	+26:57	16:56.2	+26:53	2.76	2.75	80	14.6	62.2/132
P/Hartley 3 (1993m)	9:30.0	+11:13	9:32.6	+11:00	2.57	3.36	32	15.8	65.9/115
Takamizawa-Le (1994f)	11:37.8	+25:29	11:40.5	+25:13	2.14	3.03	23	12.7	21.2/154
Shoemaker-Lev (1994d)	0:42.8	+56:58	0:45.7	+57:14	2.04	1.36	119	16.8	169/237
P/Tuttle (1992r)	11:36.1	-33:51	11:38.6	-34:08	1.58	2.27	37	14.3	123/115
Takamizawa (1994i)	11:37.7	-21:58	11:40.2	-22:15	2.17	3.05	25	12.3	23.4/179
P/Reinmuth 2 (1993g)	1:58.8	+24:53	2:01.6	+25:07	2.01	1.16	136	15.4	10.7/331
P/Kohoutek	9:25.0	+12:42	9:27.8	+12:29	1.92	2.67	34	15.9	87.4/112
P/Tempel 1 (1993c)	16:56.5	-31:17	16:59.7	-31:21	1.67	1.46	83	11.9	100/ 99
Nakamura-Nish (1994m)	21:13.4	-26:53	21:16.4	-26:40	1.54	0.64	138	10.3	232/199

P/Wild 3 (1994b)	16:09.5	-25:39	16:12.5	-25:47	2.33	2.44	72	16.0	62.1/108
P/Harrington (1994g)	2:14.7	- 6:43	2:17.1	- 6:29	1.59	0.68	140	14.2	26.1/128
P/Brooks 2 (1994j)	3:07.8	+13:19	3:10.5	+13:30	1.85	1.08	125	13.2	31.0/102
P/Machholz 2 (1994o1)	8:40.6	+27:28	8:43.6	+27:17	0.75	0.65	48	11.2	161/141
P/Machholz 2 (1994o)	8:40.1	+27:11	8:43.1	+27:00	0.75	0.64	48	6.2	161/140
P/Shoemaker 4 (1994k)	17:04.5	-25:13	17:07.5	-25:17	2.95	2.88	84	17.0	39.1/116
P/Borrelly (1994l)	5:41.0	- 3:01	5:43.5	- 2:60	1.46	1.08	89	11.7	103/ 69
P/McNaught-Ha (1994n)	20:57.4	-42:14	21:00.7	-42:02	2.59	1.86	127	15.5	21.7/356
P/Whipple (1993n)	0:35.1	+ 3:07	0:37.6	+ 3:23	3.13	2.15	164	15.6	24.4/229

------------------------- Sunday, 1994 Sep. 18 -------------------------

P/Ashbrook-Ja (1992j)	7:28.7	+33:33	7:31.9	+33:27	3.54	3.82	66	16.1	32.7/ 88
P/Kushida (1994a)	13:28.7	-11:07	13:31.4	-11:23	3.05	3.87	30	15.4	54.1/110
Mueller (1993a)	19:30.0	-53:47	19:34.0	-53:41	3.46	3.02	108	12.3	31.0/273
Shoemaker-Lev (1993h)	11:40	-81:38	11:42	-81:55	5.16	5.17	84	16.7	26.2/149
P/Tempel 2	4:38.9	+ 7:22	4:41.6	+ 7:28	2.27	1.80	105	16.6	17.1/118
McNaught-Russ (1993v)	16:55.6	+26:41	16:57.6	+26:36	2.77	2.77	79	14.6	62.0/132
P/Hartley 3 (1993m)	9:31.6	+11:02	9:34.3	+10:49	2.57	3.36	33	15.9	65.7/115
Takamizawa-Le (1994f)	11:38.1	+25:22	11:40.7	+25:05	2.15	3.04	23	12.8	20.8/154
Shoemaker-Lev (1994d)	0:36.0	+56:20	0:38.8	+56:37	2.05	1.36	120	16.8	171/235
P/Tuttle (1992r)	11:39.7	-34:12	11:42.2	-34:29	1.59	2.29	36	14.3	122/115
Takamizawa (1994i)	11:37.7	-22:08	11:40.3	-22:24	2.18	3.05	24	12.3	23.6/179
P/Reinmuth 2 (1993g)	1:58.6	+24:56	2:01.4	+25:11	2.01	1.16	137	15.4	10.8/324
P/Kohoutek	9:27.3	+12:29	9:30.0	+12:16	1.92	2.67	34	15.9	87.1/112
P/Tempel 1 (1993c)	16:59.6	-31:23	17:02.8	-31:27	1.68	1.47	83	12.0	100/ 99
Nakamura-Nish (1994m)	21:11.2	-28:17	21:14.2	-28:05	1.55	0.66	136	10.4	214/199
P/Wild 3 (1994b)	16:11.2	-25:47	16:14.3	-25:55	2.33	2.45	71	16.0	62.3/108
P/Harrington (1994g)	2:15.2	- 6:49	2:17.7	- 6:35	1.59	0.68	141	14.2	24.8/130
P/Brooks 2 (1994j)	3:08.6	+13:16	3:11.4	+13:28	1.85	1.07	126	13.2	29.9/104
P/Machholz 2 (1994o1)	8:43.6	+26:39	8:46.6	+26:28	0.75	0.66	49	11.2	158/140
P/Machholz 2 (1994o)	8:43.2	+26:23	8:46.2	+26:12	0.75	0.65	48	6.3	158/140
P/Borrelly (1994l)	5:43.6	- 2:46	5:46.1	- 2:45	1.46	1.08	89	11.6	103/ 68
P/McNaught-Ha (1994n)	20:57.4	-42:05	21:00.6	-41:53	2.59	1.86	126	15.5	22.1/358
P/Whipple (1993n)	0:34.6	+ 3:00	0:37.1	+ 3:17	3.13	2.15	165	15.6	24.8/229

