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Several of the A.L.P.O. staff and members who attended the COSMOCON '92 convention in San Jose, California, in July 1992. From left to right, the persons shown are: John Westfall, Donald Parker, Elizabeth Westfall, Ashley McDermott, José Olivarez, Thomas Cragg, Michael Mattei, Robert Lunsford, Derald Nye, Richard Schmude, and Jack Eastman. For more about the 42nd A.L.P.O. convention, see the report on pages 109-110 of this issue.

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO
Founded in 1947

In This Issue

THE 1992-93 APHELIC APPARITION OF MARS: THINGS TO COME

By: Jeff Beish, A.L.P.O. Mars Recorder

INTRODUCTION

Camille Flammarion finished his extraordinary book, *The Planet Mars,* as the 1892 Apparition came to an end. He summarized all Mankind's knowledge of the Red Planet up to that time. Himself a keen observer and historian, he detailed the scientific interests of his contemporaries—great astronomers such as G.V. Schiaparelli, E.M. Antoniadi, and Percival Lowell. These men, who understood our insatiable appetite to explore the u known, helped give us the courage for space missions to the Moon and planets of our Solar System.

One hundred years later, we have embarked on the most ambitious exploration of the Red Planet to date. Launched recently, the Mars Observer spacecraft will arrive in Mars' orbit in Fall, 1993, to begin tests and calibration, and then to follow a polar orbit for a Martian year (687 Earth days) of mapping and scientific investigation. We too can journey out to Mars with this magnificent spacecraft. Amateur and professional astronomers are welcome to join in ground-based support of the Mars Observer adventure.

MARS OBSERVER SPACE MISSION AND GROUND-BASED SUPPORT

The Mars Observer space probe was launched on September 25, 1992, and will arrive for a four-month calibration/test period in Fall, 1993. Mars Observer will begin a full-scale investigation of the Red Planet in a polar orbit in mid-December 1993 and is scheduled to continue its surveillance for a full Martian year through October 1995. This period will provide Earth-based observers with an opportunity to record the planet Mars from a distance while receiving close-up observations from a Mars-orbiting space station. The 1992-93 and 1994-95 Apparitions of Mars will be important for the A.L.P.O. International Mars Patrol (IMP) as well as for the professional planetary scientists. We hope that, if this spacecraft achieves orbit around the Red Planet, observations by amateur astronomers will help to determine how effective ground-based telescope observations are in the long-term watch of our neighbor, the planet Mars. However, before we get ahead of ourselves, some recent history of Mars is in order.

SPACE MISSIONS OF THE PAST

Seventeen years ago the United States launched the Viking 1 and Viking 2 spacecraft to Mars, providing the first successful exploration of the planet's surface. Viking 1 reached Mars in June 1976 and sent Lander 1 to the surface on 20 July, 1976. As originally planned, these spacecraft and landers were to provide data for only 90 days. Viking Orbiter/Lander-2 failed in 1980 and Orbiter/Lander-1 sent data to Earth until November 1982—a period of six years!

What were we looking for? Of primary interest was to determine if any life form had existed in Mars' past. We assumed, from earlier space flights, that if any life was found on this planet, it would probably be microscopic. The best data available at that time suggested that Mars had wetlands, the basic stuff to sustain life. We then thought the atmospheric pressure too high, 80-85 millibars, and anticipated that liquid water would dampen some of the lowlands as temperatures increased above 0°C.

Safety was the first priority in determining where to land. The Chryse Planitum was selected for Lander 1, as it appeared to be a smooth enough place and was deemed to be one of the most interesting regions on Mars—morning bright patches, even bright cloud-like features and limb hazes, had been regularly recorded in this region by Earth-based observers for years. Lander 2 touched down far to the north in the region Utopia near Mars' north polar cap. Observers had suspected that a region very close to the retreating polar cap would be moist and a possible harbor for life. Experienced observers had reported a dark collar next to the retreating Martian polar cap during Martian Spring and early Summer, so it was suspected that this was a region of wet or moist surface material.

Not only did we find no life on Mars, we added to the long list of questions about this red world remaining to be answered. We hope that we will shorten that list in the near future.

It is ironic that most Americans do not remember this great achievement. Some would say Mankind's greatest scientific adventure was the Viking mission to Mars. It is puzzling why the American public knows so little of it.

THE INTERNATIONAL MARS PATROL

The Association of Lunar and Planetary Observers (A.L.P.O.) Mars Section's observing program is an international cooperative effort among individual observers and members of observing groups located around the world. Established in the late 1960's by the late Charles F. Capen, the International Mars Patrol (IMP) has contributed more than 22,000 observations of Mars. Contained within the archives of the A.L.P.O. Mars Section library are the records of thirteen apparitions of Mars covering a span of 25 years.

The IMP participates in professional activities such as providing observers for Lowell Observatory's International Planetary Patrol and contributing high-quality photographs to the United States Geological Survey for creating maps of albedo features of the Red Planet. From the late 1960's, interested amateur and professional astronomers located in 42 foreign countries and United States territories have cooperated in a 24-hour watch of Mars. Additional support has been provided by the Oriental Astronomical Association (OAA), the British Astronomical Association (BAA), the Arbeitskreis Planetenbeobachter (Germany) and the Groupement International d'Observateurs des Surfaces Planetaires (GIOSP).

The Mars Section Recorders coordinate and instruct the cooperating observers in using similar visual, photographic, photometric, and micrometric techniques employing color filters and standard methods for reporting their observations, which results in homogeneous sets of observing data that have good analytic value. Each apparition, the A.L.P.O. Mars Section receives thousands of individual observations consisting of visual disk drawings made with the aid of color filters, black-and-white and color photographs, intensity estimates of light and dark albedo features, color contrast estimates, and micrometer measurements of polar caps, cloud boundaries, and variable surface features during the 10 to 12-month observing period. These data are filed chronologically, so that the Universal Date must be recorded correctly on the standard observing report forms.

To foster consistency, a simple, efficient standard Mars Observing Report Form has been prepared by the A.L.P.O. Mars Recorders. This Standard Form, or another using its format, can be used for reporting all types of observations, such as: micrometry, transit timings, intensity estimates, and so on. Photographs may also be attached to the top or back of the form, and the relevant information blanks can be filled in at the telescope. Ephemeris data blanks can be filled in at other times than while observing.

Observational data consist of color filter photography, visual disk drawings, visual photometry (intensity estimates on the standard A.L.P.O. scale: 10 = maximum polar brightness, 8 = desert mean brightness, 0 = night sky), micrometry, and CCD imaging. We place great emphasis on high-quality photographs in red, blue, and violet light; full-disk drawings using standard color filters; polar-cap measurements made with the astronomical m crometer; and other data obtained with modern observing techniques such as full-disk photometry and CCD imaging.

APPARITIONS OF MARS

The term "apparition" refers to the time span during which a planet is observable, in theory from one conjunction with the Sun to the next, but in reality the time from when one first can view the planet after it emerges from conjunction into the morning dawn sky to the time just before the next conjunction, when the planet is seen low in the western sky after sunset. Practically speaking, however, high-quality telescopic observations of Mars commence when its apparent diameter is greater than about 6 arc-seconds. Approximately in the middle of the apparition is Mars' *opposition* with the Sun, which is within a few days of the time of its closest approach to the Earth. Mars has an average 15.8-year opposition cycle in terms of terrestrial and Martian seasons, a cycle which consists of three or four aphelic oppositions and three consecutive perihelic oppositions.

Although at the extremes of the apparition Mars is low in the sky where the turbulence of Earth's atmosphere is severe, we encourage A.L.P.O. astronomers to make observations even at these times. Fortunately, Mars will appear high in the Northern-Hemisphere's sky during the next four apparitions.

A red (Wratten 25 or equivalent) filter lessens the apparent seeing effects, because red wavelengths are refracted less, and also improves image contrast. While little or no fine detail can be discerned when the planet is low and of small apparent size, gross features, such as Syrtis Major, can be seen. If the observer has been regularly recognizing such features and suddenly notes their disappearance, one is led to suspect an obscuration, such as a dust storm.

OBSERVING MARS

Mars is a most difficult object to observe, owing to its small apparent size and high surface brightness. An excellent telescope and human patience is required for this study, and the rewards may appear small. However, major discoveries are made each apparition by amateur astronomers willing to take the time and effort to look at the God of War and then report their findings to us. Don't keep those telescopes locked up waiting for the Moon to go away—remember, light pollution has little or no effect on observing the planets and it is a long way out there to your favorite dark hideaway; so put your telescopes to work in your highly illuminated backyard tonight!

A SUMMARY REPORT FOR 1990-91

Although participation in the 1990-91 Mars observation program fell short of the 7,063 observations turned in during 1988, the Association of Lunar and Planetary Observers' International Mars Patrol successfully convinced 96 Mars observers using 122 telescopes to contribute 2,024 visual and multicolored photographic observations of Mars; polar-cap measurements; and 44 video tapes of CCD images during the 1990-91 apparition of Mars. A complete apparition report is now being prepared.

During the 1990-91 Apparition of Mars, the planet's South Pole was tilted toward Earth, allowing detailed observations of the highly cratered and topographically interesting

Southern Hemisphere of the Red Planet. The 1990-91 Apparition was considered transitional because opposition occurred almost exactly 90 degrees from perihelion (see *Figure 1*, p. 100). Mars reached opposition on November 27, 1990, and was closest to the Earth on November 20, 1990, with a distance of 48,050,617 miles (77,330,127 km) and an apparent disk diameter of 18.11 arc-seconds.

The study of dust storms has been one of the priorities of the IMP. The dust program has two goals: (1) to alert professional astronomers as soon as dust clouds are detected; and (2) to monitor the progression and boundaries of the dust clouds. The system worked well for the two dust storms of 1988, but it was the 1990-91 Apparition that provided the opportunity to demonstrate the true international character of the IMP.

MARS IN 1992 AND 1993

For observers located in the Northern Hemisphere of Earth, Summer, Autumn, and Winter of 1992-1993 will provide an opportune time to investigate the Northern Hemisphere of Mars. Over the last five years, the Southern Hemisphere of Mars has been exposed to ground-based observers; however, the next four apparitions, 1992-93, 1994-95, 1996-97, and 1998-99, will be Aphelic. This means that Mars' Northern Hemisphere will be most favorably positioned for Northern-Hemisphere observers. For many observers, Mars' north will be a new experience.

Mars will be favorably placed in the sky, north of the Celestial Equator, throughout the entire 1992-93 apparition.

CHARACTERISTICS OF THE 1992-93 MARS APPARITION

The 1992-93 Apparition is considered an aphelic apparition because opposition occurs only 49 degrees before aphelion (opposition occurs at 022° Ls and aphelion at 071° Ls, where Ls is the areocentric longitude of the Sun). Mars will be closest to Earth on January 3, 1993 (020° Ls) and will reach opposition on January 7, 1993 (022° Ls). For a graphical representation of this and other apparitions' aspects, refer to *Figure 1* (p. 100).

During most of the 1992-93 Apparition Mars' North Pole will be tilted earthward, covering most of the Martian Northern Hemisphere mid-Winter, and Spring. Thus, astronomers can again study the regression of the North Polar Cap (NPC) and follow both Martian antarctic and arctic meteorology. This apparition should also allow careful scrutiny of the summer NPC remnant. As Mars will have an apparent diameter of over 11 arc-seconds at the northern spring equinox, this apparition should also allow careful scrutiny of the summer NPC remnant.

The Rima Tenuis.—While using a 9-inch refractor in 1888, G. Schiaparelli noted that the North Polar Cap of Mars was divided in two parts by a dark rift or fissure. This observation was soon confirmed by Terby and Perrotin. This rift, called Rima Tenuis, was observed many times from 1901 through 1918. Records from the British Astronomical Association (B.A.A.) indicate that the Rima Tenuis has also been observed during 1933 and again in 1950.

C.F. Capen carried out a search for the Rima Tenuis during the 1960's. Even though he used large telescopes of 16, 30 and 82 inches in aperture, the search was unsuccessful. It was not until late 1979 that the Rima Tenuis appeared again. The first evidence of its return was observed by D. Troiani of Chicago, Illinois, who observed a dark notch at the south edge of the NPC near 335° areographic longitude. R. Robotham, J. Dragesco, J. Beish and D. Parker observed the Rima Tenuis within days of the first observations of the notch. Later, on February 22, 1980, P. Moore and C.F. Capen observed the complete Rima Tenuis while using the Lowell Observatory's 24-inch refractor. This rift became a regular feature during the 1980 apparition and again in 1982 and 1984.

Photographs of the Rima Tenuis have been taken by A.L.P.O. astronomers A. MacFarlane, L. Aerts, and D. Parker. However, due to the extremely low contrast and small size of this feature, we do not yet have a photograph good enough to publish.

OBSERVING AIDS

(1) Now available from the Astronomical League is the *Mars Observer's Handbook* by Jeffrey D. Beish and Charles F. Capen at a new low price of $8.00. This very important and informative book is in its second printing due to popular demand. Formerly published for The Planetary Society's "Mars Watch '88," the book was sold out and has been out of print for the past two years. Send an $8.00 check or money order to: Astronomical League Sales, Four Klopfer Street, Pittsburgh, PA 15209.

2) Picked as one of the top twelve non-technical astronomy books of 1989 by the Astronomical Society of the Pacific, *Introduction to Observing and Photographing the Solar System*, by T.A. Dobbins, D.C. Parker, and C.F. Capen contains both theoretical and observational information on Solar-System objects, with very detailed chapters on Mars, astrophotography, micrometry, and so forth. There is a Forword by the A.L.P.O. founder Walter H. Haas. The book is available in hardcover for $19.95 from Willmann-Bell, Inc., P.O. Box 35025 Richmond, VA 23235, telephone (804) 320-7016.

CALENDAR OF EVENTS: MARS, 1992-93 APPARITION

Table 1 (p. 100) gives forecasts of Mars' appearance and phenomena for the 1992-93 Apparition. Begin observing Mars now in order to watch these predicted phenomena, and possibly unpredicted phenomena as well!

Table 1. Predicted Martian Phenomena, 1992-93 Apparition.

Earth Date	Ls °	Phenomena
1992		
23 APR	236	Disk diameter is now 4".8 (arcsec.). Maximum earthward tilt of 25°.0 of the Martian South Pole for this apparition. Numerous white patches possible on surface.
10 MAY	246	Disk diameter is now 5".0. Mars crosses into celestial Northern Hemisphere.
17 MAY	251	Mars at Perihelion, watch for dust clouds.Several "planet-encircling dust storms" reported during this Martian season. Disk diameter 5".1.
17 JUN	270	Northern Winter/Southern Summer Solstice. Mars' north polar region covered with bright hood. North Polar Cap (NPC) should be near maximum diameter. Disk diameter only 5".5. Mars rises approximately 3 hours before Sun.
19 JUL	290	Mars 6".0, De -11°.2 (areocentric Earth declination). Look for orographic clouds (violet filter). Orographics over the Tharsis volcanoes—W-Cloud? Low-resolution CCD imaging possible.
30 AUG	315	De 0° . Disk diameter is now 7".0.
31 OCT	349	De +11°.6 Disk diameter is now 10".0. NPC large, hood present. High-quality micrometer measurements of NPC possible. Views of surface details better. Some photography now possible. Discrete (white) clouds and white areas should be seen. Measure latitude of North Polar Hood (NPH).
21 NOV	000	Northern Spring/Southern Autumn Equinox. Disk diameter is now 11".8. NPH breaking up, NPC should be exposed. High-resolution CCD imaging possible.
23 NOV	001	De +12°.6 , Disk diameter is now 12".0. Begin high-resolution visual observations and high-quality photography.
1993		
03 JAN	020	Closest Approach to Earth at 13.6h UT, Mars diameter 14".95.
07 JAN	022	Opposition at 22h 37m UT, Dec. = +26° , De = +7°.5. Disk diameter is now 14".9. Photography and CCD imaging desired.
30 JAn	033	De +4°.3 , Declination +27°.02 (farthest north). Disk diameter is now 13".4.
28 MAR	058	Disk diameter rapidly shrinking--now 8".0. Northern Hemisphere Spring. Continue NPC measurements. Is North Cap fairly static or entering rapid-retreat phase? South polar regions becoming difficult to observe. Any signs of SPH? De +8°.3. High- resolution CCD imaging still possible.
25 APR	071	Mars at Aphelion, Disk diameter is now 6".5. De +13°.5.
07 MAY	076	Disk diameter 6".0. N. Hemisphere late-Spring. Is NPC beginning rapid retreat? Are limb arcs increasing in frequency, intensity? Use filters! Antarctic hazes, hood? Cloud activity increases. Aphelic chill observed? Low-resolution CCD imaging possible.
08 JUN	090	Northern Summer/Southern Winter Solstice. Orographics over the Tharsis volcanoes-W-Cloud? Disk diameter 5".0. De +21°.4.

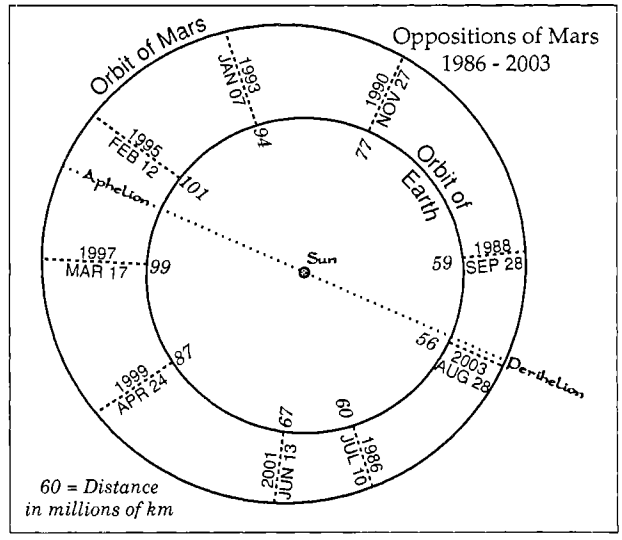


Figure 1. Diagram of oppositions of Mars for 1986-2003, showing how the eccentricity of Mars' orbit affects the opposition distance between the Earth and Mars. Although oppositions of Mars occur at 25-26 month intervals, there is also a 15-17 year cycle of the oppositions themselves; note the two favorable oppositions of 1988 and 2003, for example. This cycle also affects the opposition declination of Mars. Mars has a high northern declination for its *aphelic* (distant) oppositions, which occur in the Earth's Northern-Hemisphere Winter, and is far south for its *perihelic* (close) oppositions, which occur in Earth's Northern late Summer or early Fall.

THE 1990 WESTERN (MORNING) APPARITION OF THE PLANET VENUS: VISUAL AND PHOTOGRAPHIC OBSERVATIONS

By: Julius L. Benton, Jr., A.L.P.O. Venus Recorder

ABSTRACT

This report summarizes visual and photographic observations of Venus for the 1990 Western (Morning) Apparition, based on data submitted by A.L.P.O. Venus Section observers in the United States, Canada, and Germany; including the instrumentation and sources of data used in obtaining those observations. Comparative studies deal with observers, instruments, and visual and photographic data. The report includes illustrations and a statistical analysis of the categories of features in the atmosphere of Venus, including cusps, cusp-caps, and cusp-bands, seen or suspected at visual wavelengths, both in integrated light and with color filters. One observer conducted ultraviolet and infrared photography. Terminator irregularities and the apparent phase are discussed, as well as results from the continuing monitoring of the dark hemisphere of Venus for the Ashen Light.

INTRODUCTION

Observers submitted numerous, good visual and photographic observations of Venus during the 1990 Western (Morning) Apparition. The geocentric parameters of that apparition are given in *Table 1* below.