------------------------- Monday, 1994 Sep. 19 -------------------------

P/Ashbrook-Ja (1992j)	7:29.7	+33:34	7:32.9	+33:27	3.54	3.81	67	16.1	32.3/ 88
P/Kushida (1994a)	13:30.1	-11:15	13:32.8	- 11:30	3.05	3.88	30	15.4	54.0/110
Mueller (1993a)	19:28.7	-53:47	19:32.6	-53:40	3.47	3.04	107	12.3	29.8/273
Shoemaker-Lev (1993h)	11:43	-81:45	11:46	-82:02	5.17	5.18	84	16.7	24.5/139
P/Tempel 2	4:39.3	+ 7:19	4:42.0	+ 7:25	2.28	1.79	105	16.6	16.2/120
McNaught-Russ (1993v)	16:57.0	+26:24	16:59.0	+26:20	2.78	2.79	79	14.7	61.7/131
P/Hartley 3 (1993m)	9:33.2	+10:51	9:35.9	+10:38	2.57	3.35	33	15.9	65.6/115
Takamizawa-Le (1994f)	11:38.3	+25:14	11:40.9	+24:58	2.16	3.04	23	12.8	18.8/170
Shoemaker-Lev (1994d)	0:29.3	+55:41	0:32.1	+55:57	2.07	1.35	122	16.8	172/234
P/Tuttle (1992r)	11:43.3	-34.32	11:45.8	-34:49	1.60	2.30	36	14.4	121/114
Takamizawa (1994i)	11:37.7	-22:17	11:40.3	-22:34	2.19	3.06	24	12.3	23.7/178
P/Reinmuth 2 (1993g)	1:58.4	+24:60	2:01.2	+25:14	2.01	1.15	137	15.4	11.0/317
P/Kohoutek	9:29.5	+12:16	9:32.2	+12:03	1.93	2.67	35	15.9	86.8/112
P/Tempel 1 (1993c)	17:02.6	-31:29	17:05.9	-31:33	1.68	1.49	83	12.0	99.8/ 98
Nakamura-Nish (1994m)	21:09.2	-29:35	21:12.1	-29:23	1.56	0.68	134	10.5	199/199
P/Wild 3 (1994b)	16:13.0	-25:55	16:16.1	-26:02	2.34	2.46	71	16.0	62.6/108
P/Harrington (1994g)	2:15.7	- 6:56	2:18.2	- 6:42	1.60	0.68	141	14.2	23.5/133
P/Brooks 2 (1994j)	3:09.4	+13:13	3:12. 1	+13:25	1.85	1.07	127	13.1	28.8/105
P/Machholz 2 (1994o1)	8:46.6	+25:51	8:49.6	+25:39	0.75	0.67	49	11.3	156/140
P/Machholz 2 (1994o)	8:46.3	+25:35	8:49.2	+25:24	0.75	0.66	49	6.3	156/139