Table 1. Geocentric Data in Universal Time (UT) for the 1990 Western (Morning) Apparition of Venus.
[U.S. Naval Observatory, 1989]

		d	h
Inferior Conjunction	1990 JAN	18	23
Greatest Brilliancy (-4.6)	FEB	22	13
Greatest Elongation West (46°)	MAR	30	07
Dichotomy (predicted)	MAR	31	04
Superior Conjunction	NOV	01	15
Apparent Diameter (observed range)	60".30 (1990 JAN 26)- 9".80 (1990 OCT 07)		

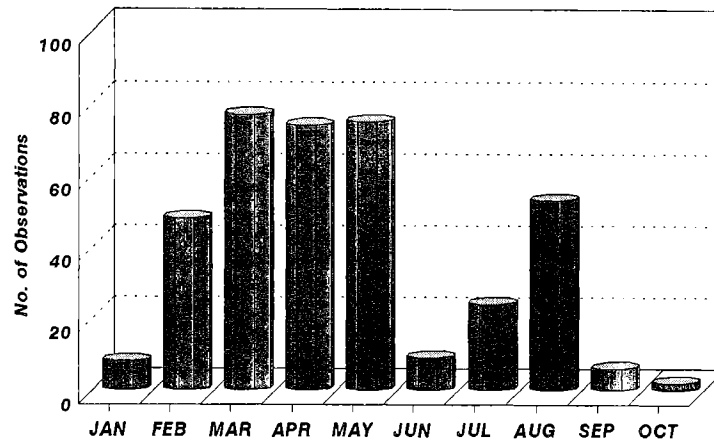
A total of 376 observations consisting of visual drawings and photographs was received for the 1990 Apparition, supplemented by the welcome efforts of M. Gélinas of Québec, Canada to carry out several CCD, ultraviolet, and infrared (IR) photographic studies of Venus. *Figure 2* (p. 102) illustrates the distribution of observations for each month during that apparition.

On the basis of the number of reports received, the observational coverage was excellent, with individuals initiating their programs quite early in the apparition and following through up until a month before Venus reached Superior Conjunction with the Sun. The "observing season," or observational period, was from 1990 JAN 26 through OCT 07, with the maximum emphasis during the months of February through May (72.9 percent of the total observations). As in many previous apparitions, the greatest observational activity during 1990 was near the period when Venus was at greatest brilliancy and maximum elongation from the Sun.

Four individuals submitted visual and photographic observations of Venus for the 1990 Apparition. These observers are listed in *Table 2* (below), with their observing sites, number of observations, and instruments used.

Table 2. Participants in the A.L.P.O. Venus Observing Program during the 1990 Western (Morning) Apparition.

Observer	Observing Site	Number of Observations	Telescope(s) Used
Benton, J.L.	Wilmington Island, GA	26	15.2-cm (6.0-in) Refractor
Gélinas, M.A.	N.D.-Ile-Perrot, Qué., Canada	12	15.2-cm (6.0-in) Refractor
		11	20.3-cm (8.0-in) Schmidt-Cass.
Graham, F.	Cleveland, OH	1	22.9-cm (9.0-in) Refractor
Niechoy, D.	Göttingen, Germany	21	6.0-cm (2.4-in) Refractor
		305	20.3-cm (8.0-in) Schmidt-Cass.



# Observations	8	48	77	74	75	9	24	53	6	2

72.9% of Observations were received during the period from 1990 Feb 1 to May 31 (Gr. Brilliancy occurred on 1990 Feb 22, and Gr. Elong. West on 1990 Mar 30)

Month of Observation (1990)

Total Observations Received: 376
Observational Range: 1990 Jan 26 - Oct 07
Range of k: 0.027 (Jan 26) - 0.995 (Oct 07)

Figure 2. Number of observations contributed to the A.L.P.O. Venus Section by month during the 1990 Western (Morning) Apparition.

The observers were international. Two of the four were located in the United States, although those individuals accounted for only 7.2 percent of the total observations. Indeed, one individual, D. Niechoy of Göttingen, Germany, contributed 86.7 percent of the total observations!

As for the types of telescopes used, as in the 1988-89 Western (Morning) Apparition, Schmidt-Cassegrain telescopes were popular; they accounted for 84.0 percent of the 1990 observations. This situation is unusual because more frequently "classical" designs such as the refractor and Newtonian reflector predominate. Also, 94.4 percent of the observations were made with telescopes of 15.2-cm (6.0-in) aperture or greater.

In terms of atmospheric conditions, the mean Seeing was 6.9, or "good," on the standard A.L.P.O. Seeing Scale that ranges from 0.0 for worst to 10.0 for perfect. The mean Transparency, expressed as the limiting stellar magnitude in the vicinity of Venus, was about +4.6 for the very few observations made when the planet was seen in a fairly dark sky, and thus at a relatively low altitude. Observers usually followed Venus into a daylight sky, and thus took advantage of better Seeing conditions, throughout most of 1990.

This Recorder expresses his warmest gratitude to the four dedicated colleagues mentioned in this report who carried out observations for the A.L.P.O. Venus Section.We cordially invite observers everywhere to join, or to continue, with us in the coming observing seasons. We are continuing efforts to encourage and coordinate comprehensive studies of Venus throughout the 1990's; with good cooperation from such groups as the British Astronomical Association, and the Vereinigung der Sternfreunde in Germany, and with others throughout the world.

OBSERVATIONS OF VENUSIAN ATMOSPHERIC DETAILS

As noted in our previous Venus Reports [e.g., Benton, 1991], the methods for conducting visual studies of the somewhat vague, characteristically elusive "markings" in the atmosphere of Venus have been outlined in the appropriate Venus Section publications. [Benton 1973, 1987] We recommend that new observers of Venus study these sources as well as previous apparition reports.

Nearly all the observations used for this report were at visual wavelengths. The only exception was some CCD, ultraviolet, and infrared photography by M. Gélinas of Québec, Canada. Several examples of drawings and photographs appear in this report in order to aid the reader in interpreting the phenomena reported or suspected on Venus in 1990 (see *Figures 5-14*, pp. 107-108).

The visual and photographic data for the 1990 Apparition represented essentially all of the categories of dusky and bright markings/features on Venus, as covered in the literature cited above. [Benton 1973, 1987, 1991] *Figure 3* (p. 103) summarizes the frequency with which the specific forms of markings were reported. Note that many observations showed more than one type of marking or fea-

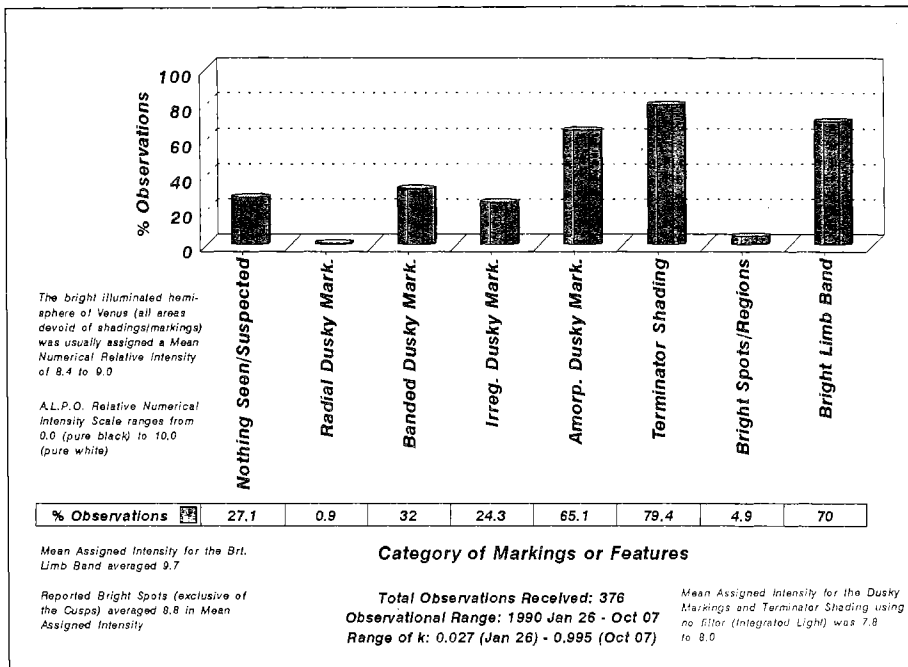


Figure 3. Frequency of occurrence of types of markings and other features, 1990 Western (Morning) Apparition of Venus.

ture, so that totals over 100 percent are possible. Undoubtedly, there is a subjective element in the reporting of the vague markings of Venus which must affect the values in *Figure 3*. Nevertheless, our tentative conclusions derived from these data appear reasonable.

The dusky markings of Venus' atmosphere are quite elusive, both to the novice and to the experienced observer. Ultraviolet (UV) photographs of Venus are usually preferred to drawings in order to bring out these subtle shadings. The A.L.P.O. Venus Section actively seeks UV photographs because many features' appearances in UV are different than in visual wavelengths, particularly radial dusky patterns. However, it is interesting that during 1990 almost three-quarters (72.9 percent) of the drawings and other visual observations of Venus did show shadings or markings of some kind. This was almost exactly the same situation as was encountered during the 1988-89 Western (Morning) Apparition, but not for many of the observing seasons prior to 1988-89. In the photographs taken at visual wavelengths, as well as those that were done in UV and IR by M. Gélinas, there were no indications of markings. In the photographs, Venus displayed a completely blank disk even though visual observers then reported banded, radial, irregular, and amorphous dusky markings. One important factor here is that in recent years observers have been utilizing more standard, systematic techniques with polarizing and color filters, which may have helped them to glimpse detail visually.

Most of the dusky markings that were reported were in the category of "Amorphous Dusky Markings," reported in 65.1 percent of the observations. Other dusky atmospheric features were distributed fairly evenly between the categories of "Banded Dusky Markings" (32.0 percent) and "Irregular Dusky Markings" (24.3 percent), and only 0.9 percent of the observations reported "Radial Dusky Markings" in 1990.

Terminator shading was prominent during the 1990 Apparition, and was recorded in 79.4 percent of the observations, as shown in *Figure 3*. Unlike most of the drawings, however, the photographs seldom clearly showed terminator shading.There was the usual tendency for the terminator shading to lighten (i.e., assume a higher intensity value) as one proceeded from the terminator region toward the illuminated limb of the planet. Sometimes this gradation in brightness ended in the Bright Limb Band (see below), and frequently this terminator shading extended all the way from the northern to the southern cusp region.

The mean relative intensity for all of the dusky features reported on Venus in 1990 ranged from 7.8 to 8.0 on the A.L.P.O. Standard Relative Intensity Scale (from 0 for black shadow to 10 for the brightest possible feature).

Except for the cusp regions, bright areas or mottlings were infrequently observed for the 1990 Western (Morning) Apparition, and averaged about 8.8 in mean relative intensity. At visual wavelengths, only a small number of drawings showed these bright spots or mottlings on Venus. Moreover, no photographs at visual, UV, or IR wavelengths revealed any indication of these features.

Color-filter techniques were effectively and systematically applied to Venus during

the 1990 Western (Morning) Apparition. These gave promising results when compared with integrated-light observations. The use of Wratten and Schott color filters and variable-density polarizers improved the overall visibility of atmospheric phenomena on Venus.

THE BRIGHT LIMB BAND

In the 1990 Western (Morning) Apparition, 70.0 percent of the observations submitted described an obvious "Bright Limb Band" on the sunlit hemisphere of Venus. Of the instances when this brilliant band was recorded, the feature extended uninterrupted from cusp to cusp 62.4 percent of the time, and was broken or partially visible in the remaining 37.6 percent of the positive reports. The mean numerical intensity of the Bright Limb Band was 9.7. Its visibility was significantly enhanced by the use of color and variable-density polarizing filters.

CUSPS, CUSP-CAPS, AND CUSP-BANDS

The most contrasting and conspicuous features sometimes seen in the atmosphere of Venus are found at or near the planet's cusps, usually when the phase coefficient **k** [the fraction of the disk that is illuminated] lies between 0.1-0.8. These cusp-caps are occasionally bounded by dark, often diffuse, peripheral cusp-bands. *Figure 4* (below) shows visibility statistics for Venus' cusp features in 1990.

When the northern and southern cusp-caps were recorded, they were often seen at the same time. They were then as a rule equal in size, but the northern cusp-cap was usually the more conspicuous in terms of brightness. There were, though, a few instances when the southern cusp-cap was the larger and brighter. In slightly over one-third of the observations, neither cusp-cap was reported. When seen, the mean relative intensity of the cusp-caps was about 9.6 during the 1990 Apparition.

The cusp-caps were fairly frequently bordered by dusky cusp-bands with a mean relative intensity of about 7.6. Just as often, however, neither cusp-band was reported.

CUSP EXTENSIONS

In theory, the illuminated portion of the limb of Venus should always subtend very close to 180°; an extent significantly larger is described as a *cusp extension*, and is presumably an effect of Venus' atmosphere. This is reported only when Venus has a narrow crescent phase and 85.4 percent of the observations submitted in 1990 showed absolutely no cusp extensions, with colored and polarizing filters as well as in integrated light

However, from 1990 JAN 26 through APR 02, several reports were received of extensions of both cusps ranging from 2° to 40° on the average. There were even several instances when the reported extensions of both cusps joined, forming a strikingly beautiful halo encircling the entire dark hemisphere of Venus. These cusp extensions were depicted on drawings, and were enhanced by color filters and polarizers, but were wholly invisible on all photographs submitted. As expected, cusp extensions are exceedingly difficult to capture

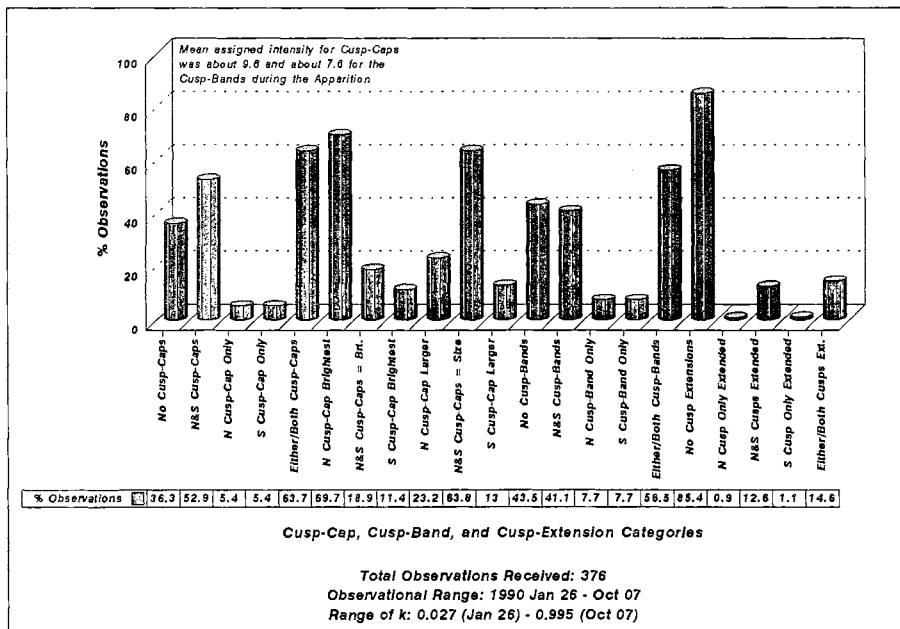


Figure 4. Frequency of occurrence of cusp-caps, cusp-bands, and cusp-extensions. 1990 Western (Morning) Apparition of Venus. The range of **k** (fraction of disk illuminated) was from 0.027 (1990 JAN 26) to 0.994 (1990 OCT 07).

on film, being considerably fainter than the sunlit portions of the disk.

TERMINATOR IRREGULARITIES

The terminator of Venus is the geometric curve that separates the sunlit and dark hemispheres. Unlike the high frequency of terminator deformities reported during the 1988-89 Western (Morning) Apparition, only 38 percent of the observations in 1990 referred to an asymmetric or irregular terminator. When the terminator was not seen as a regular geometric feature, amorphous and irregular dusky markings, and to a lesser extent banded and radial dusky shadings, merged with the terminator shading and with possible reported deformities. As with other observations during this apparition, successful filter techniques probably enhanced the visibility of any terminator irregularities and associated dusky atmospheric features. Also, the phenomenon of irradiation may cause bright features adjacent to the terminator to become apparent bulges into the dark hemisphere, while dark features may appear as hollows into the sunlit hemisphere.

ESTIMATES OF DICHOTOMY

The "Schröter Effect" on Venus, a discrepancy between the predicted and the observed dates of dichotomy (half-phase), was reported in 1990. The predicted half-phase occurs when **k** = 0.500, and the phase angle **i** between the Sun and the Earth as seen from Venus equals 90°. The observed *minus* predicted discrepancies for 1990 are given in *Table 3* (below).

Table 3. Observed versus Predicted Dichotomy of Venus: 1990 Western (Morning) Apparition.

Quantity		Observer: J.L. Benton	Observer: M. Gélinas
Date (1990 APR/MAR):	Observed (O)	02.25 d	03.20 d
	Predicted (P)	31.15	31.15
	Difference (O - P)	+2.10	+3.05
Phase Coefficient:	Observed (O)	0.500	0.500
	Predicted (P)	0.511	0.516
	Difference (O - P)	-0.011	-0.016

THE ASHEN LIGHT

The Ashen Light, first reported by the Italian observer G. Riccioli in 1643, is an exceedingly elusive, faint illumination of the dark hemisphere of Venus. It resembles Earthshine on the dark portion of the Moon, but the latter has a completely different origin. It is often argued that Venus must be viewed against a dark sky in order to detect the Ashen Light, but Venus is then very low in the sky and hence suffers from poor seeing and glare in contrast with the dark sky background.

Table 4 (p. 106) summarizes the positive and negative Ashen Light observations of D. Niechoy, who was responsible for 86.7 percent of the total number of observations during the 1990 Apparition. Mr. Niechoy was alone in reporting any positive sightings of the Ashen Light. His data have merit also because they were nearly all made with the same instrument, magnification, and filters. When variations in these factors occur among the entire group of observers, as has been the case in past apparitions, comparisons become considerably more troublesome.

On several occasions Mr. Niechoy suspected, and in some cases was certain of, the presence of the Ashen Light while using color filters and also in integrated light against a twilight sky. There were also a few times when observers suspected that the dark hemisphere of Venus looked actually *darker* than the background sky, but this phenomenon is almost certainly a contrast effect.

CONCLUSIONS

Atmospheric activity on Venus during the 1990 Western (Morning) Apparition was moderate. It is of considerable interest to compare these results with those of previous morning observing seasons, as well as with evening apparitions of the planet. Our studies of the Ashen Light, which intensified during the Pioneer Venus Orbiter project, are continuing with significant emphasis. The cooperation of individuals and organizations throughout the world in our investigations of Venus has solidified the international scope of our endeavors. Continuous, systematic, and simultaneous monitoring of the planet by regular, dedicated participants over the span of many years remains our principal goal; and we invite interested readers to join us in our commitment to gather reliable information about Venus.

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Table 4. Ashen-Light Observations by D. Niechoy: 1990 Western (Morning) Apparition of Venus.

Date, UT	Instrument, Mag.	Filter	S/T	AL
1990				
JAN 26				
11h 48m	20.3 S-C, 51×	IL	3/3	S
11h 53m	20.3 S-C, 112×	IL	3/3	DS
12h 01m	20.3 S-C, 112×	RG610	3/3	StS
JAN 29				
11h 33m	20.3 S-C, 51×	IL	3/4	S
11h 37m	20.3 S-C, 225×	IL	3/4	DS
11h 42m	20.3 S-C, 225×	RG610	3/4	S
11h 49m	20.3 S-C, 225×	W15	3/4	NS
11h 55m	20.3 S-C, 225×	W47	3/4	S
FEB 04				
09h 48m	20.3 S-C, 225×	IL	3/3	VStS
09h 52m	20.3 S-C, 225×	RG610	3/3	NS
09h 58m	20.3 S-C, 225×	W15	3/3	NS
10h 03m	20.3 S-C, 225×	W47	3/3	NS
10h 09m	20.3 S-C, 225×	OG550	3/3	NS
10h 15m	20.3 S-C, 225×	W11	3/3	NS
FEB 10				
10h 46m	20.3 S-C, 112×	IL	3/3	VStS
10h 58m	20.3 S-C, 112×	RG610	3/3	NS
FEB 17				
10h 57m	20.3 S-C, 225×	IL	3/3	NS
11h 04m	20.3 S-C, 225×	W15	3/3	S
11h 09m	20.3 S-C, 225×	RG610	3/3	NS
11h 18m	20.3 S-C, 225×	BG28	3/3	StS
11h 26m	20.3 S-C, 112×	IL	3/3	StS
11h 33m	20.3 S-C, 225×	W47	3/3	NS
FEB 21				
05h 24m	6.0 Refr, 33×	IL	3/3	S
05h 30m	6.0 Refr, 33×	IL	3/3	S
05h 41m	6.0 Refr, 33×	IL	3/3	NS
06h 20m	20.3 S-C, 112×	IL	3/3	S
06h 26m	20.3 S-C, 112×	RG610	3/3	NS
06h 32m	20.3 S-C, 112×	W15	3/3	NS
06h 37m	20.3 S-C, 112×	W47	3/3	NS

(Continued in right column.)

Date, UT	Instrument, Mag.	Filter	S/T	AL
1990				
FEB 23				
05h 17m	6.0 Refr, 33×	IL	3/3	S
05h 24m	6.0 Refr, 33×	IL	3/3	NS
05h 29m	6.0 Refr, 33×	IL	3/3	NS
06h 15m	20.3 S-C, 225×	IL	3/3	NS
06h 23m	20.3 S-C, 225×	W15	3/3	NS
06h 31m	20.3 S-C, 225×	W25	3/3	NS
06h 38m	20.3 S-C, 225×	W47	3/3	NS
FEB 24				
08h 13m	20.3 S-C, 225×	IL	3/3	S
08h 29m	20.3 S-C, 225×	W15	3/3	NS
08h 48m	20.3 S-C, 225×	W25	3/3	NS
08h 50m	20.3 S-C, 225×	W15	3/3	NS
08h 57m	20.3 S-C, 225×	W47	3/3	NS
09h 03m	20.3 S-C, 225×	W11	3/3	NS
FEB 25				
08h 47m	20.3 S-C, 170×	IL	3/4	NS
08h 51m	20.3 S-C, 170×	W25	3/4	S
08h 56m	20.3 S-C, 170×	W15	3/4	NS
MAR 11				
10h 03m	20.3 S-C, 225×	IL	3/4	NS
10h 10m	20.3 S-C, 225×	W25	3/4	S
10h 16m	20.3 S-C, 225×	W47	3/4	NS
10h 25m	20.3 S-C, 225×	W15	3/4	S
10h 31m	6.0 Refr, 83×	IL	3/4	NS
10h 36m	20.3 S-C, 225×	RG610	3/4	NS
10h 42m	20.3 S-C, 225×	GG10	3/4	NS
MAR 30				
04h 53m	6.0 Refr, 33×	IL	3/3	NS
04h 58m	6.0 Refr, 33×	IL	3/3	S
APR 01				
08h 35m	20.3 S-C, 170×	IL	3/3	S
08h 45m	20.3 S-C, 170×	W15	3/3	NS
08h 50m	20.3 S-C, 170×	W25	3/3	NS
08h 59m	20.3 S-C, 170×	W47	3/3	NS
09h 08m	20.3 S-C, 170×	W11	3/3	NS
09h 14m	20.3 S-C, 170×	BG28	3/3	NS

Notes for Table 4

Instrument = Aperture in cm; Type (Refr = Refractor; S-C = Schmidt-Cassegrain); Magnification.

Filter = Type of filter, where IL = Integrated Light. Wratten series filters are abbreviated W. Other designations indicate Schott filters. The colors of the filters are as follows:
Wratten: W11 = Yellow; W15 = Yellow; W25 = Red; W47 = Blue.
Schott: BG28 = Blue-Green; GG10 = Yellow; OG550 = Green; RG610 = Red.

S/T = Seeing and transparency. Seeing is on the standard A.L.P.O. scale, ranging from 0 for worst to 10 for perfect. Transparency is on a scale, ranging from 0 for worst to 5 for perfect.

AL = Ashen Light visibility as follows: DS = Definitely Seen; NS = Nothing Seen or Suspected; S = Suspected; StS = Strongly Suspected; VStS = Very Strongly Suspected.

SELECTED DRAWINGS AND PHOTOGRAPHS, 1990 WESTERN (MORNING) APPARITION OF VENUS

Notes: Figures 5-14 are oriented with celestial south at the top and the preceding direction to the left (simple inverted views). Unless otherwise stated, Seeing is on the standard A.L.P.O. scale, ranging from 0 for worst to 10 for perfect and Transparency is on a scale, ranging from 0 for worst to 5 for perfect. Note that Mr. Niechoy's drawings are laterally *reversed.*

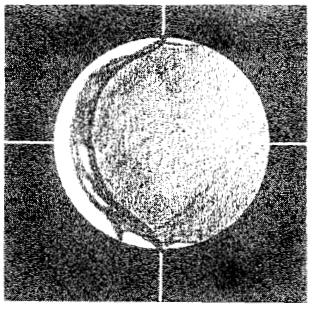
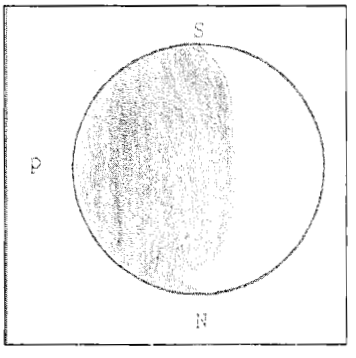


Figure 5 (right). Drawing of Venus by D. Niechoy. 1990 FEB 22, 06h 25m UT. 20.3-cm (8.0-in) Schmidt- Cassegrain, 225×.W15 (yellow) Filter. Seeing = 2, Transparency = 3. Phase (**k**) = 0.254. Diameter = 40".6. Note Ashen Light and terminator shading.

Figure 6 (below). Drawing of Venus by Marc Gélinas. 1990 MAR 08, 14h 55m-15h 18m UT. 20.3-cm (8.0-in)Schmidt-Cassegrain, 290×. W15 (yellow), W25 (red), W38(light blue) Filters. Seeing = 8, Transparency = +5 (limiting magnitude). Phase (**k**) = 0.364, estimated as 0.36±.01. Diameter = 32".5.



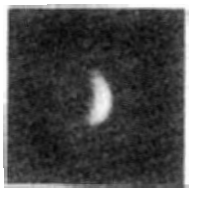


Figure 7 (right). Photograph of Venus by Marc Gélinas.1990 MAR 08, 14h 36m UT. 20.3-cm (8.0-in) Schmidt-Cassegrain at f/30. 1 sec. on Kodak TP2415 Film with a W18A Filter (ultraviolet, but with a "red leak"). Seeing = 8, Transparency = +5 (limiting magnitude). Phase (**k**) = 0.364. Diameter = 32".5. Compare with *Figure 6* to the left, drawn slightly later.

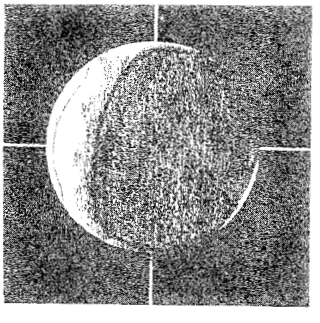


Figure 8 (left). Drawing of Venus by D. Niechoy. 1990 MAR 11, 10h 10m UT. 20.3-cm (8.0-in) Schmidt-Cassegrain, 225×. W25 (red) Filter. Seeing = 2, Transparency = 3. Phase (**k**) = 0.384. Diameter = 31".2. A very pronounced light zone is visible on the darkside limb, along with cusp extensions.

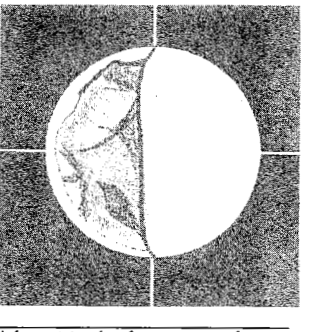


Figure 9 (right). Drawing of Venus by D. Niechoy. 1990 MAR 31, 06h 37m UT. 20.3-cm (8.0-in) Schmidt-Cassegrain, 225×. Integrated light (no filter). Seeing = 2, Transparency = 3. Phase (**k**) = 0.501. Diameter = 24".2. A bright limb band is evident, adjoined by two bright spots.

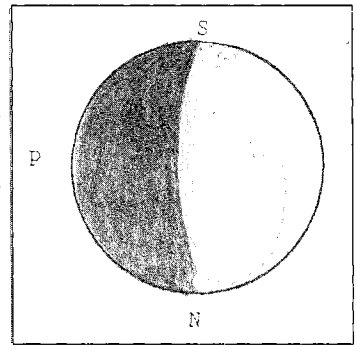


Figure 10 (right). Drawing of Venus by Marc Gélinas. 1990 APR 19, 13h 27m-13h 55m UT. 15.2-cm (6.0-in) refractor, 261×. W15 (yellow), polarizing, W38 (light blue), and magenta filters. Seeing = 8, Transparency = 4. Phase (**k**) = 0.592, estimated as 0.57±.01. Diameter = 19".9.

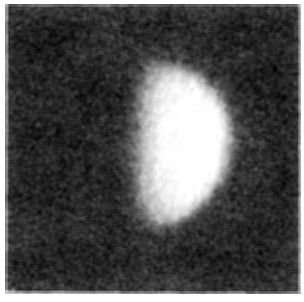


Figure 11 (left). Photograph of Venus by Marc Gélinas. 1990 APR 19, 14h 10m UT. 15.2-cm (6.0-in) refractor, f/68. 1/60 sec. on HIE 2481 infrared film, W29 (deep red) Filter. Seeing = 7, Transparency = +4.5 (limiting magnitude). Phase (**k**) = 0.593, Diameter = 19".9. Compare with the drawing above, made shortly before.

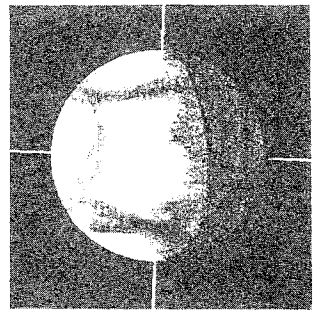


Figure 12 (right). Drawing of Venus by D. Niechoy. 1990 MAY 12, 09h 02m UT. 20.3-cm (8.0-in) Schmidt-Cassegrain, 112×. W25 (red) Filter. Seeing = 3, Transparency = 2. Phase (**k**) = 0.683. Diameter =16".4. Several dusky shadings are visible.

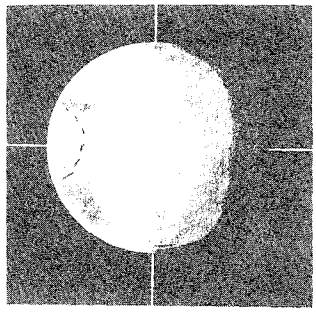


Figure 13 (left). Drawing of Venus by D. Niechoy. 1990 JUN 16, 07h 12m UT. 20.3-cm (8.0-in) Schmidt-Cassegrain, 112×. W25 (red) Filter. Seeing = 2, Transparency = 3. Phase (**k**) = 0.796. Diameter = 13".2. Note distinct bright area on the IAU east limb.

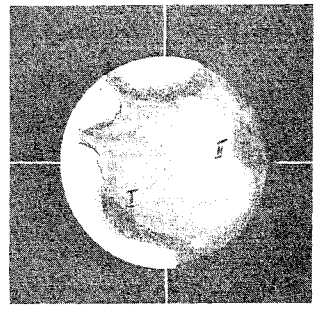


Figure 14 (right). Drawing of Venus by D. Niechoy. 1990 AUG 25, 06h 45m UT. 20.3-cm (8.0-in) Schmidt-Cassegrain, 225×. W15 (yellow) Filter. Seeing = 1, Transparency = 2. Phase (**k**) = 0.950. Diameter = 10".4. "I" indicates a possible dusky band; "II" a dusky spot.

COSMOCON'92: A PHOTOGRAPHIC REPORT

The Association of Lunar and Planetary Observers recently held its forty-second convention, on the campus of San Jose State University in San Jose, California, on July 13-18, 1992. We were not alone because the same meeting included the annual conventions of the Astronomical League and the Western Amateur Astronomers, making COSMOCON'92 a truly national amateur meeting. We here extend our thanks to the Astronomical Association of Northern California, who sponsored the event.

Such meetings feature a variety of activities. As usual, there were several paper sessions. A.L.P.O. Members speaking on Solar-System topics were well-represented here, as shown in the listing to the upper right. Their papers will appear in the forthcoming convention Proceedings.

Such annual meetings also provide the occasion where the participating groups make their annual awards. The A.L.P.O. can be proud that three of its members received such awards in 1992: (1) Phillip W. Budine was the 1992 recipient of the A.L.P.O.'s own *Walter H. Haas Observing Award*; (2) Donald C. Parker received the 1992 *Leslie C. Peltier Award* of the Astronomical League; and (3) *John Westfall* was presented with the *G. Bruce Blair Award* for achievement in amateur astronomy (for 1991, presented in 1992). These persons, with their awards, are shown in *Figures 15* and *16* (right and below, respectively).

Then, there are the Business Meetings of the groups involved. These included the organizational meeting of Region X of the Astronomical League, including California, Nevada, Arizona, and Hawaii. The Astronomical League and the Western Amateur Astronomers also had their meetings. Likewise, the A.L.P.O. held a Business Meeting, which is described in the minutes that follow this

A.L.P.O. Papers at COSMOCON'92—

Julius L. Benton, Jr.:
Saturn's Ring System: What to Observe
Phillip W. Budine
The South Temperate Belt Fade and Related Events on Jupiter
José Olivarez
Highlights of Recent Activity on Jupiter
Donald C. Parker and Richard Berry
Lunar and Planetary Imaging with a Small CCD Camera
Richard W. Schmude, Jr.
Photoelectric Photometry of Uranus in Early 1992: Preliminary Results
John Westfall
The Coming Public Transits of Mercury and Venus

All of the Above (and others)
A.L.P.O. Observing Workshop

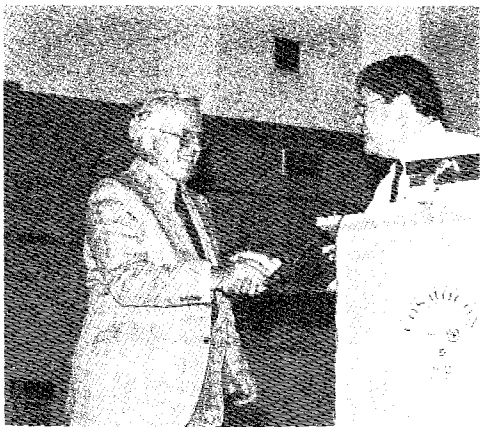


Figure 15. Phillip W. Budine (left) receiving the A.L.P.O. Walter H. Haas Observing Award from José Olivarez. (Unless otherwise stated, the photographs in this report were taken by Phillip S. Houston and were contributed by José Olivarez.)

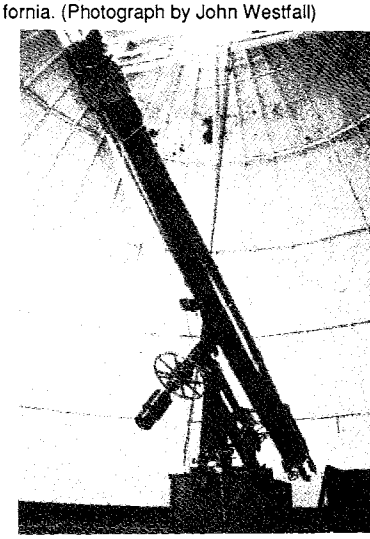
Figure 16. The gentleman to the left is Donald C. Parker, holding the Astronomical League's Leslie C. Peltier award, which he received for 1992. To his right is his wife, Maureen. To Dr. Parker's left is John Westfall, holding the Western Amateur Astronomer's G. Bruce Blair Award for 1991. To Dr. Westfall's left is his wife, Elizabeth.

Figure 17. The 1992 A.L.P.O. Business Meeting in San Jose, California. Facing the camera, from left to right, are José Olivarez*, Harry Jamieson*, Donald Parker*, Phillip Budine*, Richard Schmude, John Westfall* (standing), and Elizabeth Westfall.* (* indicates an A.L.P.O. Board member).

report. Above (*Figure 17*) is a view of the 1992 A.L.P.O. Business Meeting.

COSMOCON'92 was noteworthy for its field trips, which included one to the nearby NASA Ames Research Center, home of the Kuiper Airborne Observatory (KAO). Unfortunately the KAO was indeed airborne when our group visited the Center, but we could console ourselves with visits to four ground-based observatories, three of which had the large refractors so beloved of lunar and planetary observers. First was Lick Observatory, in the mountains east of San Jose, home of the 36-inch (91-cm) Alvan Clark refractor and the 120-inch (3-meter) Shane reflector. The next evening saw a trip to Chabot Observatory in Oakland, housing a 20-inch (51-cm) Brashear and an 8-inch (20-cm) Alvan Clark refractor. Then, many of those attending the convention learned for the first time that a 16-inch (41-cm) Alvan Clark refractor was housed only a few miles away, at Ricard Memorial Observatory in Santa Clara, restored to working order largely by student efforts. (See *Figure 18* to the right.)

Figure 18. The 16-inch (41-cm) Alvan Clark refractor at Ricard Memorial Observatory at the University of Santa Clara, in Santa Clara, California. (Photograph by John Westfall)



The final field trip was to an amateur-built observatory at Fremont Peak State Park south of San Jose, featuring a 30-inch (76-cm) Newtonian reflector, shown in *Figure 19* (below). Perhaps 20 amateurs also brought their own telescopes to Fremont Peak, with apertures ranging up to 24 inches (61 cm), so nobody had to wait long in line before seeing Saturn, Uranus, the Moon, or (for those who like them) deep-sky objects as well.

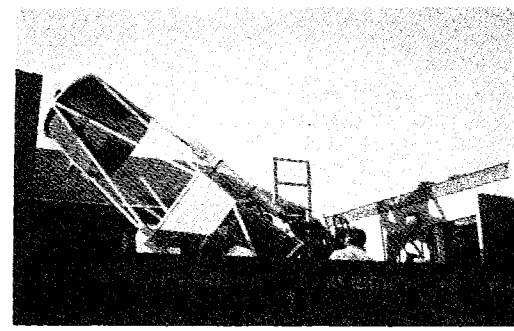


Figure 19. The 30-inch (76-cm) Newtonian reflecting telescope at Fremont Peak Observatory south of San Jose, California. Note the large observing floor and slide-off roof, allowing groups easy access to the sky. (Photograph by John Westfall)

Add to all the above the "Star-B-Que" dinner at Fremont Peak, the traditional Banquet, and notable guest speakers such as Carolyn Shoemaker ("Comets, Craters and Catastrophes"), Don Osterbrock ("The Pauper and the Prince: George Willis Ritchey, George Ellery Hale and Big American Telescopes"), Tom Thompson ("Venus-Magellan Science Discoveries"), George Textor ("Voyager: The Incredible Journey"), and Roger Sinnott ("What You Can Do With a Backyard CCD Camera—Right Now!"), and it is clear that there just wasn't enough time to do it all!