P/Borrelly (1994l)	5:46.1	- 2:30	5:48.6	- 2:29	1.45	1.07	89	11.6	103/ 68
P/McNaught-Ha (1994n)	20:57.4	-41:56	21:00.6	-41:45	2.59	1.87	126	15.5	22.6/ 1
P/Whipple (1993n)	0:34.1	+ 2:54	0:36.6	+ 3:10	3.13	2.14	166	15.6	25.1/229

MAGELLAN EXECUTES 'WINDMILL' EXPERIMENT AS MISSION END DRAWS NEAR

by
Douglas Isbell
Headquarters, Washington, D.C.
and
Jim Doyle
Jet Propulsion Laboratory, Pasadena, Calif.

NASA Magellan probe yesterday began a unique experiment designed to return data about the upper atmosphere of Venus and the behavior of a spacecraft entering it. The experiment marks the beginning of final activities for the spacecraft, which is expected to burn up in the atmosphere of Venus by October 14.

"This is the next to last act of a truly magnificent performance by Magellan and its science and operations teams," said Dr. Wesley T. Huntress, Associate Administrator for Space Science at NASA Headquarters, Washington, D.C. "Magellan has far surpassed all ofits original mission goals and, in the process, revolutionized ourunderstanding of a planet that represents what Earth might be like with a runaway greenhouse effect."

With its primary mission of mapping the surface of Venus successfully accomplished, Magellan has been used for a series of experiments that were unanticipated before its launch. In the latest maneuver, known as the "windmill" experiment, the spacecraft's wing-like solar arrays are turned in opposite directions, like windmill sails, to encounter pressure from molecules in the upper atmosphere of Venus.

The experiment is measuring how much torque will be needed to keep the spacecraft from spinning on its axis, said Project Manager Doug Griffith at NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif. These data will allow engineers and scientists to better understand basic gas-surface interactions and to gain additional aerodynamic and atmospheric data on Venus for future mission designs.

The windmill experiment is scheduled to last until September 14. Two weeks later, more orbit trim maneuvers are scheduled to lower the spacecraft's altitude to prepare for the final termination experiment. Three further trim maneuvers will change the altitude by 5 to 6 miles (8 to 9 kilometers) each on October 10, placing the altitude of periapsis --or closest approach to the planet -- at 96 miles (155 kilometers). The spacecraft's orbit will be lowered finally to 85 miles (136 kilometers) on October 12, with Magellan again put in a windmill attitude to collect more atmospheric data during its final entry. Gravity data acquisition will continue during all theseperiods up until October 10.

"After October 12, Magellan will permanently enter the atmosphere in about two days, possibly in one day," Griffith said. The atmosphere will drag the spacecraft toward the surface of the planet, but it will burn up high in the skies over Venus, he said.

There are two primary possibilities leading to NASA's final loss of contact with Magellan, Griffith said. Either the spacecraft will overheat and its communications systems will be damaged, or Magellan's control thrusters will be unable to maintain pointing control toward ground-based receiving dishes on Earth as the spacecraft spins to its demise.

In recent weeks, the performance of the spacecraft's solar arrays has begun to degrade due to the extreme temperature changes as the spacecraft passes from direct sunlight to shadow during its orbit. The thermal stress after more than five years in space and several weeks in low orbit has caused degeneration of its solar cell connections and has brought the spacecraft near the end of its usefullife, Griffith said.

"It is a race to the finish," said Betsy Beyer, Magellan Program Manager at NASA Headquarters. With the continuing loss of power due to the solar cell degeneration, the spacecraft may shut downeven earlier than projected, before a planned entry experiment. "Magellan has done more than its duty," Beyer said. "If it goes in its own way, instead of how we planned to end it, it is still a winner."

Controllers sent commands to Magellan in late August for orbital trim maneuvers that reduced its altitude from a near-circular orbit of 123 by 338 miles (197 by 541 kilometers) to an orbit of 107 by 242 miles (172 by 390 kilometers). These altitude reductions were required to set up conditions for the final experiment phases.

Magellan was launched in May 1989, and began mapping the surface of the planet using synthetic aperture-- or side-looking--radar in September 1990. In three cycles, each comprising one Venus day or 243 Earth days, the spacecraft providing unprecedented views of its unique pancake domes of lava, strange volcanic structures, craters and high mountains.

In three subsequent cycles, it has measured Venusian gravity over 95 percent of the planet, gathering data so that scientists can map the planet's interior. Magellan also has contributed to ongoing study of the planetes massive atmosphere of carbon dioxide and high sulfuric acid clouds. This period included the first-ever "aerobraking" of a spacecraft into a near-circular planetary orbit, for Magellanes final operations.

The data which have streamed back from Magellan's radar imager, its atmospheric studies and its gravity data acquisition maneuvers have built a vast data base of new knowledge about Venus and the formation of the Solar System that will be studied by scientists for decades to come, project officials said.

JPL manages the Magellan project for NASA's Office of Space Science, Washington, D.C.

Strange, Powerful Object in Milky Way Galaxy Shoots Out Material at Super Speeds

from the NATIONAL RADIO ASTRONOMY OBSERVATORY

Researchers using the Very Large Array (VLA) have discovered that a small, powerful object in our own cosmic neighborhood is shooting out material at nearly the speed of light -- a feat previously known to be performed only by the massive cores of entire galaxies. In fact, because of the direction in which the material is moving, it appears to be traveling faster than the speed of light -- a phenomenon called "superluminal motion." This is the first superluminal motion ever detected within our Galaxy.

. During March and April of this year, Dr. Felix Mirabel of the Astrophysics Section of the Center for Studies at Saclay, France, and Dr. Luis Rodriguez of the Institute of Astronomy at the National Autonomous University in Mexico City and NRAO, observed "a remarkable ejection event" in which the object shot out material in opposite directions at 92 percent of the speed of light, or more than 171,000 miles per second. This event ejected a mass equal to one-third that of the moon with the power of 100 million suns. Such powerful ejections are well known in distant galaxies and quasars, millions and billions of light-years away, but the object Mirabel and Rodriguez observed is within our own Milky Way Galaxy, only 40,000 light-years away. The strong emitter of X-Rays, sometimes becoming the strongest source of X-Rays in the Milky Way. The X-rays, they think, are emitted from the system's accretion disk. The VLA observations, along with other evidence the researchers have uncovered, leads them to believe that, despite being much less massive than galactic cores, other double-star systems may be capable of ejecting material at speeds near that of light. The researchers reported their discovery in the September 1 issue of the journal Nature.

. "This discovery is one of the most valuable results of more than a decade and a half of observations at the VLA," said Dr. Miller Goss, assistant director of NRAO for VLA/VLBA operations. "We see these fast-moving jets of material throughout the universe, and they represent an important physical process. However, they're usually so far away that it's difficult to study them. This object, relatively nearby, offers the best opportunity yet to build a good understanding of how such jets actually work," Goss added.

. GRS 1915+105 was discovered in 1992 by an orbiting French-Russian X-ray observatory called SIGMA-GRANAT. It had not been found before because its X-rays are highly-energetic "hard" X-rays not regularly observed by satellites before then. Since its discovery, it has repeatedly been seen as a source of "hard" X-rays. Despite searching, the scientists have been unable to observe .the object in visible light. Observations with the VLA in 1992 and 1993 showed that the object changed both its radio "brightness" and its apparent position in the sky, but it was then too faint at radio wavelengths for precise measurements. In March of 1994, the object began an outburst of strong radio emission just as the VLA had entered a configuration capable of its most precise positional measurements. Through March and April of 1994, Mirabel and Rodriguez were able to track the movement of the two condensations in the jets of material moving away from the object's core.

. They found that the core remained stationary, while the approaching condensation was apparently moving at 125 percent of the speed of light. After correcting for relativistic effects, they conclude that the ejected material actually is moving at 92 percent of light speed. Their calculations indicate that the pair of "blobs" they tracked were ejected from the core on March 19, during a period when the object was emitting more X-rays than usual.

. GRS 1915+105 somewhat resembles a famous astronomical object that was intensively studied in the late 1970s and early 1980s, called SS433. The VLA was used for many observations of SS433, which, astronomers believe, is also a double-star system with a dense, massive star as its centerpiece. SS433 has jets similar to those of GRS 1915+105, but the fastest motions detected in SS433's jets are only 26 percent the speed of light. Comparing it to quasars, which are believed to be phenomena associated with supermassive black holes at the centers of galaxies -- objects much larger and more massive than stars -- astronomers have called SS433 a "stellar microquasar." With kinetic energies 40 times those of SS433, GRS 1915+105 "appears to be a scaled up version" of the other object, Mirabel and Rodriguez say.