MINUTES OF THE 1992 A.L.P.O. BOARD MEETING, SAN JOSE, CALIFORNIA, JULY 16, 1992

Minutes taken by: Elizabeth W. Westfall, A.L.P.O. Board Secretary

The Annual Board Meeting of the Association of Lunar and Planetary Observers for 1992 was called to order on July 16, at 4:10 PM PDT. Six of the seven Board members were present—Phillip Budine, Harry Jamieson, José Olivarez, Donald Parker, Elizabeth Westfall, and John Westfall. Approximately twelve A.L.P.O. members and staff who were not Board members were also present. Such persons attend in a nonvoting capacity, but are always welcome at our meetings for the valuable input that they supply.

OLD BUSINESS

1. Financial Report.—The total balance in the three A.L.P.O. bank checking accounts (Heber Springs, San Francisco, and Las Cruces) was $5692. The amount owed to the Executive Director, chiefly for postage and photocopying expenses, was $66 (he bills the Association for such costs at the end of each year)

2. Staff Changes.—It was announced that Paul Mackal (Jupiter Section) and Jim Phillips (Lunar Section) had relinquished their Recorderships. Harry Jamieson had replaced Jim Phillips as Acting Recorder of the Lunar Dome Survey.

3. The A.L.P.O. Journal.—There were 608 subscribers for the July, 1992, issue; 78 percent lived in the United States and 22 percent elsewhere. The costs for the previous issue, with 622 subscribers, were $499 for domestic postage, $147 for foreign mailing, $98 for mailing services and $929 for printing. This amounted to $2.69 per issue per subscription, or $10.76 per year. This figure does not include envelopes, renewal notices, and other services of the Association. Since the last Board Meeting, we had published four quarterly issues, each with 48 pages.

4. Solar System Ephemeris.—About 100 copies of the 1992 Edition had been distributed; 17 were complimentary copies and the rest were sold at a price of $6.00 per issue for North American purchasers and $8.50 for those in other countries. The 1992 Edition had 122 pages. The 1993 Edition should be available in November, 1992. Mr. Mark Davis is generously handling production and distribution. John Westfall, the Ephemeris Editor, pointed out the need for assistance in the computations for this publication, particularly as users have requested additional tables.

5. Foreign Membership Fund.—This fund is provided by voluntary contributions and is administered by John Westfall with the intention of providing A.L.P.O. memberships to deserving but needy amateurs. We expect the recipients to participate in A.L.P.O. observing programs. Over the previous year $90 had been contributed and $112 expended for seven 1-year foreign memberships, leaving a balance of $20 as of July 11, 1992.

6. International Solar System Observers Fund (ISSOF).—This fund is supported by contributions of money, equipment, and supplies, and is administered by Paul H. Bock, Jr. As of May 24, 1992, there were 11 requests from as many countries, 3 of which had been at least partly fulfilled. Six items remain on inventory. Donors of cash or goods were T. Aranda, P.H. Bock, J. Bryan, A. Chalable, L. Deland, R. Goff, J. Griesé, A.L. Malmed, L. Netzler, E. Nussbaum, O. Piechowski, P. Rasmussen, and N. Weismann. It was pointed out that the A.L.P.O. has received favorable publicity based on this program, including letters of appreciation in *Sky & Telescope*.

6. Membership Trends.—Recent A.L.P.O. membership trends are shown by the table below:

Vol., No.	Issue Date	No. of Subscribers U.S.A.	Abroad	Total
35, 2	1991 June	476	127	603
35, 3	Oct.	467	129	596
35, 4	Dec.	433	119	552
36, 1	1992 Mar.	488	134	622
36, 2	July	476	132	608
1-year change		0	+5	+5

NEW BUSINESS

1. Future Meetings.—At the time of the meeting, we had four possible sites and times for future meetings.

• Meet by ourselves at Roper Mountain Science Center, Greenville, South Carolina (firm invitation; date open). We plan to consider this at our 1993 Meeting as a likely possibility for the 1994 Meeting.

• Meet by ourselves at the Omnisphere and Science Center, Wichita, Kansas (firm invitation, date open). A motion to make this our 1995 meeting site was voted on and passed. The Astronomical League was invited to join the A.L.P.O. at that meeting, the dates for which remain to be decided.

• Meet by ourselves in Las Cruces, New Mexico in 1993. This was voted on and passed. (For further information, see our "A.L.P.O. Affairs" section on page 140.)

• Meet with the Astronomical League in Madison, Wisconsin, on July 29-August 1, 1993. Due to the adoption of the Las Cruces meeting site, this altemative was not considered.

• The Astronomical League President mentioned the possibility of a joint A.L.P.O.-A.L. 50th Anniversary meeting in Philadelphia in 1997. It was proposed to discuss this proposal further at one or more future meetings.

2. Staff Confirmation.—Mr. Harry D. Jamieson was confirmed as permanent Recorder of the Lunar Dome Survey.

3. Instrument Section.—In response to suggestions by Harry Jamieson and Kent Volkmer, a motion to establish an Instrument Section on a provisional basis was moved, voted on and passed. Mr. Michael Mattei was appointed as Acting Recorder of the new Section. The goals of the Section are to provide information on telescopes and their selection, to provide "Consumer Reports," to test members' optics, and possibly correct deficient optics at cost. It was recognized that, before the new Section can start the last two activities, questions regarding shipping and other expenses and liability will need to be addressed.

4. A.L.P.O. Staff Guidelines.—In response to the fact that no written guidelines exist that describe the functions and obligations of A.L.P.O. staff, Mr. Harry Jamieson proposed the "A.L.P.O. Staff Guidelines" that are given in an Appendix at the end of these minutes. These guidelines were adopted, subject to review and modification by the A.L.P.O. Board. We welcome comments and suggestions by the A.L.P.O. membership on these Guidelines.

5. Other New Business: Membership Size.—The A.L.P.O. membership is now approximately 600; two years ago it was about 700. There was discussion about reasons for the drop and ways to counteract it. It was noted that most of the A.L.P.O. members (perhaps 85 percent) do not regularly submit observations to the Sections, but that there are many persons who do submit observations who are not A.L.P.O. members. The Board recommends that efforts be made to recruit members from those active observers who do not now belong.

6. Other New Business: Proposed Aurora Section.—Mr. Richard Schmude informally proposed the formation of an A.L.P.O. Aurora Section. The B.A.A. has long had such a Section, and that it might attract younger people to participate, due to its modest instrument requirements. There was a consensus that this was desirable but no action can be taken until an Acting Recorder can be selected.

7. Other New Business: A.L.-A.L.P.O. Publications.—Mr. Jim Fox, the Astronomical League President, invited the A.L.P.O. to work with his organization to develop educational programs and publications. The A.L.P.O. Board was enthusiastic about this opportunity to train new lunar and planetary observers and noted the value of the present Astronomical League publications on such topics as eclipses, Mars, comets, and meteors.

There being no further business, the Meeting was adjourned at 5:20 PM PDT.

Appendix:

A.L.P.O. STAFF GUIDELINES

By: Harry D. Jamieson

The A.L.P.O. has always suffered from having no clearly defined guidelines and enforced code of ethics and performance for its staff members. Unethical or non-performing staff members have all too often retained their positions for years after any ordinary business concern would have dismissed them. The code being offered below is based upon the contemporary standards of our society (as I see them) and what I hope everyone will agree is enlightened self-interest. It also stresses service to our membership, which is to say, our customer base.

1. Staff members should not advertise for sale, or accept money for, handbooks or other items which do not yet exist.

2. Staff members should take all reasonable care to acknowledge promptly the work of their observers, both personally and (where the work deserves publication) in the pages of the *Journal*. It is also recognized that staff members should expect to receive stamped self-addressed envelopes from persons writing to them.

3. Staff members should submit regular and timely reports covering the work of their Sections at intervals appropriate for them (e.g., within 180 days of the end of an apparition).

4. Staff members should attempt to promote the A.L.P.O. and the work of their Sections wherever possible. This need should be obvious, but I have seen articles in the major magazines by staff members which do not mention the A.L.P.O. at all.

5. Staff members should attempt to write their articles using language which invites rather than intimidates the reader. It should certainly be possible to do this without sacrificing the scientific values of the article. Indeed, the article is more valuable if more people read it.

6. Correspondence should be answered within three weeks of receipt.

7. Recorders should attend A.L.P.O. conventions at least once every three years.

8. Recorders should make every effort to standardize observing methods and reporting forms, along with illustrations submitted for publication.

9. Each Recorder should maintain well-organized files and pass them along to his or her successor upon resigning.

10. All Section publications should maintain proper standards in terms of content, English, and format.

The above points are not intended to be comprehensive, but rather to be a starting point for discussions which I hope will lead to the adoption of some rules that we can all see the need for.

GETTING STARTED: SKETCHING FULL-DISC DRAWINGS OF JUPITER

By: José Olivarez, A.L.P.O. Jupiter Recorder

INTRODUCTION

Full-disc sketches of Jupiter are scientifically useful because they depict the changing global look of Jupiter over time and because they can show gross changes at a glance, such as a faded belt or the appearance of a new bright or dark marking. They also serve as permanent records of the changes in large-scale or long-enduring features such as the Great Red Spot and the STB (South Temperate Belt) Ovals "BC", "DE", and "FA".

Full-disc drawings of Jupiter have been made for centuries, and have become widely used for the last hundred years. By convention, they are now drawn on elliptical discs that are 2-1/2 inches in equatorial diameter and with an oblateness that is commensurate with the polar flattening of Jupiter. Finished, black-background Jovian disc drawing forms of the proper oblateness are available at low cost from the A.L.P.O. Jupiter Recorders.* If you would like to try your skill at sketching Jupiter, acquire a set of these discs and follow the instructions below.

DRAWING MATERIALS NEEDED

Although planetary sketches can be done on practically any type of paper, it is best to use comparatively smooth paper which is as white as possible. Regular duplicating paper meets these conditions sufficiently and may be used for sketching. As an example, the A.L.P.O. Jupiter Recording Forms are printed on everyday duplicating paper.

However, ordinary hard-lead pencils such as the common #2's are not ideal for sketching. Draftspersons use "drafting pencils" which come in a variety of grades and can be obtained at drafting or art supply stores. These pencils are available in grades ranging from hard to soft, but the soft-lead pencils are best for sketching planetary surfaces. These soft pencils are available in grades ranging from 2B to 6B. They produce an even tone and consistent texture that can be easily modulated from light to dark shades by varying the pressure put upon them. These pencils must be sharpened with a small hand-held sharpener because the office hand-crank type of sharpener will invariably break off the soft leads. Also, if one desires an eraser, the kneaded rubber eraser is best. Available at art supply stores, this eraser is malleable and can be shaped to a point for erasing small areas on a sketch.

THE METHOD OF MAKING FULL-DISC DRAWINGS OF JUPITER

While sketching Jupiter's full disc, you have to work rapidly because the planet's rotation will shift the cloud features across its central meridian a full three degrees in just five minutes! The direction of motion will be from right to left in a normally inverted telescopic view with south at the top. [i.e., in a telescope having an *even* number of reflecting surfaces (e.g., 0 or 2) used in the Northern Hemisphere. With most instruments, using a star diagonal will *reverse* the image and make the drawing more difficult to interpret. Ed.]

The following four-step method of sketching Jupiter is illustrated by *Figures 20-23*, which were prepared by the planetary artist Mark S. Daniels. The actual features depicted on these discs are fictitious but are typical of real features observed on Jupiter in 1983.

Step 1 (Figure 20 below).—Lightly pencil in the major dark belts in their correct thicknesses and indicate their order of intensity. Then, be sure to check that the belts are correctly spaced and that they are parallel to each other and to Jupiter's equator. To best approximate the above, compare their placement and widths to each other and to an imaginary line dividing the disc in half at the equator. [Note that the equator and belts will appear slightly curved when the Earth is north or south of the planet's equator. Ed.]

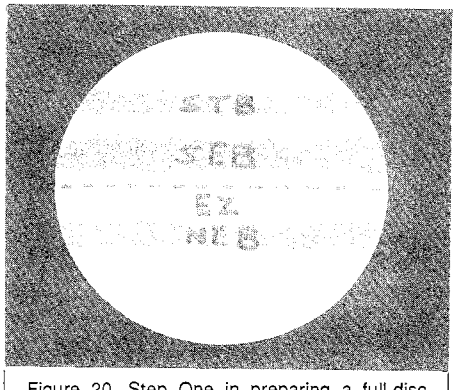


Figure 20. Step One in preparing a full-disc drawing of Jupiter. The positions and intensities of the major belts have been drawn. The belt labels and the dashed equator are informative only and would not be on the actual drawing. The labels use standard Jovian nomenclature.

* A set of 20 "Jupiter Recording Forms" containing 40 discs (two per form) is available from Jupiter Recorder José Olivarez (address on inside back cover) for $5.00 postpaid.

Step 2 (Figure 21 below).—Next, add the fainter belts and the general aspects of the main belts, such as a possible double NEB or SEB (North or South Equatorial Belt). Depict the extent of the polar shading towards the belts (North and South Polar Regions).

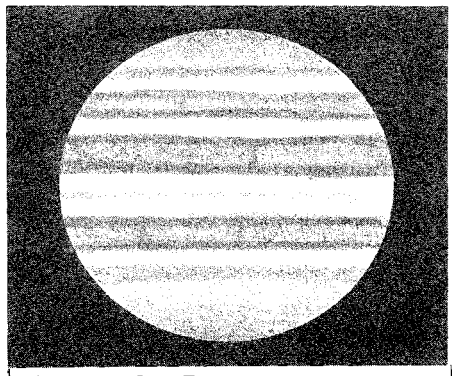


Figure 21. Step Two in preparing a full-disc drawing of Jupiter. The fainter belts and the North and South polar Regions have been added, along with the north and south components of the main belts.

Step 3 (Figure 22 below).—Now, work rapidly and place the finer details in the belts and zones. At the beginning of this step, note down the time to one-minute accuracy and keep the time spent on this step and on Step Four to at most about five minutes to minimize distortion due to the planet's rotation.

As you enter the fine details, constantly recheck their positions in relation to other main features in order to ensure accuracy in their placement. Bright areas with ill-defined outlines or little contrast with their surroundings may be outlined by dashed lines. Use a kneaded rubber eraser to pick out light areas in the belts. [This would also be a good time to draw any satellites near the limb or in transit, or any satellite shadows on the disc. Ed.]

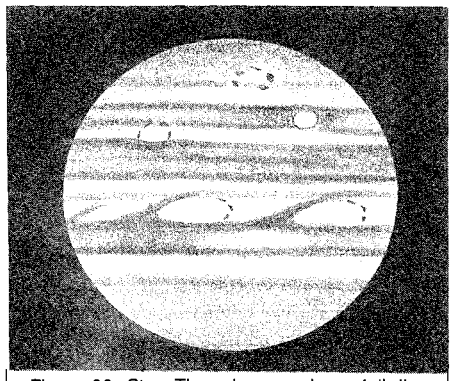


Figure 22. Step Three in preparing a full-disc drawing of Jupiter. Details have been added to the dark belts and light zones, such as diagonal festoons in the Equatorial Zone and bright ovals in the Southern (top) Hemisphere.

Step Four (Figure 23 below).—Make a final check on your placement of detail, allowing for rotation, and record the time of completion. Now, record (again to one-minute accuracy) the mean time between the beginning of Step Three and the end of Step Four. Finish the sketch by shading the belts and prominent features to their respective intensities. Use an artist's stump [a pencil-like pointed device that is used for smoothing shaded areas. Ed.] to add Jupiter's limb shading and to smooth out the belts or other dark features in order to make them appear more natural.

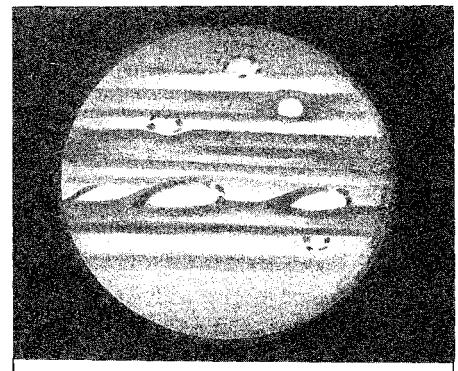


Figure 23. Step Four, a completed full-disc drawing of Jupiter. The shading of dark areas has been smoothed, positions checked, fine detail added where necessary, and the limb darkening drawn.

Notes by Editor:

The drawing methods described above are general and may be used for the other major planets; the chief difference is that one doesn't have to hurry so much for Mercury, Venus, and Mars!

For one's drawing to have scientific value, it is necessary to record all pertinent background information (Haas, 1990).

There are several "refinements" to the basic drawing methods. These include "strip sketches" which show a large longitude range on the planet, or detailed sketches of only part of the disc. Some persons prefer to copy their original drawing indoors immediately after observing; not to change any details (not! legitimate), but to make the drawing more presentable in appearance.

Finally, the artist may try a colored drawing; but this is hard to do at the telescope, particularly in a hurry. An easier and more accurate substitute is to make separate drawings through different color filters, although again this is difficult given the time constraints. For information on this and other special techniques, see Dobbins *et al.* (1988).

Dobbins, T.; Capen, C.F.; and Parker, D.C. (1988). *Introduction to Observing and Photographing the Solar System.* Richmond, VA: Willmann-Bell.

Haas, W.H. (1990). "Getting Started: Recording Your Solar System Observations." *J.A.L.P.O.*, *34*, No. 4 (November), pp. 177-179.

DIFFUSE LUMINOUS OBJECTS HAVING ANGULAR VELOCITIES SIMILAR TO METEORS

By: John S. Gallagher, 40 New St., Spotswood, NJ 08884

ABSTRACT

Meteor observers often report strange objects or occurrences in the sky above as they scan for Nature's celestial fireworks. The most common type of object reported to the Meteors Section is diffuse, luminous objects; phenomena which possess angular velocities similar to those of meteors, but which appear much larger than the normal streak associated with most meteoric phenomena.

The author reports on personal sightings of these objects and his resulting investigation into their possible source.

Diffuse luminous objects moving at angular velocities similar to those of meteors were observed during over 200 hours of meteor watching in 1991. They fell in three broad categories; arcs, patches, and "meteors" similar in appearance to comet comas. [1] Though I at first dismissed the possibility of their being related to meteors, I reconsidered this relation after eliminating other possible causes such as reflections from aircraft lights and tricks of vision. Their meteor-like behavior suggested that perhaps these events might be caused by clouds of exceedingly small meteoroids, visible only because of their numbers and compact grouping. [2] Because such a formation would be unlikely to be maintained long in space, it appeared necessary that the particles involved must have maintained some weak physical contact until just prior to becoming visible. Perhaps some type of "cosmic dust bunny," disrupted by air resistance, might be the cause of these events.

This idea remained conjectural, and was not followed up with recorded observations, until I recalled and reread an article in *Sky & Telescope* [3] regarding the theory, proposed by Louis A. Frank (University of Iowa), that the Earth might be under bombardment by vapor-cloud remnants of very small comets, disrupted by gravitational stresses just prior to striking our atmosphere. This theory was suggested by satellite observations of upper atmosphere ultraviolet emissions in which transient "holes" of the order of 50 km in diameter appeared. It was proposed that these "holes" are due to absorption of the ultraviolet emissions by water vapor in comet cloud remnants positioned between the satellite and the emitting region of the atmosphere.

Considering the possibility that the luminous events might be due to dust released from such bodies, I began recording them and also contacted Dr. Frank. He encouraged continued observations and asked to be kept informed, as the sightings could be important. We agreed that additional observations from more observers would be beneficial in terms of information and credibility.

One of the research papers that I received from Dr. Frank concerned "anomalous optical images" acquired by a sounding rocket involved in an unrelated experiment. [4] These images, from sources at apparent altitudes between 31 and 179 km, resemble events that I have recorded visually. Their photometric and very-low frequency radio signatures could also be due to infalling clouds of meteoritic particles. Experiments to date in simulating the effects of the proposed remnants, and in imaging the parent bodies prior to disruption, have lent support to the theory. Among other proposed experiments is one designed to detect the impact of such bodies on the night side of the Moon.