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----John Talbot
University of Ottawa |
jtalbot@dragon.achilles.net

But it is only the plasma that does not 'understand' how beautiful the theories are and absolutely refuses to obey them!

Hannes Alfven (1970 Nobel address)

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Ulysses Reaches Sun's Southern Pole

by Diane Ainsworth

After nearly four years in flight, the Ulysses spacecraft reached the sun's southern pole on June 26--the first spacecraft ever to explore that region of space--and began its primary mission.

Ulysses has climbed to 70 degrees south of the sun's equator, where it will spend the next four months gathering data on the complex forces at work over the sun's polar region, scientists from the joint NASA-European Space Agency (ESA) mission reported.

The Ulysses spacecraft took an intricate flight path to the sun, using Jupiter's powerful gravity field to swing out of the ecliptic plane in which the planets orbit. In February 1992, Ulysses spent nearly 11 days exploring unknown regions of Jupiter before gaining enough momentum to loop out of the ecliptic plane and onward to the poles of the sun.

Scientists are elated to be able, finally, to carry out observations in the sun's polar regions, said

of the polar magnetic fields, which switch polarity every 11 years in conjunction with the sunspot cycle, are poorly understood. Nevertheless, their existence introduces a basic north-south asymmetry into the solar atmosphere and space surrounding the sun."

A better understanding of the sun's magnetic field will be important, the scientists contended, because magnetic fields play a key role in the physics of the sun's outer atmosphere, the corona, and its extension outward into space.

"The characteristic structure of the corona is imposed by the sun's magnetic field," Smith said. "Furthermore, the source of the heat that creates the corona is unknown, but it is generally believed to be energy originally stored in the sun's twisted and irregular magnetic fields."

Whatever the heat source may be, scientists think the corona is generally too hot to be restrained by even the massive gravity field of the sun. Unless the magnetic field can hold back the coronal gas, that gas flows outward into space as the solar wind picks up speed. The solar wind is known to reach velocities many times the speed at which sound waves travel.

On the other hand, Smith added, if magnetic fields are directed outward from the sun, they can channel the flow and assist in the escape and acceleration of the coronal gas. Coronal holes, regions of the corona that appear to be dark, are known sources of the solar wind.

Although these general observations are clear, many details remain obscure and will become the focus of Ulysses' measurements, Smith added.

For instance, in the sun's polar caps, the magnetic field extends outward through semi-permanent, very large coronal holes. By virtue of being directly above these sources and in the absence of complications introduced by the sun's rotation, Ulysses is expected to contribute significant new knowledge about the escape and acceleration of the solar wind and, possibly, about the heating of the corona itself.

The magnetic field also exerts a crucial influence on matter arriving in the vicinity of the sun from the Milky Way galaxy and, in particular, from the nearby interstellar medium.

Incoming cosmic rays, the nuclei of atoms traveling at nearly the speed of light, are subject to forces exerted by the magnetic field and its superimposed irregularities. The structure of the sun's magnetic field is thought to favor entry of the cosmic rays by way of the polar regions.

Two questions of scientific importance, Smith noted, are the extent to which the galactic cosmic rays observed at Earth use this route and the ways in which their properties are modified as a consequence.

"We hope to gain more knowledge of the intensity and properties of the cosmic rays far from the sun, something that is presently unknown," Smith said. "The Ulysses mission will be able to shed new light on these longstanding riddles, as the instruments on board measure the magnetic field and the properties of the solar wind and the cosmic rays."

The Ulysses mission is managed jointly by the European Space Agency and NASA to study the regions over the sun's poles. JPL oversees the U.S. portion of the mission for NASA's Office of Space Science.

VOYAGER MISSION STATUS

from the Public Information Office at Jet Propulsion Laboratory

Both Voyager spacecraft are healthy and are continuing their fields and particles experiments as they cruise through interplanetary space.

Flight controllers believe both spacecraft will continue to operate and send back valuable data until at least the year 2015. It is the loss of electrical power from their radioisotope thermoelectric generators (RTGs) that will eventually cause them to stop functioning. At launch, the three RTGs on each spacecraft had a power output of 475 watts. Today, that output is 348 watts for Voyager 1 and 351 watts for Voyager 2. The science experiments need between 210 and 220 watts to operate.