Persons interested in the visual observing project may send reports of diffuse objects to the A.L.P.O. Meteors Section Recorder. The reports should be kept separate from "normal" meteor reports. Include as much information as is prudently possible regarding shape, dimension in degrees, angular velocity, position, direction, and so forth. Also report the beginning and ending times of all observing sessions, even when nothing is seen, so that the rate of such events can be determined. Brightness estimates are difficult because these are extended objects. I simply estimate that a given object has the same "visual impact" as a meteor of "x" magnitude. For the present, please categorize events by the following provisional classifications:

I. *Arc Segments or Bars*. These have varying degrees of curvature; they may be uniformly bright or contain knots of greater luminosity; they vary from roughly 4° to 30° in length and 0°.25 to 2° in thickness.

II. *Others*. Any other diffuse shape, usually circular or oval, from 0°.5 to 4° in diameter.

III. *Intermediate-Class Objects*. These objects are from approximately 0°.1 to 0°.5 in diameter and resemble "fuzzy" meteors (see [1]). The "meteor" itself, but not its train, if any, has the appearance of a comet's coma (with or without a nucleus).

Detection rates thus far have been approximately 1 event per 5 hours, with increased activity noted in early February and again on April 1st, 1992, when rates increased to 1 event per hour.

I will be happy to send copies of the research papers upon request.

FOOTNOTES

1. Report in *Meteor News*, No. 96 (Jan., 1992), p. 8 (courtesy of C. Smith from *Journal of Rad. and Nuc. Chemistry, 114*, No. 2, pp. 345-349) of the fall of a 60-cm ice meteor near Wuxi, China on April 11, 1983. It was said of this object that "some chemical concentrations are similar to Type L chondrites."
2. A possibly related event, though consisting of coarser and fewer particles than is assumed herein, was reported in *J.A.L.P.O.*, *36*, No. 1 (March, 1992), p. 16 ("Meteors Section News"). John King of Honolulu, Hawaii reported a "swarm of meteors," 12 to 15 in number, ". . at the limit of visibility and . . running parallel . . in a band 1.5 to 2 degrees wide . . and 2 to 3 degrees in length."
3. Washburn, Mark. "The Waters Above, the Storm Below." *Sky & Telescope, 76*, No. 6 (Dec., 1988), pp. 628-630.
4. Ya Qi Li *et al.* "Anomalous Optical Events Detected by Rocket-Borne Sensor in the WIPP Campaign." *J. Geophys. Res., 96*, No. A2 (Feb. 1, 1991), pp. 1315-1326.

METEORS SECTION NEWS

By: Robert D. Lunsford, A.L.P.O. Meteors Recorder

Table 1. Recent A.L.P.O. Meteor Observations.

UT Date	Observer and Location	Universal Time	Number and Type of Meteors Seen*	Comments* (+N = Limiting Magnitude)
1991				
AUG 05	Carl Hergenrother, NJ	07:45-08:30	3 PER, 3 SPO	+4.8
06	" " "	07:10-08:00	2 PER, 13 SPO	+5.4
08	" " "	06:15-07:00	1 PER, 5 SPO	+5.3
	" " "	07:10-08:00	9 PER, 15 SPO	+5.3
11	" " "	07:30-08:15	8 PER, 5 SPO	+5.4
DEC 15	Robert Hays, IL	05:50-06:50	24 GEM, 1 ORS, 6 SPO	+5.9
	" " "	06:50-07:50	14 GEM, 1 HYD, 6 SPO	+6.0
1992				
JAN 04	Michael Morrow, HI	08:00-12:00	5 SPO	+5.0; 65% cloudy
	John King, HI	08:10-12:00	3 SPO	+5.3; 80% cloudy
FEB 09	Michael Morrow, HI	09:00-11:30	5 SPO	+5.2; 10% cloudy
	Phyllis Eide, HI	09:30-11:30	3 SPO	+5.0; 10% cloudy
16	John King, HI	09:00-11:00	*None Seen*	+5.0; 90% cloudy
23	Michael Morrow, HI	05:30-10:00	1 SPO	+5.0; 50% cloudy
	Phyllis Eide, HI	06:12-08:00	1 SPO	+5.0; 50% cloudy
26	Phyllis Eide, HI	06:00-07:00	1 SPO	+4.5; 50% cloudy
	Michael Morrow, HI	06:00-07:00	1 SLE	+5.0; 60% cloudy
29	Phyllis Eide, HI	09:30-11:00	1 SPO	+4.8; 75% cloudy
	Michael Morrow, HI	09:30-11:00	1 VIR	+5.0; 60% cloudy
MAR 01	Phyllis Eide, HI	07:00-10:00	3 SPO	+4.5; 50% cloudy
	John King, HI	07:00-10:00	*None Seen*	+5.3; 60% cloudy
	Michael Morrow, HI	07:00-10:00	*None Seen*	+5.0; 50% cloudy
07	Michael Morrow, HI	06:30-08:30	2 VIR, 6 SPO	+4.8; 20% cloudy
	Phyllis Eide, HI	06:45-08:30	2 SPO	+5.0
08	Phyllis Eide, HI	08:15-11:30	11 SPO	+6.0
APR 01	John Gallagher, NJ	05:30-08:13	11 SPO	+7.0
03	" " "	07:35-08:40	3 SPO	+6.4; 10% cloudy
04	George Zay, CA	03:08-04:56	1 VIR, 6 SPO	+5.8
	Phyllis Eide, HI	09:30-11:30	2 SPO	+5.0; 20% cloudy
	Michael Morrow, HI	09:30-11:30	5 SPO	+5.0; 20% cloudy
05	Michael Morrow, HI	08:15-11:30	4 SPO	+6.0; 10% cloudy
	Phyllis Eide, HI	09:00-11:30	4 SPO	+5.8; 10% cloudy

Table 1 continued on pp.117-118 with notes on p. 118

Table 1—*Continued.*

1992 UT Date	Observer and Location	Universal Time	Number and Type of Meteors Seen*	Comments* (+N = Limiting Magnitude)
APR 06	John Gallagher, NJ	05:00-06:34	2 VIR, 3 SPO	+6.4
08	" " "	04:45-06:55	1 KSE, 2 VIR, 1 CAM	+7.3
	George Zay, CA	05:15-12:24	2 VIR, 29 SPO	+5.7
	Robert Lunsford, CA	08:47-11:47	2 KSE, 1 MVI, 22 SPO	+6.3
09	George Zay, CA	06:38-12:18	30 SPO	+5.9
13	John Gallagher, NJ	05:05-07:07	1 VIR	+5.6
15	" " "	01:05-02:08	1 DDR, 3 SPO	+5.9
	Leonard, Tomko, PA	02:22-03:45	3 VIR	+5.3; 10% cloudy
19	George Zay, CA	03:25-05:20	1 VIR, 1 ABO, 7 SPO	+5.5
21	" " "	03:25-12:02	7 LYR, 1 ABO, 16 SPO	+5.4
	Phyllis Eide, HI	07:15-10:00	*None Seen*	+4.8; 50% cloudy
	Michael Morrow, HI	07:15-10:00	1 SPO	+4.8; 50% cloudy
	Robert Lunsford, CA	08:17-12:17	8 LYR, 2 SPO	+5.7; 20% cloudy
22	George Zay, CA	03:30-12:00	7 LYR, 2 ABO, 16 SPO	+5.5
	Phyllis Eide, HI	05:45-09:00	2 SPO	+5.0; 15% cloudy
	Michael Morrow, HI	05:45-09:00	1 PPU, 1 VIR, 4 SPO	+4.9; 15% cloudy
	Robert Lunsford, CA	09:00-12:00	5 LYR, 8 SPO	+5.6; 15% cloudy
23	John Gallagher, NJ	05:40-07:43	1 ABO, 1 SPO	+5.3
	George Gliba, MD	05:45-06:50	3 LYR, 1 VIR, 2 SPO	+5.1
24	John Gallagher, NJ	02:25-04:28	2 SPO	+6.6; 10% cloudy
28	" " "	03:35-06:40	1 ASC, 2 SPO	+6.5; 40% cloudy
	George Zay, CA	04:07-08:57	1 SAG, 16 SPO	+5.9
29	Robert Lunsford, CA	09:00-12:00	1 ASC, 3 ETA, 23 SPO	+6.8
30	Leonard Tomko, PA	02:00-03:50	*None Seen*	+5.3; 10% cloudy
	John Gallagher, NJ	05:20-06:22	1 SPO	+6.4
MAY 02	George Zay, CA	03:40-12:00	3 VIR, 2 ABO, 1 SAG, 6 ETA, 20 SPO	+5.9
03	" " "	08:15-11:50	7 ETA, 1 SAG, 3 SPO	+6.0
	Phyllis Eide, HI	09:30-12:15	3 SPO	+5.0; 25% cloudy
	Michael Morrow, HI	09:30-12:15	1 SPO	+5.0; 30% cloudy
04	George Zay, CA	05:15-12:00	11 ETA, 1 VIR, 4 ABO, 1 SAG, 11 SPO	+5.7
	George Gliba, MD	08:22-09:22	3 ETA, 2 SPO	+5.2
	Phyllis Eide, HI	09:30-11:30	4 SPO	+5.0; 25% cloudy
	Michael Morrow, HI	09:30-11:30	2 SPO	+5.0; 25% cloudy
05	Robert Hays, IL	08:00-09:00	4 ETA, 9 SPO	+6.5
	" " "	09:00-10:00	5 ETA, 7 SPO	+6.4
	Robert Lunsford, CA	09:00-12:00	*None Seen*	+6.5; 90% cloudy
06	John Gallagher, NJ	07:15-08:52	3 ETA, 1 MVI, 1 FBO, 2 SPO	+6.2
07	" " "	04:30-05:33	1 SPO	+5.3; 50% cloudy
	Robert Hays, IL	08:00-09:00	6 ETA, 8 SPO	+6.5
	" " "	09:00-10:00	8 ETA, 4 SPO	+6.4
11	John Gallagher, NJ	05:05-06:37	1 SPO	+5.0
12	" " "	05:00-06:36	1 FBO, 6 SPO	+6.0
13	Robert Lunsford, CA	08:00-12:00	1 SOP, 7 ETA, 1 GCA, 1 NOP, 1 ASC, 25 SPO	+5.7
	George Zay, CA	08:21-11:52	4 SOP, 1 NOP, 6 ETA, 11 SPO	+5.5
20	John Gallagher, NJ	04:20-07:29	1 SOP, 8 SPO	+5.8
21	" " "	04:30-06:36	1 SOP, 1 CSC, 4 SPO	+5.8
23	" " "	05:10-07:19	1 SOP, 1 ASC, 9 SPO	+6.8
24	George Zay, CA	04:39-07:00	1 SOP, 7 SPO	+5.8
26	Robert Lunsford, CA	08:15-11:45	1 ASC, 15 SPO	+5.9
27	" " "	09:47-11:47	9 SPO	+6.4
	George Zay, CA	10:00-11:39	1 OSC, 5 SPO	+5.4

Table 1 continued on p. 118 with note

Table 1—*Continued.*

1992 UT Date	Observer and Location	Universal Time	Number and Type of Meteors Seen*	Comments* (+N = Limiting Magnitude)
MAY 28	John Gallagher, NJ	04:25-06:35	1 SOP, 7 SPO	+6.6
	George Zay, CA	04:46-11:33	3 ASC, 3 CSC, 1 OSC	+5.7
29	John Gallagher, NJ	04:00-06:06	1 THE, 6 SPO	+6.7
30	J. Kenneth Eakins, CA	07:15-09:15	4 THE, 1 SPO	+5.4
31	" " " "	07:15-08:15	*None Seen*	+5.3
JUN 01	" " " "	07:45-08:40	2 SPO	+5.4
02	George Zay, CA	06:00-10:01	1 ASC, 1 GSA, 1 OSC, 14 SPO	+5.8
	J. Kenneth Eakins, CA	07:40-08:40	1 SPO	+5.3
	Robert Lunsford, CA	08:47-11:47	1 OPH, 1 ASC, 1 ISC, 29 SPO	+6.7
03	Leonard Tomko, PA	02:22-04:10	5 SPO	+5.7; 5% cloudy
	John Gallagher, NJ	03:30-06:07	5 SPO	+6.1
04	" " "	04:30-06:38	2 JLY, 1 GSA, 4 SPO	+6.1
06	Michael Morrow, HI	09:45-11:30	4 SPO	+5.2, 40% cloudy
	Phyllis Eide, HI	10:00-11:20	1 SPO	+5.0, 35% cloudy
07	George Zay, CA	04:25-11:08	4 TOP, 1 GSA, 2 CSC, 1 OSC, 26 SPO	+6.0
	John Gallagher, NJ	05:10-06:12	1 ASC, 2 SPO	+4.5
	Phyllis Eide, HI	09:30-11:30	2 SPO	+4.5; 20% cloudy
	Michael Morrow, HI	09:30-11:30	3 SPO	+5.1; 20% cloudy
09	George Zay, CA	06:48-11:37	1 TOP, 1 OSC, 19 SPO	+5.8
	Robert Lunsford, CA	07:47-11:47	1 TOP, 1 SAG, 1 THE, 1 SCU, 24 SPO	+6.3
10	John Gallagher, NJ	04:05-07:15	1 JLY, 5 SPO	+6.8; 5% cloudy
	Robert Lunsford, CA	08:47-11:47	2 ISC, 1 CSC, 1 SCU, 1 GSA, 1 OSC, 22 SPO	+6.7
	George Zay, CA	08:56-11:37	1 OSC, 1 LSA, 21 SPO	+5.9
11	John Gallagher, NJ	04:25-06:34	1 GSA, 1 THE, 1 CSC, 7 SPO	+6.3
13	" " "	05:20-08:01	1 JLY, 6 SPO	+6.0
15	" " "	03:55-05:45	3 SPO	+5.8
16	" " "	04:45-08:08	2 JLY	+4.4
17	" " "	02:45-06:05	1 JLY, 6 SPO	+5.8; 20% cloudy
18	" " "	05:15-06:48	3 SPO	+6.5; 10% cloudy
20	George Zay, CA	04:05-07:00	1 TOP, 9 SPO	+5.6
21	John Gallagher, NJ	03:30-07:44	1 TOP, 1 CSC, 4 JLY, 10 SPO	+6.3
22	" " "	03:35-07:11	2 SPO	+6.7
	Robert Lunsford, CA	11:00-12:00	*None Seen*	+4.8; 50% cloudy
23	John Gallagher, NJ	04:20-07:01	1 JLY, 10 SPO	+6.8; 30% cloudy
	Robert Lunsford, CA	08:48-09:48	*None Seen*	+5.2; 50% cloudy
24	" " "	08:48-11:48	*None Seen*	+5.1; 50% cloudy
25	" " "	03:30-04:30	*None Seen*	+5.3
26	John Gallagher, NJ	05:20-06:23	3 SPO	+6.4
28	George Gliba, PA	04:00-04:30	2 CRV, 1 JBO, 2 SPO	+6.0
	John Gallagher, NJ	05:00-07:41	1 JLY, 11 SPO	+7.0
	George Gliba, PA	05:45-06:45	1 SCU, 8 SPO	+6.0
29	John Gallagher, NJ	04:40-06:16	2 JLY, 7 SPO	+7.1
	Robert Lunsford, CA	08:32-12:10	1 SCU, 1 RSA, 3 LSA, 19 SPO	+5.6
30	George Zay, CA	05:34-11:36	3 TOP, 27 SPO	+5.9
	Robert Lunsford, CA	08:47-11:47	2 SCU, 1 CET, 1 LSA, 24 SPO	+6.8

***Key to Abbreviations:** **ABO** = Alpha Bootid, **ASC** = Alpha Scorpiid, **CAM** = Camelopardalid, **CET** = Tau Cetid, **CRV** = Corvid, **CSC** = Chi Scorpiid, **DDR** = Delta Draconid, **ETA** = Eta Aquarid, **FBO** = Phi Bootid, **GCA** = Gamma Capricornid, **GEM** = Geminid, **GSA** = Gamma Sagittarid, **HYD** = Sigma Hydrid, **ISC** = Iota Scorpid, **JBO** = June Bootid, **JLY** = June Lyrid, **KSE** = Kappa Serpentid, **LSA** = Lambda Sagittarid, **LYR** = Lyrid, **MVI** = Mu Virginid, **NOP** = N. Ophiuchid, **OPH** = Ophiuchid, **ORS** = S. Chi Orionid, **OSC** = Omega Scorpiid, **PER** = Perseid, **PPU** = Pi Puppid, **RSA** = Rho Sagittarid, **SAG** = Sagittarid, **SCU** = June Scutid, **SLE** = Sigma Leonid, **SOP** = S. Ophiuchid, **SPO** = Sporadic, **THE** = Tau Herculid, **TOP** = Theta Ophiuchid, **VIR** = Virginid.

AN UNDERSTUDIED CRATER IN NEVADA

By: Harry D. Jamieson

ABSTRACT

This article reports on a visit to a little-known possible meteorite crater in Nye County, Nevada on July 11, 1992, and is accompanied by photographs of the feature.

Early this summer, John E. Westfall accidentally came across a topographic quadrangle map of part of Nye County, Nevada enticingly titled "Meteorite Crater". [1; a section of the map is reproduced below in *Figure 24*] A search of the geological literature yielded only one further reference to this feature. [2] It is surprising that this feature has received so little study or notice.

Apparently discovered in the early 1920's by Ralph Irwin of Duckwater, Nevada, studies of this crater (which I shall now call *Irwin Crater*) have not revealed its origin. At John Westfall's suggestion, I visited this feature on July 11, 1992, while enroute to Cosmocon'92.

Irwin Crater lies on a gentle alluvial slope with the Railroad Valley to its east and the Pancake Range to its west, at coordinates 115° 40' 32" W, 38° 43' 16" N (ECN coordinates +1157,387). The depression is 225 feet (69 m) wide and 10-15 feet (3-5 m) deep. It is circular except where the western (uphill) rim has been eroded away. Runoff from a gully terminating there has deposited at least 25 feet (8 m) of spongy sediment upon the floor of the crater, making any search for possible meteoritic material difficult. The rim is not raised above the outside terrain; and the crater's interior has about the same coloring and sagebrush vegetation as its surroundings, making the crater difficult to see from a distance (*Figure 26*, p. 120).

A hole in the center of the crater, dug by Mr. Irwin and his brother some 70 years ago, is still there, complete with fragments of the ladder that they—or someone—used to get to the bottom in order to search for meteorite fragments (*Figure 27*, p. 120). None were ever found. Later attempts to find fragments with World War-II mine detectors and Alnico magnets were also fruitless. However, the authors of Reference [2] are certain that this feature is not a volcanic crater or caldera, as there is no evidence of thermal action or a runoff channel. Perhaps the crater was formed by the impact of a non-metallic object, such as a tiny ball of ice and rock (a mini-comet?), which would not leave many fragments. Clearly, more study of this feature is needed.

Persons interested in visiting Irwin Crater will find it along a little-traveled dirt road some 11 miles (18 km) west of Currant, Nevada, at the junction of U.S. Highway 6 and State Route 379. Go west from Currant on U.S. 6 to a point about 100 feet (30 m) east of mile marker 103 (known locally as "the second curve"). From there, follow a dirt road northwest for about 2.75 miles (4.4 km), where you will come to a place where the road splits in several directions. Go north-northeast about 7 miles (11 km) until you reach the east-west road that runs by the crater. At this point, go about 3,300 feet (1000 m) west.

These dirt roads have a high crown and pot-holes in places; and I recommend the use of an off-road vehicle, although I got in and out with my Mazda 323. The short east-west road that runs by the crater is not easily seen from the north-south road because of a high shoulder, which is another reason to use a vehicle that places you high above the road, and I drove past it the first time. *Figure 25* (p. 120) shows a view of the Pancake Range to the magnetic west of the final intersection, and should be helpful in finding the turnoff. [Magnetic west is approximately 14°.5 north of true west at this location. Ed.] I also recommend being prepared for desert conditions in case you have car trouble. The area has no nearby

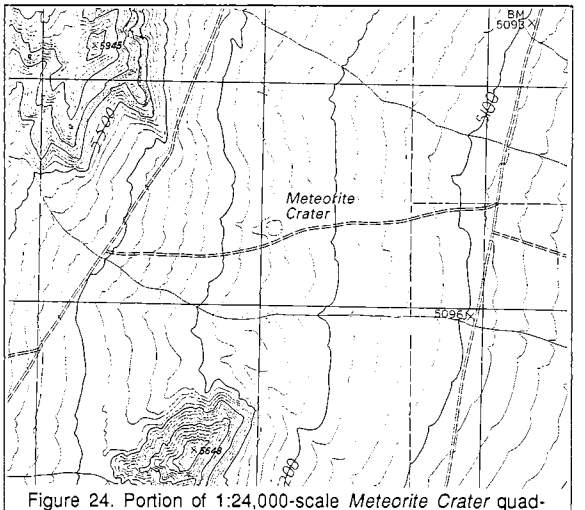


Figure 24. Portion of 1:24,000-scale *Meteorite Crater* quadrangle. [1] Located in Nye County, Nevada. Contour interval 20 feet (6.2 m), with elevations in feet above mean sea level. Reduced to about 70 percent of the original scale, this reproduction's scale is indicated by the square grid lines, spaced 1000 meters apart. North at top.

homes and is not often visited; mine were the only tire tracks visible at the crater. You will find the people at MaxOil, located near mile marker 104 on U.S. 6, to be very nice about giving directions and agreeing to send help if you do not return after a specified period of time. When asking for directions locally, remember that the local people call the feature "the meteor crater," rather than "Irwin Crater" as I have done here. Also, some of them may mistakenly try to guide you to a nearby volcanic crater called "Lunar Crater," which is some miles farther west on U.S. 6. In addition to the people at MaxOil, the owner of the bar and filling station in Currant is familiar with the crater and its location, and has a 3-dimensional topographical map of the area on a table for public viewing.

Those who wish more information about the Irwin Crater may write to me for a copy of Reference **[2]**; please include a stamped self-addressed envelope with your request.

REFERENCES

1. U.S. Geological Survey. *Meteorite Crater Quadrangle. Nevada—Nye Co. 7.5 Minute Series (Topographic).* Provisional Edition, 1990. Scale 1:24,000, contour interval 20 feet.
2. Rinehart, John S. & Elvey, C.T. "A Possible Meteorite Crater near Duckwater, Nye County, Nevada (ECN = +1157,387)." *Popular Astronomy, 58*, No. 4 (April, 1951), pp. 209-211.

Figure 25. Looking to the magnetic west toward Irwin Crater from the N-S road, showing the E-W road leading to the crater. The crater itself is about 1000 m (0.6 mi) away and not visible from this distance. The Pancake Range forms the skyline. All photographs by author.

Figure 26. Looking approximately north from the south rim of Irwin Crater, which extends to the left. The crater is approximately 5,250 feet (1600 m) above sea level; the unnamed triangular peak left of center is about 1.9 mi (3.1 km) north and 5942 feet (1811 m) above sea level.

Figure 27. Excavation in the floor of Irwin Crater, showing remnants of ladder

COMET CORNER

By: Don E. Machholz, A.L.P.O. Comets Recorder

COMET FINDS FOR THE FIRST HALF OF 1992

Comet Helin-Alu (1992a).—E. Helin and J. Alu reported this discovery on a photograph taken by them and K. Lawrence on 1992 JAN 09, using the 46-cm (18-in) Schmidt at Palomar Mountain. When discovered, the comet was a 16th-magnitude object in the constellation Hydra, 20° south of the Beehive Cluster, M44. The comet did not get much brighter. On 1992 JUL 08 this object was closest to the Sun, at a distance of 3.0 AU. [1 AU, or *astronomical unit*, is the mean distance of the Earth from the Sun, or 149,597,870 km. Ed.]

Comet Bradfield (1992b).—William Bradfield of Australia found this, his 15th comet, on 1992 JAN 31. He was then using his 15-cm (6-in) f/5.5 refractor at 26×. This find came after 299 hours of comet seeking since his last previous find three years earlier.

At discovery, the comet was in the constellation Scorpius, at magnitude +10. When he first found the comet, a lack of good alignment with field stars prevented Bradfield from determining the direction and amount of motion. The next morning was cloudy, but Bradfield finally confirmed the comet's existence and motion by observing through a hole in the clouds. The comet was headed toward a perihelion on 1992 MAR 19, with a solar distance of 0.50 AU. However, instead of brightening, the comet held steady in brightness, and then dimmed so that by early March it was barely visible on long-exposure photographs.

Periodic Comet Howell (1992c).—S. Larson and A.L.P.O. Assistant Comets Recorder Jim Scotti recovered this comet on CCD images obtained on 1992 MAR 05 with the Steward Observatory's 2.3-m (91-in) reflector when the comet was at magnitude +21. This comet will be closest to the Sun in late February, 1993, at a solar distance of 1.41 AU. It should reach magnitude +12 by then.

Comet Tanaka-Machholz (1992d).—This comet was first observed visually by Zenichi Tanaka of Japan, on 1992 MAR 24. He also photographed it, which appeared to indicate a motion of 4° per day. The reported rapid motion and cloudy weather prevented the Tokyo Observatory from confirming the comet. Then, one week later the writer picked up an object 8° away from Tanaka's discovery position, with motion in a direction similar to that he reported, but moving at only 1° per day. It now appears that this was Tanaka's object, with his earlier reported motion in error. Tanaka had used a 20-cm (8-in) reflector at 40× with a 1°.5 field and had been searching the morning sky in strong moonlight. He had searched for 244 hours for this, his first discovery. The writer had used a homemade 12-cm (4.7-in) refractor at 20.5× with a 3°.0 field, having searched for 760 hours since his last previous find in August, 1988. At discovery, this comet's magnitude was +10.

Comet Tanaka-Machholz was closest to the Sun at 1.26 AU on 1992 APR 22. It continued to move NE, through Andromeda and Cassiopeia. An outburst on 1992 MAY 12 brightened it to magnitude +7. After this, it swung under the North Celestial Pole, dimming until it was lost in the evening twilight in mid-July. This comet is not expected to become visible again.

Periodic Comet Singer-Brewster (1992e).—Jim Scotti recovered this comet from Kitt Peak on 1992 APR 01 when it was at magnitude +20. It will be closest to the Sun on 1992 OCT 27 at 2.03 AU and should not get much brighter.

Periodic Comet Shoemaker-Levy 8 (1992f).—Carolyn and Eugene Shoemaker and David Levy discovered this comet with the 46-cm (18-in) Schmidt at Palomar Mountain on 1992 APR 05. It was magnitude +17 at discovery, but it will not get much brighter since its 7.5-year orbit is now carrying it away from the Sun after its 1992 JUN 19 perihelion of 2.7 AU.

Periodic Comet Mueller (1992g).—Jean Mueller discovered this comet on plates taken for the Palomar Sky Survey II. Found on 1992 APR 09, the comet was then just past perihelion (2.6 AU) on its 9-year orbit. It was never brighter than magnitude +17.

Comet Spacewatch (1992h).—D. Rabinowitz used moving-object detection software and the 1.1-m (43-in) Spacewatch Telescope at Kitt Peak to pick up this comet on 1992 MAY 01. The orbital calculations indicate that this comet will be closest to the Sun on 1993 SEP 08, when it might reach magnitude +12.

Comet Bradfield (1992i).—William Bradfield discovered this comet on 1992 MAY 03, when it was in the morning sky in the constellation Cetus at magnitude +10. Bradfield was again using his 15-cm (6-in) refractor. This find came after 30.3 hours of searching since his discovery of 1992b three months before.

The ephemeris indicated that this comet would be closest to the Sun, at 0.59 AU, on 1992 MAY 25. However, it did not brighten as expected and was not well observed after the month of May.

Periodic Comet Ashbrook-Jackson (1992j).—Alan Gilmore and Pam Kilmartin recovered this comet on 1992 MAY 04, more than one year before its perihelion. They used the 60-cm (24-in) reflector at Mt. John Observatory in New Zealand. The comet was then at magnitude +19, but may reach magnitude +12 by Summer, 1993.

PRESENT COMET ACTIVITY

Excluding near-future discoveries, few comets should be visible in the latter part of 1992. Nonetheless, at least two comets should be present. Please send your observations to the writer (address on inside back cover).

Periodic Comet Schwassmann-Wachmann 1.—This comet is in a nearly-circular orbit at about 5 AU from the Sun. It is normally quite faint, but will occasionally outburst to magnitude +11 or +12. You may wish to monitor this comet. (See *Table 1*, below and top right column.)

Periodic Comet Schaumasse.—This comet, first found in 1911, has an 8-year orbital period. It will be closest to the Sun on 1993 MAR 04 at 1.2 AU, but its brightness is difficult to predict. Its ephemeris is given on *Table 2* (to right); during the first few months of the ephemeris this comet will probably be brighter than predicted. Note that in February, 1993, it will be within 0.6 AU of the Earth.

[Note by Editor: Comet P/Swift-Tuttle has been recovered. For information see the announcement on page 140 of this issue.]

EPHEMERIDES

Notes: In the "Elongation. from Sun" column, E refers to visibility in the evening sky, and M to morning visibility. "Total Mag." values are forecasts of visual total magnitudes and are subject to considerable uncertainty.

Table 1. Ephemeris of Periodic Comet Schwassmann-Wachmann 1.

1992 UT Date (0h UT)	2000.0 Coörd. R.A. h m	Decl. ° '	Elongation from Sun °		Total Mag.
OCT 05	05 54.4	+31 25	103	M	+17.6
10	05 54.6	+31 29	108	M	+17.5
15	05 55.0	+31 34	113	M	+17.5
20	05 54.8	+31 38	118	M	+17.4
25	05 54.2	+31 42	122	M	+17.4
30	05 53.4	+31 45	128	M	+17.4
NOV 04	05 52.2	+31 48	133	M	+17.4
09	05 50.7	+31 51	138	M	+17.3
14	05 48.9	+31 53	144	M	+17.3
19	05 46.9	+31 54	149	M	+17.3
24	05 44.6	+31 55	154	M	+17.3
29	05 42.1	+31 54	159	M	+17.3
DEC 04	05 39.5	+31 53	164	M	+17.3
09	05 36.8	+31 50	169	M	+17.3
14	05 34.0	+31 47	171	M	+17.3
19	05 31.2	+31 42	171	E	+17.3
24	05 28.4	+31 37	168	E	+17.3
29	05 25.8	+31 30	163	E	+17.3
1993					
JAN 03	05 23.2	+31 23	158	E	+17.3
08	05 20.9	+31 15	153	E	+17.3
13	05 18.8	+31 07	147	E	+17.3
18	05 16.9	+30 59	142	E	+17.4
23	05 15.3	+30 50	137	E	+17.4

(continued on top of right column)

Ephemeris of Periodic Comet Schwassmann-Wachmann 1—Continued.

1993 UT Date (0h UT)	2000.0 Coörd. R.A. h m	Decl. ° '	Elongation from Sun °		Total Mag.
JAN 28	05 14.0	+30 41	131	E	+17.4
FEB 02	05 13.0	+30 32	126	E	+17.4
07	05 12.4	+30 23	121	E	+17.5
12	05 12.0	+30 14	116	E	+17.5
17	05 12.0	+30 06	111	E	+17.5
22	05 12.4	+29 58	106	E	+17.6
27	05 13.0	+29 51	101	E	+17.6

Table 2. Ephemeris of Periodic Comet Schaumasse.

1992 UT Date (0h UT)	2000.0 Coörd. R.A. h m	Decl. ° '	Elongation from Sun °		Total Mag.
OCT 05	04 31.9	+11 14	123	M	+17.8
10	04 34.6	+11 17	128	M	+17.4
15	04 36.7	+11 21	132	M	+17.0
20	04 38.2	+11 25	136	M	+16.6
25	04 38.9	+11 31	141	M	+16.1
30	04 38.7	+11 39	146	M	+15.7
NOV 04	04 37.7	+11 50	151	M	+15.3
09	04 35.7	+12 04	156	M	+14.9
14	04 32.7	+12 23	161	M	+14.4
19	04 28.7	+12 48	166	M	+14.0
24	04 23.8	+13 19	171	M	+13.5
29	04 18.1	+13 57	172	E	+13.1
DEC 04	04 11.7	+14 43	169	E	+12.7
09	04 04.8	+15 37	164	E	+12.3
14	03 57.8	+16 40	158	E	+11.9
19	03 50.9	+17 50	152	E	+11.5
24	03 44.6	+19 11	146	E	+11.1
29	03 39.1	+20 38	140	E	+10.7
1993					
JAN 03	03 34.9	+22 12	134	E	+10.4
08	03 32.0	+23 53	129	E	+10.1
13	03 30.8	+25 39	124	E	+9.8
18	03 31.4	+27 31	119	E	+9.5
23	03 33.9	+29 28	115	E	+9.2
28	03 38.5	+31 29	111	E	+9.0
FEB 02	03 45.3	+33 32	108	E	+8.8
07	03 54.3	+35 37	105	E	+8.6
12	04 05.6	+37 42	103	E	+8.4
17	04 19.6	+39 44	101	E	+8.3
22	04 36.6	+41 40	100	E	+8.2
27	04 55.4	+43 27	098	E	+8.1

Those wishing to compute their own ephemerides for these two comets may use these orbital elements.

Value	Comet S-W 1	Comet Schaumasse
T	1989 OCT 26.7	1993 MAR 04.1
q (AU)	5.7718	1.2022
ϖ	049°.897	057°.451
Ω	312°.123	080°.386
i	009°.367	011°.846
e	0.04466	0.70487
Epoch	1950.0	2000.0

LUNAR DOME CATALOG (APRIL 30, 1992 EDITION)

By: Harry D. Jamieson, A.L.P.O. Lunar Dome Recorder (1992-), and James H. Phillips, A.L.P.O. Lunar Dome Recorder (1986-1992).

Note by Editor: As announced in our March, 1992, issue (p. 45), James H. Phillips has resigned as Lunar Dome Recorder, and has been replaced by Harry D. Jamieson. Dr. Phillips has been kind enough to provide the introduction below (referring to the Dome Catalog as he left it). Mr. Jamieson has subsequently revised the catalog, however; and his version is the one given below. Our readers should realize that such a catalog is never complete, and is constantly being revised. Many questions remain to be answered. Also, the following catalog is highly abbreviated in order to fit this Journal, although I have tried to explain terms and abbreviations at the end.

INTRODUCTION
(by James H. Phillips)

After a lapse of several years, the present Lunar Dome Survey was reactivated in 1986. Our initial goals were to compile a catalog based on data from the original survey, which had been headed by Harry Jamieson. In addition, the objects were plotted on lunar quadrant maps in order to aid observers in identifying the domes. The following catalog was the results of the efforts of all who participated in the present survey to this point [with subsequent revisons and additions by the present Recorder. Ed.]. Additional information on objects was also obtained and was added to the catalog. As can be seen, a great deal of data have been compiled on individual domes. However, a great deal more needs to be done. Harry Jamieson, an original Recorder of the A.L.P.O. Lunar Dome Survey, has now again taken over as Recorder. I am grateful to all who have participated in the Survey up to this time, and particularly for all the help received from Harry Jamieson and John Westfall. The Lunar Dome Survey is a very worthwhile project for interested amateurs and I urge all those interested in this project to contact Harry Jamieson (address on inside back cover).

The following individuals have contributed to the Survey, and I am grateful for all their help and support. (I have also given the nationalities of those who are not residents of the United States.)

José Aguirre (Spain)	Schuyler Allen
Kocsis Antal (Hungary)	Joe Caruso
Karl Fabia	Alika Herring
Harry Jamieson	Charles Kapral
Craig Macdougal	Rob Moseley (UK)
José Olivarez	Michael Porcellino
Za Pujic (Australia)	Robert Robinson
George Rosenberg	John Sabia
R. Turner (UK)	Ed Vinson
Ross Weyburg	John Westfall

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)

Xi	Eta	Feature Near	Observer/Date/Remarks
915	025	M Spumans	F-JEW 11/26/69 27km-JEW
904	025	M Spumans	F-JEW 11/26/69 35km-JEW
860	290	M Crisium	F-KJD 12/26/72 25km-KJD
856	290	M Crisium	F-KJD 12/26/72 35km-KJD
838	-035	Webb B	F-??? Part of a ridge-CLR.
822	-309	Vendelinus	F-KJD DW/2A/5F/0 5km, 51m-KJD
811	-315	Vendelinus	F-KJD Uncertain-KJD DW/2A?/5G/0
807	-310	Vendelinus	F-KJD DW/2A/5G/0 17km-KJD
795	-316	Petavius B	F-HDJ Seen-CLR. Nothing seen-KJD
791	-525	Adams	F-CLR Large Irreg. Complex
787	088	S of M Crisium	F-KJD
783	594	Gauss	F-HDJ
781	-242	Crozier	KHS 66 F-1960
779	216	Lick	F-HDJ Suspected by CLR
779	211	Lick	F-HDJ Seen-CLR
779	-252	Crozier E	KHS 6 F-1960
777	-225	Crozier	F-CP
777	-238	Crozier	F-KJD 10km-KJD
777	-318	Petavius B	KHS 63 F-1960
776	217	Lick	F-HDJ Seen-CLR
775	605	In Gauss	F-HDJ A2-B
774	-348	Petavius B	KHS 5 F-1960
773	078	Taruntius	F-KJD
773	058	M Crisium	F-KJD 10/13/65 13km-KJD
773	-228	Crozier	F-CP 03/19/72
773	-232	Crozier	F-CP 03/19/72
773	-238	Crozier	F-HDJ 9km-CP Same as +777-238?
769	223	Lick	F-MWH 4km- HDJ
769	-168	Crozier	F-???
768	-237	Crozier	F-HDJ 14km- KJD DW/2A/6F/0 KJD
766	-348	Petavius B	KHS 54 F-1960
761	-305	Petavius B	F-HDJ Rümker-type cluster?
761	-312	Petavius B	KHS 55 F-1960
755	-074	Messier	F-HDJ
755	-164	Messier	F-HDJ 20km-CP Cntr. of region containing 4 suspected domes.
754	-047	Messier	F-MWHHigh w/sharp summit 5km-HDJ A5-D
747	026	Taruntius G	F-??? cf *JBAA* v.76#5 p. 326
745	265	O'Neil's Bridge	F-??? Dumbbell- shaped (2 domes?) 20km N-S-KJD
744	-172	Goclenius	F-HDJ 13km-HDJ 24km-KJD
737	-217	Bellot	F-KJD 4km-KJD (AKH +740 -215) A5-D DW/1A/5F/0
736	-085	Messier	F-HDJ 9.6km-HDJ Seen-MWH
734	-145	Messier	F-HDJ 14.3km-HDJ 12km-CP
732	-395	Biot	F-???
729	-172	M Fecunditatis	F-??? 24km
728	-060	Messier	F-HDJ Seen-MWH
728	-355	Biot	F-KJD 03/03/68 30km - Too steep for dome?-KJD LAC98