The other vital consumable onboard the spacecraft is the amount of hydrazine propellant which keeps the Voyagers stable and pointed toward Earth. Each spacecraft started out with 104 kilograms of propellant. Today, after 17 years on the job and multiple encounters and trajectory correction maneuvers, Voyager 1 is down to 34.8 kilograms and Voyager 2 is at 37.3 kilograms. However, during its current interstellar mission, each spacecraft uses only about six grams of fuel a week. Flight controllers stress the Voyagers will run out of electrical power long before they start spinning out of control due to loss of their attitude-adjusting propellant.

Both Voyagers continue to be tracked every day by the large antennas of the Deep Space Network. Voyager 1 receives about 120 hours of tracking time each week, while Voyager 2 receives about 90 hours a week. Voyager 2 is tracked less because it shares the resources of the DSN station in Canberra, Australia, with NASA's Galileo spacecraft. The Canberra station has the best "look angle" for both Voyager 2 and Galileo.

It is now estimated that Voyager 1 will pass the Pioneer 10 spacecraft in January 1998 to become the most distant human-made object in space.

Voyager 1 is approximately 8.5 billion kilometers (5.3 billion miles) from Earth, while Voyager 2 is 6.5 billion kilometers (4 billion miles) from home.

S-L 9 SPOT UPDATE

by Stuart Goldman

The dark spots left behind on Jupiter by Comet Shoemaker-Levy 9 continue to evolve, say obser-vers. The smallest ones, like those caused by fragments A and C, have disappeared. Larger features, like impact L and the K/W and D/G/S complexes, have expanded considerably but have not faded very much. According to British observer John Rogers, the System II longitude of K/W is roughly 160-205 degrees, L is 225-260, and D/G/S is 285-328.

Comet Machholz (and Friends)

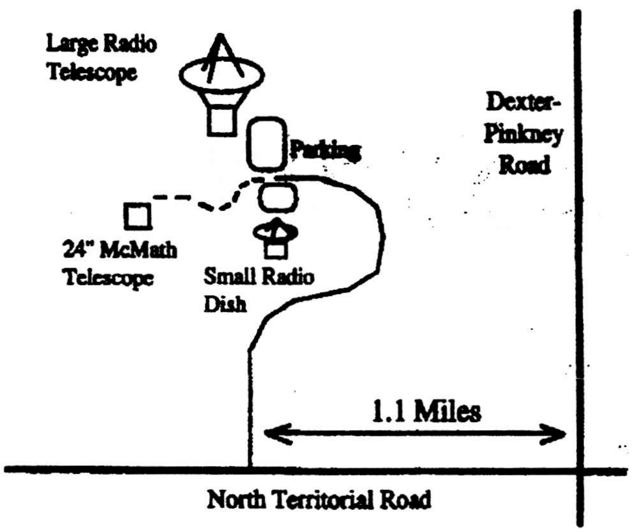
by Charles Morris

Comet Machholz (1994o), which is currently about 7th magnitude with a one-degree tail (in dark skies), has four companion comets in the same orbit. The brightest is m1 = 11.5. They are all within a degree (to the NE) of the parent object.

Places:

Dennison Hall is also known as University of Michigans Physics and Astronomy building. It is found in Ann Arbor on Church Street about one block north of South University Avenue.. This is also one block north of the Brown Jug, our after meeting eating place. We meet in room 807.

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 in 807 Dennison Hall. 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 480-4514 to check on their status. Many members bring their telescopes; visitors are welcome to do likewise. Peach Mountain gets cold at night 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 (Douglas Warshow) at 998-1158, or send e-mail to 75054,310 via CompuServe to discuss length, format, etc.. Announcements and articles are due 14 days before each monthly meeting. Contributions should be mailed to:

Douglas Warshow
1010 Catherine,apt. 408
Ann Arbor, MI 48104-1647

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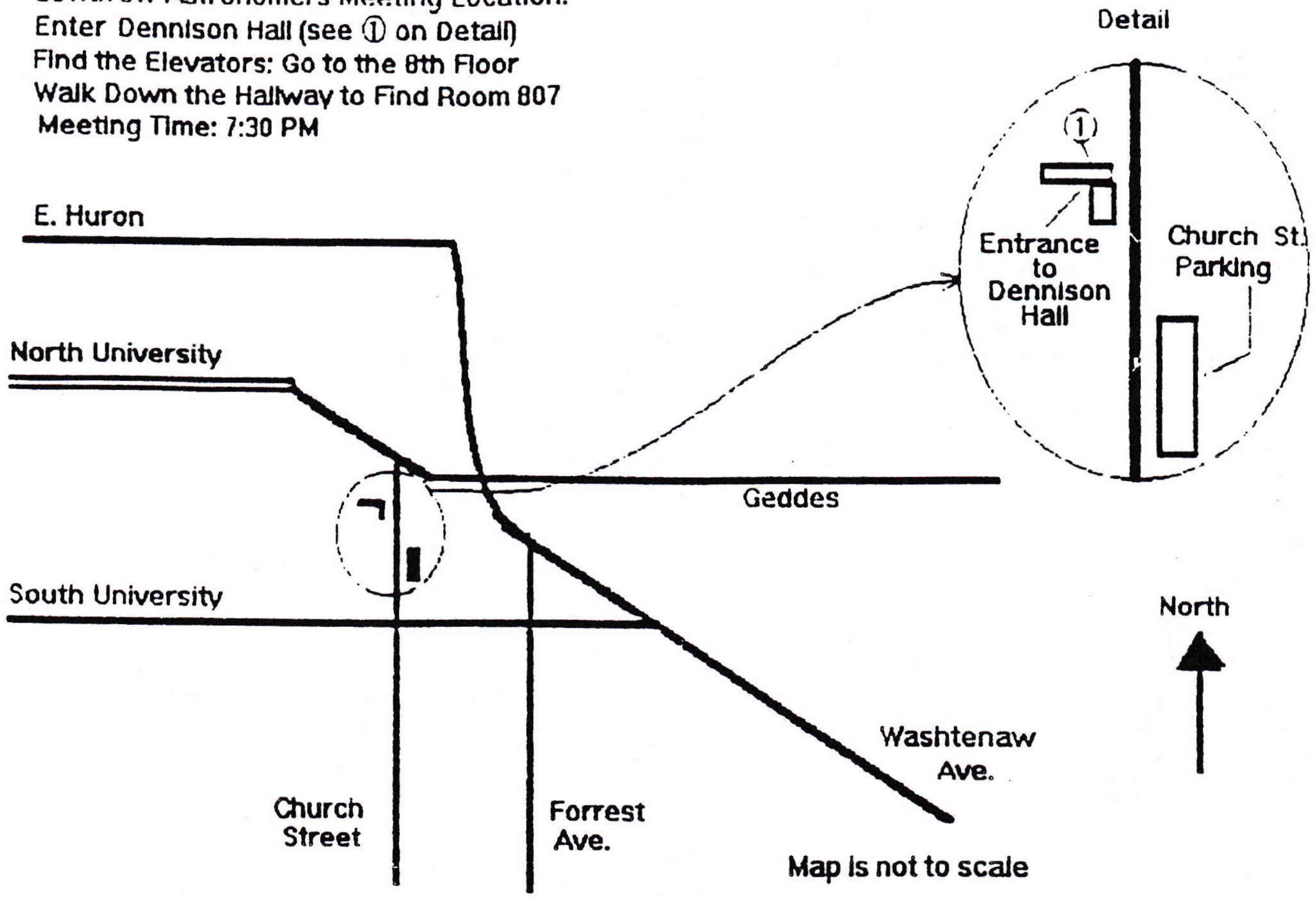
	Stewart Cohen	665-0131
	Tom Ryan	662-4188
	Steve Musko	426-4547
Treasurer:	Doug Scobel	429-4954
Observatory:	Bernard Friberg	761-1875
Newsletter:	Douglas Warshow	998-1158
Membership:	Doug Scobel	429-4954

Peach Mountain Keyholder:
Fred Schebor 426-2363

Lowbrow Astronomers Meeting Location:
Enter Dennison Hall (see ① on Detail)
Find the Elevators: Go to the 8th Floor
Walk Down the Hallway to Find Room 807
Meeting Time: 7:30 PM



Monthly Meeting

All About Telescopes
and
What Kinds to Buy
by
Tom Ryan and
John Causland

September 16, 1994
at 7:30 PM
At
Room 807 Dennison Hall
Physics and Astronomy Bldg

Close-up view of a white hole.

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

Check your membership expiration date on the mailing label!