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)—*Continued.*

Xi	Eta	Feature Near	Observer/Date/Remarks
719	-190	Gutenberg	F-HDJ 15km-HDJ
710	015	Taruntius	F-HDJ Ridge? HDJ 15km-Flat Irreg.-CP
708	004	Messier	F-HDJ 15km-CP A5-D
703	-113	Gutenburg	F-??? 24km
698	-175	In Goclenius	F-KJD 33km-KJD
697	-075	Messier	F-HDJ 40km-HDJ 53km-CP 45km- KJD
680	-210	Magelhaens	F-KJD 18X12km-CP
670	571	Geminus	F-HDJ Seen-CLR
669	568	Geminus	F-HDJ Seen-CLR
667	-079	Gutenburg	F-MWH A5-D 9.5km-CP
640	-380	Santbech	F-HDJ A hill-KJD 5/24/66
622	350	Macrobius A	F-HDJ B3-A 3km
622	-156	Gutenburg	F-HDJ 6.2km-HDJ Seen-CLR (tentative)
622	-336	Santbech	F-HDJ cf. CLR Obs 12/27/65
620	009	Cauchy	F-HDJ
620	045	Cauchy	F-KJD 30km-KJD
619	-371	Santbech	F-HDJ Seen-KJD 5/24/66
618	-167	Gutenburg	F-??? 13km-HDJ 8km-KJD 41m- KJD
617	068	Cauchy	F-KJD Very doubtful-KJD 16km
616	-354	Santbech	F-HDJ Seen-CLR 9km
615	126	Cauchy	F-??? ABJC LAC-61 9.6km 413m- KJD
615	065	Cauchy	F-KJD 06/23/66 Ill-defined 25km-KJD Seen-JO
613	-344	Santbech	F-??? 4km
612	-358	Santbech	F-HDJ? Seen-CLR 9km
609	173	Cauchy	F-CLR?
609	-381	Santbech	F-HDJ 4km
608	-376	Santbech	F-???
606	146	Cauchy	F-KJD Seen-JEW
606	124	Cauchy	F-HDJ on B4-B Seen-MWH 11/22/71
603	-380	Santbech	F-??? 5.5km-HDJ ABJC
602	177	Cauchy	F-HDJ Part of ridge-CLR
600	055	Cauchy	F-KJD DU/2E/5F/0 8km-KJD
599	183	Cauchy	F-HDJ
599	-344	Santbech	F-HDJ Seen-CLR 5.3km
598	-389	Santbech	F-HDJ Seen-CLR 9.6km-HDJ
596	151	Cauchy	F-KJD LAC-61 Seen-CLR
595	055	Cauchy	F-KJD 30km Ill-defined-KJD
594	275	Maraldi	F-HDJ B3-A Small
593	360	Maraldi	F-HDJ B3-A 6.6km Oval
593	321	Maraldi	F-HDJ B3-A
593	319	Maraldi	F-HDJ B3-A
593	131	Cauchy	ABJC B4-B LAC-61 AIC-61D 10.3km DW/2A/6F/9MN 150m
592	103	Cauchy	F-MWH
588	324	Maraldi	F-KJD B3-A Shows possible junction of ridges-HDJ
586	364	Maraldi	F-HDJ B3-A 5km Slightly oval
584	107	Cauchy	F-MWH10km Round-HDJ
583	301	Maraldi	F-HDJ B3-A 7km Round
581	379	Römer	F-HDJ B3-A
574	327	Maraldi	F-HDJ B3-A
568	244	Maraldi D	ABJC 6.0km DW/2A/6F/0
567	269	Maraldi D	F-HDJ?
565	247	Maraldi	F-JEW on LAC-61 6km-JEW Seen-HDJ on B4-B
565	243	Maraldi	F-by JEW on LAC-61 Seen-HDJ on B4-B 5km-JEW
561	078	Maskelyne F	F-JO 11/11/72
557	113	Sinas	F-HDJ
556	042	Maskelyne F	F- KJD 4km Seen by JEW
553	255	Vitruvius	F-KJD
551	075	Maskelyne F	F-JO 11/11/72
550	248	Vitruvius	F-KJD
549	259	Vitruvius	F-KJD
548	185	Sinas	F-HDJ Seen-JEW & Kiplinger
545	252	Vitruvius	F-KJD
545	205	Sinas	F-CLR 12/27/65
544	567	Neander	F-HDJ?
540	245	Vitruvius	F-KJD
540	223	Jansen	KHS 51 F-1960
539	121	Sinas	KHS 34 F-1960
538	257	Maraldi	F-KJD
537	224	Jansen F	F-CLR 12/27/65
537	204	Sinas	ABJC 11km-KJD DW/2A/5F/0
537	117	Sinas	KHS 35 F-1960
536	183	Sinas	ABJC 7.5km DW/2A/6G/7J
534	288	Maraldi D	ABJC 60.9km 975m high (Ashbrook) DUW/4A/6I/7P8P9P
534	242	Maraldi	F-??? 6km
532	239	Lucian	KHS 52 F-1960
531	195	Sinas	F-CLR
530	135	Sinas	KHS 41 F-1960
529	292	Gardner	KHS 45 F-1960. Very large & mountainous.
529	237	Lucian	KHS 48 F-1960
528	152	Sinas	F-CLR Very low-only seen when right on terminator-CLR
528	121	Sinas	KHS 36 F-1960
526	144	Sinas	KHS 44 F-1960.
526	136	Sinas	KHS 42 F-1960
525	124	Sinas	KHS 38 F-1960
525	-336	Fracastorius	F-CLR?Large cinder heap-CLR
524	187	Maraldi	ABJC 8km DW/2A/6H/0-KJD
524	140	Sinas	KHS 43 F-1960
523	223	Jansen	KHS 46 F-1960. 38m-KS.
523	206	Sinas	ABJC DW/2C/6G/7P 15km- KJD
523	126	Sinas	KHS 39 F-1960
523	-334	Fracastorius	F-KJD? 21km DCW/1A/5A/0?-MWH
522	122	Sinas	F-HDJ Seen-CLR
521	237	Jansen	KHS 47 F-1960
520	240	Sinas	F-HDJ
520	-166	Isidorus	KHS 20 F-1960
520	-331	Fracastorius	KHS 32 F-1960
519	251	Maraldi	F-HDJ
519	186	Sinas	LAC-61 ABJC DW/2A/5F/0 7km
518	-326	Fracastorius	F-HDJ B6-B
517	247	Maraldi	F-HDJ
517	-379	Fracastorius	F-HDJ B6-B
516	131	Sinas	F-HDJ Seen-CLR, JEW
516	-154	Isidorus	KHS 21 F-1960
515	-330	Fracastorius	KHS 31 F-1960
514	-152	Isidorus	KHS 22 F-1960
511	231	Jansen	KHS 49 F-1960
511	075	Maskelyne	F-HDJ B4-D
510	224	Jansen	KHS 50 F-1960
510	200	Sinas	ABJC 6.8km DW/2A/6H/0
510	092	Maskelyne	F-HDJ
508	207	Maraldi	F-HDJ 4.8km
508	-330	Fracastorius	KHS 33 F-1960
507	184	Sinas	ABJC DW-/3B/5F/7M 10km-KJD
506	-380	Fracastorius	F-HDJ B6-B
503	203	Maraldi	F-HDJ 4.8km
503	-334	Fracastorius	F-HDJ
500	175	Sinas	F-Pither (BAA) Seen by KJD
500	112	Sinas	F-HDJ
500	105	Sinas	F-HDJ
499	172	Sinas	F-Pither (BAA)
499	-323	Fracastorius	KHS 29 F-1960
494	192	Sinas E	F-HDJ 5.5km
492	208	Jansen	F-HDJ B4-D
490	210	Jansen	F-HDJ B4-D
490	-103	Torricelli	KHS 24 F-1960
490	-111	Torricelli	KHS 23 F-1960
490	-160	Theophilus	KHS 17 F-1960
488	624	Maury	F-???
488	-338	Fracastorius	KHS 30 F-1960
486	623	Maury	F-???
486	-151	Theophilus	KHS 18 F-1960

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)—*Continued.*

Xi	Eta	Feature Near	Observer/Date/Remarks
480	-133	Theophilus	KHS 19 F-1960
478	229	Jansen	F-HDJ
475	578	L Somniorum	F-HDJ B2-A Small
475	284	Jansen	F-KJD
472	592	L Somniorum	F-HDJ B2-A Small
470	572	L Somniorum	F-HDJ B2-A Small
469	575	L Somniorum	F-HDJ B2-A Small
467	293	Jansen	F-KJD
467	286	Jansen	F-KJD
466	256	Jansen	F-KJD
465	225	Jansen	F-HDJ 6.2km
460	543	Posidonius	F-HDJ on B2-A Small
455	540	Posidonius	F-HDJ B2-A Small
453	281	Dawes C	F-HDJ on B3-E B4-D
452	-332	In Beaumont A	F-Dall'Ara Hill-KJD
451	-389	Fracastorius	F-JEW
449	-030	Maskelyne	F-Pither (BAA) Double hill-KJD
449	-104	Torricelli	F-MWH (Doubts nature) 07/17/72 DCW/3D/5F/7K8MK9K
446	-730	In Janssen	F-HDJ B7-A Quite large
442	263	Jansen	F-JA Quite Steep-CLR 6/24/66
433	164	Ross	KHS 14 F-1960
430	280	Dawes	ABJC DW/2E/6F/0?? B4-B B3-E Uncertain
428	167	Ross	KHS 16 F-1960
427	417	Lemonnier	F-JEW
427	206	Ross A	KHS 12 F-1960
424	533	Posidonius	F-HDJ? B3-A 9.1km
424	317	Dawes	F-KJD
424	-462	Piccolomini	LAC-96 B6-B DU/2A/6H/8P9K-KJD ABJC 13.7km
423	511	Posidonius	F-HDJ? B3-A 7km
423	239	Ross	F-HDJ B4-D Oval
423	170	Ross	KHS 13 F-1960
422	175	Ross	KHS 25 F-1960
420	707	Hercules	F-HDJ B2-A
420	310	Dawes	F-KJD
420	167	Ross	KHS 15 F-1960
419	535	Posidonius	F-HDJ? B3-A 13X5 km Double dome?
417	000	Moltke	F-HDJ on Horiguchi Photo. 08/11/71 About size of Moltke
416	536	Posidonius	F-J. Brannen B3-A 9km-HDJ
413	-146	Theophilus	KHS 28 F-1960
411	-362	Polybius	F-JEW 2 others nearby-KJD
405	145	Arago	F-HDJ on Horiguchi Photo. 08/11/71 Forms double dome with +402+148
404	-145	Theophilus	KHS 26 F-1960
403	227	Ross	F-HDJ on Horiguchi Photo. 08/11/71 Bright patch
403	210	Ross	F-HDJ on Horiguchi Photo. 08/11/71 Very elongated
402	148	Arago	F-HDJ on Horiguchi Photo. 08/11/71 Forms double dome with +405+145
400	195	Ross	F-HDJ on Horiguchi Photo. 08/11/71 About size of Ross B
385	735	Hercules	F-HDJ
382	280	Plinius	KHS 5 F-1960 Catalog
377	277	Plinius	KHS 6 F-1960 Catalog
377	105	Arago	F-HDJ on Horiguchi Photo. 08/11/71
377	-267	Catharina	KHS 10 F-1960
376	542	Giner	F-JEW
376	276	Plinius	KHS 7 F-1960 Catalog
375	108	Arago	F-HDJ on Horiguchi Photo. 08/11/71
375	-258	Catharina	KHS 11 F-1960
374	655	Grove	F-HDJ 6.2km C2-A B2-A
374	547	Posidonius P	F-HDJ
374	103	Arago	F-HDJ on Horiguchi Photo. 08/11/71 About size of Arago D
373	273	Plinius	KHS F-1960
373	095	Arago	F-JEW C4-D Horiguchi Photo. 8/11/71
372	100	Arago	F-HDJ on Horiguchi Photo. 08/11/71 About size of Arago D
369	277	Plinius	KHS 9 F-1960
368	096	Arago	F-HDJ on Horiguchi Photo. 08/11/71 About size of Arago E
365	-488	Zagut	F-KJD 12/29/65 8km DU/2E/5F/0? 380m high-KJD
363	159	Arago	F-HDJ on Horiguchi Photo. 08/11/71 About size of Arago D
363	130	Arago	LAC-60 ABJC DCW/3D/6I/7P8P9P 24km- HDJ
362	-282	Catharina	F-CLR
362	-478	Rothmann	F-HDJ?
361	167	Arago-Maclear	F-HDJ on Horiguchi Photo. 08/11/71 About as large as Arago - HDJ
359	-480	Rothmann	F-HDJ?
358	149	Arago	LAC-60 ABJC 9km DW/2E/6F/0
357	554	Luther	F-??? 10km
357	077	S of Arago	F-HDJ Seen-JEW
354	550	Luther	F-HDJ Seen-CLR 6/24/66 at +349+550
353	155	Arago	LAC-60 ABJC DW/2E/6F/0 10km
353	-474	Rothmann	F-CLR
351	549	Luther	F-HDJ Seen-CLR 6/24/66
350	-478	Rothmann	F-???
349	161	Arago	Several Ob., B4-B LAC-60 7km DW/2B/5I/9J Appears double
349	148	Arago	F-KJD DW/1A/6F?7J?4km-KJD
343	723	Bürg	F-???
339	107	Arago	F-??? Well-known
335	607	Plana	F-HDJ 12.3km
325	733	Bürg	F-???
324	-528	Zagut	KHS F-1960 Catalog
318	-526	Zaugt	KHS 3 F-1960 Catalog
315	-520	Zagut	F-HDJ
313	-753	Pitiscus	F-HDJ Small
312	053	Ritter	F-CLR C4-D Cut by cleft. Seen-MWH.
278	660	Bürg	F-HDJ C2-A DW/2B/5G-MWH
275	653	Plana	F-CLR
275	576	Luther	F-CLR
274	299	Menelaus	Several Ob., well-confirmed ABJC
273	658	Bürg	F-HDJ C2-A
273	141	Julius Caesar	F-HDJ 5.5km-HDJ Can't find- MWH
272	669	Plana	F-CLR DW/2A/5F/8K-MWH
269	300	Menelaus	Several Ob. 12km-KJD DW/2E/5?/0 Cut by cleft
266	153	Julius Caesar	F-HDJ DW/2B/5I/0-MWH
262	790	Aristoteles	F-HDJ 5.5km
259	304	Menelaus	F-HDJ Might be +255+304. DW/2A/5F?/0 12km-KJD
255	155	Julius Caesar	F-HDJ
252	-292	Almanon	F-HDJ
245	361	Bessel-S. Gallus	F-MWH 07/02/72 DW/1A/4F/0
245	165	Julius Caesar	F-HDJ Seen-MWH DW/2A/5H/0
243	-290	Almanon	F-HDJ
242	588	Alexander	F-HDJ (RJW Photo.) 8km
240	371	S. Gallus	F-MWH DW/2A/5G/0 Position uncertain
239	361	S. Gallus	F-MWH Position uncertain
238	582	Alexander	F-HDJ on RJW Photo. 4km
235	371	Bessel - S. Gallus	F-MWH 07/02/72 DW/2A/4G/0
231	739	Mitchell	F-HDJ

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)—*Continued.*

Xi	Eta	Feature Near	Observer/Date/Remarks
226	790	Aristoteles	F-CLR Very uncertain
225	365	Bessell-S. Gallus	F-MWH 07/02/72 DW/1B/4F/0
222	362	Bessell-S. Gallus	F-MWH 07/02/72 DW/1E/4F/0
220	210	Boscovich	F-KJD Very uncertain (KJD) DU/2E/6I'/? 10km
201	326	S. Gallus	F-MWH 07/18/72 DW/2A/5F
193	-660	In Maurolycus	F-HDJ
191	866	Kane	F-KJD DW/2A/5F'/0 16km-KJD
185	353	S. Gallus	F-??? 07/18/72 DW/1A/5F (MWH)
183	348	S. Gallus	ABJC 12km-KJD DW/2A/6F/7K9PM
181	465	Jansen B	KHS 68 F-1960
180	278	Manilius	F-KJD 01/17/67 Very low 20km-KJD
176	648	Alexander	F-MWH 07/18/72 White patch under high sun
176	-060	Sarder	F-??? 16km
163	487	Linné	F-??? 19X38km
152	510	Linné	CLR KJD HDJ AKH C3-A C3-E 22km DW/3C/6G/8P ABJC
144	511	Autolycus	F-??? 38km
140	250	Auwers	F-KJD 07/09/66
138	441	Aratus	F-???
136	387	Aratus	F-??? 14km
126	249	Manilius	F-HDJ C4-B DW/2A/5H?/7J MWH Dark-haloed, Central pit
125	259	Manilius	F-JEW (LAC-59) Possible dark-haloed crater 6.5km
122	791	Egede A	F-HDJ Portion of a ridge-MWH
122	742	Egede	F-HDJ C2-A Too steep-MWH
122	249	Manilius	F-HDJ Can't find-MWH
119	738	Egede	F-MWH 07/18/72 DW/1A/4F
115	252	Manilius	F-JEW (LAC) 2.5km (C4-B) Seen-MWH
110	777	Egede	F-KJD? DW/2A/4F/8J (MWH) 6km-KJD
109	950	Meton	F-MWH 11/10/72 9km
108	765	Egede	F-??? 7km
108	706	Egede	F-???
106	956	Meton	F-MWH11/10/72
101	775	Egede	F-MWH 07/18/72 DW/2A/4F
098	260	Manilius	F-HDJ Seen-MWH 12km-KJD 239m high-KJD
097	957	Meton	F-Heath DW/2D/5F (MWH) Seen-HDJ KJD
096	262	Manilius	F-HDJ Seen-MWH
095	911	Meton-Bond	F-MWH 07/18/72 DW/2A/4F
095	775	Egede	F-MWH 07/18/72 DW/1A/4F
095	582	Aristillus	F-KJD 15km-KJD Portion of ridge (MWH)
093	768	Egede	F-??? 12km
092	774	Egede	F-MWH 07/18/72 DW/1A/4H
091	-117	Hipparchus	F-KJD 05/27/66 8km-(KJD) Steep
090	768	Egede	F-??? 8km
085	764	Egede	F-KJD 08/01/68 8km (KJD) DW/3B/5F/8K (MWH)
078	-059	Horrocks	F-CLR 08/21/69
075	-053	Horrocks	F-CLR 08/21/69
071	571	P. Nebularum	HDJ D2-A Can't find- MWH
069	065	Triesnecker	F-MWH
061	068	In Triesnecker	ABJC 5.1km×3km (C4-B) DW-2A/6F/0
060	-060	Horrocks	F-CLR 08/21/69
059	512	Autolycus	F-??? 35km
057	549	P. Nebularum	F-HDJ - D2-A MWH Can't find
055	504	Autolycus	F-CLR KJD JO Very low slope - about 28km
052	619	Cassini	F-HDJ D2-A Can't find- MWH
050	903	Bond	F-??? 12km
045	-033	Réaumur	F-JEW LAC 2X4km-HDJ D5-A.
024	444	Archimedes	F-??? 14X22km
022	438	Archimedes	F-??? 21km
017	-046	Réaumur	F-JEW on LAC 1X2.5km-JEW. Seen by HDJ on D5-A
016	434	P. Putredinis	F-??? 2km
013	-032	In Réaumur	F-HDJ D4-A
013	-048	Réaumur	F-JEW on LAC 3X4km-JEW. Seen by HDJ on D5-A.
012	827	M. Frigoris	F-by BAA 17km-KJD Double dome
005	-091	Gyldén	F-HDJ D5-A 2.5km-HDJ
004	041	Chladni	BAA HDJ LAC 59 C4-B-KJD CLR 11km-CLR 12km-KJD
003	-086	Gyldén	F-HDJ D5-A 2.5km- HDJ
002	438	P. Putredinis	F-KJD 01/05/66
002	088	Murchison	C4-B 67-H-311 Well-confirmed
001	-091	Gyldén	F-HDJ D5-A 2.5 km-HDJ
-001	080	Murchison	ABJC 6km-HDJ
-012	456	Archimedes	F-??? 6km-HDJ
-013	-232	Alphonsus	F-HDJ Very small D5-A Ranger-IX
-019	730	Mouth of Alpine Valley	KHS 89 ABJC 4km-KJD 5km-HDJ
-024	830	M. Frigoris	F-???
-040	443	Archimedes	F-KJD 40X30km-KJD
-046	409	Archimedes	F-Doherty (BAA)
-050	010	Murchison	F-KJD 25km-KJD
-056	415	Archimedes	F-Doherty (BAA)
-057	-047	Flammarion	ABJC
-060	-056	Flammarion	ABJC
-060	-060	Flammarion	F-??? 8km
-061	-051	Flammarion	ABJC
-066	-057	Flammarion	ABJC
-067	851	Plato	F-KJD 11/21/66 6km-KJD
-067	-050	Flammarion	ABJC
-070	843	Plato	F-KJD 11/21/66 19km-KJD
-070	-070	Flammarion	F-CLR 14km-CLR
-073	375	Wallace	F-HDJ-KJD 14km-HDJ 12km-KJD DW 2B/6F'/0 KJD
-075	-053	Flammarion	F-??? 11X8km-Don Watts
-077	784	Plato	F-KJD on Orbiter-IV Photo. 8km-KJD
-077	-060	Flammarion	ABJC 9km-KJD
-078	-054	Flammarion	ABJC
-078	-059	Flammarion	F-Watts 9km-Watts
-078	-066	Flammarion	F-CLR 6km-CLR
-080	845	Plato	F-KJD 11/21/66 19km-KJD
-082	389	Wallace	F-KJD
-090	870	Birmingham	F-???
-108	316	Wallace	F-??? 45km
-114	780	Plato	F-??? 30X40km
-114	-396	Stag's Horn Mts.	KHS 80 F-1960
-121	670	Pico E	F-JO DW /2D/5G/0
-127	-475	Pitatus	KHS 81F-1960
-128	316	Eratosthenes	F-CM 17-22km
-134	428	Beer	F-???
-138	447	Beer	ABJC DUW 2B/6F/0-KJD
-138	-344	Wallace	KHS 69 F-1960
-142	448	Beer	F-???
-142	304	Wallace	F-??? 25X15km
-144	-342	Birt	KHS 7 F-1960
-145	-307	Lassell	F-KJD 10X20km-KJD
-148	866	M. Frigoris	F-??? 16X32km
-148	-265	Lassell	F-AKH
-152	863	Plato	F-CLR 18km?
-155	783	Plato	F-CLR
-155	-347	Birt	ABJC 10km-KJD
-156	-353	Birt	ABJC 12km-HDJ. 11km-KJD Cleft extends half through dome
-162	-347	Davy	F-WLR 4km Crossed by cleft-KJD
-169	-004	Sömmering	KHS 71F-1960
-170	530	N of Timocharis	F-HDJ on Horiguchi Photo. Very small. Unresolved crater?

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)—*Continued.*

Xi	Eta	Feature Near	Observer/Date/Remarks
-177	003	Sömmering	KHS 72 F-1960
-179	529	N of Timocharis	F-HDJ on Horiguchi Photo. Very small
-180	540	N of Timocharis	F-HDJ on Horiguchi Photo. Very small
-183	409	Timocharis	KHS 83 F-1960
-183	344	Eratosthenes	F-KJD 10X6km-KJD
-183	-005	Sömmering	KHS 73 F-1960
-185	854	M. Frigoris	ABJC 10km-LAC 11
-186	851	Fontenelle	F-???
-186	-353	Nicollet	KHS 82 F-1960
-191	424	Timocharis	F-R Horiguchi 10km-RH.
-191	320	Wallace	F-???
-192	358	Wallace	KHS 88 F-1960
-193	005	Gambart B	F-??? 13km-KJD
-197	488	Timocharis	F-HDJ on Horiguchi Photo. 4km-HDJ.
-198	412	Timocharis	F-R Horiguchi 70km N-S. Has -191+424 on NE Flank-HDJ
-198	055	Gambart B	F-CLR
-202	-504	In Pitatus	F-???
-203	037	Gambart	KHS 76 F-1960
-204	043	Gambart	KHS 78 F-1960
-204	040	Gambart	KHS 74 F-1960
-205	-069	Lalande	F-KJD 8X11km-KJD
-206	040	Gambart	KHS 75 F-1960
-206	-503	In Pitatus	KHS 85 F-1960
-207	042	Gambart	KHS 79 F-1960
-209	-509	In Pitatus	F-??? KJD says at -214-507
-210	180	Stadius	KHS 84 F-1960
-210	-481	In Pitatus	KHS 87 F-1960
-212	049	Gambart B	ABJC 21km-HDJ. 328m high-HDJ
-212	-484	Pitatus	F-KJD Cleft winds around
-213	069	Gambart	F-???
-214	062	Gambart	F-???
-214	041	Gambart B	F-KJD
-214	-507	Pitatus	F-AKH 10km-KJD
-217	-485	Pitatus	F-AKH 7km-KJD
-218	042	Gambart B	F-??? 8X13km-KJD
-218	-090	Parry	F-???
-222	065	Gambart B	F-MWH DCW 3E/4G/7KM9K Low & difficult-MWH.
-223	419	Timocharis C	F-HDJ on Horiguchi Photo. Unresolved crater?
-224	408	Timocharis	F-HDJ on Horiguchi Photo. Unresolved crater? HDJ
-235	-467	Hesiodus	F-??? 15-20km
-236	335	Pytheas	F-HDJ on Horiguchi Photo. 5km-HDJ Steep
-240	404	Timocharis	F-HDJ on Horiguchi Photo. See also -223+419
-243	082	Whewell	F-HDJ?
-247	013	Gambart	ABJC 13km-JEW.
-250	021	Gambart	ABJC 10km-JEW
-251	-771	Longomontanus	KHS 107 F-1960
-254	915	Carpenter	F-MWH DW 2A/4F/7km-MWH.
-257	030	Gambart	F-??? 20km
-262	560	Leverrier	Ref S&T 29,5 p. 294. Many others possible in area
-274	-405	Wolf	F-CLR Low slope, Irreg. outline- CLR.
-275	009	Gambart	F-HDJ? 6km-HDJ
-290	008	Gambart	F-HDJ Very uncertain. Could be same as -295+016.
-295	701	Pr. Laplace	F-HDJ (E2-E) 7km
-295	016	Gambart	F-HDJ Doubtful- HDJ See -290+008.
-296	678	Helicon	F-HDJ (E2-E) 5km
-297	008	Gambart	F-HDJ at -295+016 V. uncertain
-297	-475	Hesiodus-Kies	F-JO 15X22km-KJD
-300	290	Pytheas	F-CLR Portion of a ridge- MWH
-301	019	Gambart	ABJC
-301	-233	Guericke	ABJC 57-60km
-305	670	Helicon	F-HDJ Small
-311	649	Helicon	F-HDJ 7km-E2-E
-313	665	Helicon	F-HDJ 7km-E2-E
-325	653	Helicon	F-HDJ Small
-329	649	Helicon	F-HDJ 5km-HDJ E2-E
-330	-554	In Capuanus	KHS 98 F-1960
-340	-441	Kies	F-HDJ 4km-HDJ E6-A
-342	548	Carlini	F-HDJ Small
-343	582	Carlini	F-??? 4km-HDJ.
-343	580	Carlini	F-??? 4km-HDJ
-343	574	Carlini	F-??? 4km-HDJ Don Watts
-346	-433	Kies	F-??? 5km
-347	548	Carlini	F-HDJ Small
-348	531	Carlini	F-???
-349	-527	In Capuanus	KHS 100 F-1960
-349	-556	In Capuanus	KHS 99 F-1960
-350	-441	Kies	F-JEW (LAC-94) 7km-JEW E6-A. Seen-MWH.
-351	-427	Kies	F-JEW (LAC-94) 2X5km-JEW E6-A. Seen-MWH.
-352	-527	In Capuanus	KHS 102 F-1960
-355	310	Draper	F-???
-356	305	Draper	F-HDJ
-358	561	Carlini	F-HDJ Small (E2-E)
-359	-298	Bullialdus	F-HDJ Small. Ill-defined. Others nearby?
-360	-534	In Capuanus	KHS 101 F-1960
-362	-460	Kies	KHS 90 F-1960
-362	-527	Capuanus	KHS 103 F-1960
-362	-556	Capuanus	KHS 97 F-1960
-362	-556	Capuanus	ABJC 7km-KJD (E7-D) [Dup.?]
-362	-871	Zucchius	ABJC
-363	-562	Capuanus	KHS 91 F-1960
-365	-561	Capuanus	KHS 104 F-1960
-366	-453	Kies	ABJC 3km, 145m high-HDJ
-368	-549	In Capuanus	Wilkins & Moore, *The Moon*
-368	-552	In Capuanus	KHS 96 F-1960
-370	618	Pr. Heraclides	F-HDJ 4km-HDJ E2-E
-370	-563	Capuanus	ABJC 6km-HDJ. 8km-Don Watts
-372	-562	In Capuanus	KHS 92 F-1960
-373	-281	Lubiniesky	F-HDJ 6km-HDJ E6-A. Might be a hill - HDJ
-375	625	Pr. Heraclides	F-HDJ (E2-E) 4km-HDJ
-375	-554	Capuanus	ABJC 8km-KJD 10X15km-Don Watts
-376	-548	In Capuanus	KHS 95 F-1960
-376	-580	Capuanus	KHS 94 F-1960
-378	334	Draper	F-HDJ (E3-A 6km-HDJ. Double pit
-378	-428	König	F-HDJ
-378	-549	Capuanus	KHS 93
-378	-560	Capuanus	ABJC 15X10km-KJD
-379	-433	Kies	KHS 106 F-1960
-379	-438	Kies	KHS 105 F-1960
-383	-445	Kies	F-??? 8km
-384	-439	Kies	F-???
-384	-442	Kies	F-???
-385	-306	Lubiniesky	F-HDJ (E6-A) 5km-HDJ
-385	-555	Capuanus	ABJC 9km-KJD
-388	-420	König	F-HDJ?
-389	321	Draper	F-HDJ 5km-HDJ
-390	-433	König C	F-HDJ 5km-HDJ
-396	632	Pr. Heraclides	F-HDJ (E2-E) 4km
-397	-418	König	F-HDJ
-400	684	Pr. Heraclides	F-HDJ (E2-E) 3km-HDJ
-401	-023	Lansberg	KHS 123 F-1960
-404	-020	Lansberg	KHS 126 F-1960
-405	-401	König	F-???
-406	-018	Lansberg	KHS 127 F-1960
-407	-015	Lansberg	KHS 121 F-1960
-409	-060	Lansberg	F-HDJ? 29km-HDJ

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)—*Continued.*

Xi	Eta	Feature Near	Observer/Date/Remarks
-410	657	Pr. Heraclides	F-HDJ (E2-E) 27km-HDJ
-410	078	Lansberg	F-JO? 28km-HDJ
-410	-015	Lansberg	KHS 129 F-1960
-411	-025	Lansberg	KHS 125 F-1960
-412	-013	Lansberg	KHS 130 F-1960
-418	608	Pr. Heraclides	F-HDJ 3km on E2-E.
-423	-256	Darney C	F-HDJ on E6-A 4km-HDJ
-428	054	Reinhold	F-??? 12km-KJD on AIC 580
-428	012	Lansberg	F-???
			A little larger than Lansberg
-431	-197	Darney	ABJC 12km-HDJ. 16km-KJD
			Strange-KJD
-436	042	Reinhold	ABJC 7X12km-KJD
-438	-245	Darney C	F-JEW (LAC-76) 5km-JEW
			Seen-HDJ E5-A.
-440	459	Euler	F-??? 35km
-440	-100	Riphaeus Mts.	ABJC 23km-HDJ.
			Three domes fused together?
-443	-574	Ramsden	F-??? 10km-HDJ
-444	-438	Hippalus	F-JEW (LAC-94) 3km-JEW.
			Seen-HDJ E6-A
-449	132	Hortensius	ABJC 4km-HDJ. 6km-KJD
			Dark under high sun
-450	207	Copernicus H	ABJC 2km-HDJ. Triangular
-452	138	Hortensius	Wilkins & Moore, *The Moon*
			10km-KHS
-452	132	Hortensius	Wilkins & Moore 6kmi-KHS
-452	131	Hortensius	Wilkins & Moore, *The Moon*
			8.9km-KHS
-452	122	Hortensius	F-HDJ Not Seen-MWH
-455	136	Hortensius	ABJC 8km-HDJ. 10km-KJD
			DW/2B/5F/0-Don Watts
-458	137	Hortensius	ABJC 5km-HDJ. DW/1A/5F/7J
			MWH. Too steep?-KJD
-458	130	Hortensius	ABJC 5km DW/2A/6G/7J-KJD
-462	132	Hortensius	ABJC 8km. DW/2B/6F/7K8M
-465	211	Wagner B	KHS 108 F-1960
-465	133	Hortensius	Wilkins & Moore, *The Moon*
			KHS 115 8km-KHS
-466	242	T. Mayer	F-HDJ
-466	127	Hortensius	KHS 113
-466	124	Hortensius	ABJC 6km-HDJ.
			DW/2A/5G/7J-MWH
-467	134	Hortensius	KHS 114
-468	128	Hortensius	KHS 112
-468	-721	Nöggerath	KHS 120 F-1960
-469	124	Hortensius	Wilkins & Moore, *The Moon*
			KHS 111, 6.0km- KHS
-470	763	Harpalus	F-HDJ Not seen-KJD E1-B
-472	125	Hortensius	ABJC 6km-HDJ KJD
			DW/2A/5G/7J-Don Watts
-473	134	Hortensius	F-MWH DW/2A/4G/7J8K-MWH
-474	242	T. Mayer	ABJC 3km-HDJ.
			Joins with -475+244-MWH
-475	244	T. Mayer	F-HDJ 3km-KJD. Connects
			with -474+242 & -478+242.
-476	238	T. Mayer	ABJC 3km-KJD.
			DW/?A/4G-MWH
-478	242	T. Mayer	ABJC 3km-HDJ
-480	325	Brayley D	F-HDJ
-480	-125	Euclides	F-??? 8km
-483	157	Milichius	ABJC 8km-HDJ. 15km-KJD
-485	235	T. Mayer	F-HDJ Seen-KJD
-486	219	T. Mayer	ABJC 7km-HDJ.
			At -486+223, KJD
-488	-082	Ural Mts.	KHS 116 F-1960
-489	222	T. Mayer	F-??? About 22km
-489	217	T. Mayer	F-HDJ
-489	-063	Ural Mts.	KHS 119 F-1960
-492	-079	Ural Mts.	KHS 117 F-1960
-493	236	T. Mayer	ABJC 7km-HDJ 19km-KJD.
			Two pits on surface
-496	250	T. Mayer	KHS 109 F-1960
-496	-062	Lansberg D	F-JO 25km DW/3E/6G
-497	218	T. Mayer	ABJC 9km-HDJ. 11km-KJD.
			May merge with -486+219.
-498	-078	Lansberg	F-JO 25 The size of Lansberg-
			JO. DW/2A/4F/7J-MWH
-499	238	T. Mayer	F-HDJ 14km-CP
-500	242	T. Mayer	KHS 110 F-1960
-500	-290	N of Agatharchides	ABJC 60km-KJD.
			DW/3D/5G/7KM8M-MWH.
			"Fireman's Hat"
-502	227	T. Mayer	ABJC 12km-KJD 14km-CP.
			DW/2A/4F/ MWH
-502	071	Lansberg	ABJC 20km-KJD 17km-RCP
-503	485	Delisle	F-HDJ 10km?
-503	245	T. Mayer	ABJC 6km-KJD 20km-CP.
			DW/2A/4G/8M MWH.
-503	-174	Riphaen Mts.	KHS 132 F-1960
-504	360	Brayley D	F-HDJ 2km-HDJ.
-506	439	Diophantus	ABJC 8km-HDJ KJD
			F-Leonard Abbey
-506	220	T. Mayer	F-HDJ? 12km-HDJ
-507	337	Brayley D	F-HDJ Seen-JEW
-508	331	Brayley D	F-HDJ
			At -508+329, Crater-cone-KJD
-508	200	Milichius	ABJC 20km-HDJ
			DW/3D/4G/8M-MWH.
-509	357	Brayley D	F-HDJ 3km-HDJ
-509	172	Milichius	KHS 131 F-1960
-510	457	Delisle	F-HDJ DW/1E/4?-MWH.
-510	229	T. Mayer	ABJC 10km-HDJ. 12km-CP.
			DW/2E/4F-MWH.
-510	220	T. Mayer	ABJC 4km-KJD 12km-CP.
			DW/2A/4G-MWH.
-510	175	Milichius	ABJC 9km-HDJ CP.
			DW/2A/5F/7J-MWH
-511	186	T. Mayer	F-HDJ? 19km-CP. Vague
-512	223	T. Mayer	F-HDJ Position uncertain
-514	-206	Herigonius	ABJC 18km?-HDJ. Too steep?
-515	228	T. Mayer	F-??? 15km-KJD 12km-CP.
			May overlap -510+229
-518	225	T. Mayer	F-HDJ 10km-CP
-520	-620	Clausius	KHS 137 F-1960
-522	223	T. Mayer	F-HDJ? 8km-CP
-523	484	Delisle	ABJC 19km-KJD
			DW/3A/5F/8K-MWH
-523	441	Diophantus	ABJC F-Leonard Abbey.
			Very small
-523	227	T. Mayer	F-HDJ? 6km-CP
-523	183	Milichius	ABJC 11km-HDJ.
			DW/2A/4F/7K-MWH
-525	223	T. Mayer	F-HDJ? 5km-CP
-526	211	Milichius	F-??? 15km-?
-527	141	Milichius	F-HDJ? 4km-HDJ
-528	247	T. Mayer	ABJC 12km-HDJ
-528	220	T. Mayer	ABJC 4km-KJD
-529	-212	Herigonius	F-HDJ
-530	200	Milichius	ABJC 12km-HDJ
-532	166	Milichius	ABJC 5km-HDJ. 7km-KJD.
			May be too steep for dome
-532	-601	Clausius	KHS 134 F-1960
-536	481	Delisle	F-HDJ
-536	136	Milichius	ABJC 8km-HDJ
-537	496	Delisle	F-HDJ
-537	446	Diophantus	F-??? Seen-KJD
-537	204	T. Mayer	F-HDJ 5km-CP. Seen-KJD
-538	486	Delisle	F-HDJ 7km-HDJ
-538	474	Diophantus	ABJC 24X15km-KJD
			From LAC 39.
-540	070	Kunowsky	F-HDJ
			Diamond-shaped flat top- HDJ
-542	496	Delisle	F-HDJ
-550	-101	Euclides	KHS 138 F-1960
-552	-500	Lee	KHS 133 F-1960

Table 1. Lunar Dome Catalog (April 30, 1992 Version, provided by Harry D. Jamieson)—*Continued.*

Xi	Eta	Feature Near	Observer/Date/Remarks
-566	-131	Wichmann	F-??? 10km-KJD
-568	-702	Schickard	F-HDJ 8km-HDJ
-569	593	Gruithuisen	F-??? 40km
-569	221	Bessarion	F-KJD 12km-CP
-570	-553	Clausius	KHS 136 F-1960
-573	-553	Clausius	KHS 135 F-1960
-600	-140	Encke	F-KJD 60km-KJD
-612	451	Prinz	ABJC 18km-KJD DW/3C/5F/7K-MWH
-613	671	Rümker	F-HDJ F2-A Small-HDJ
-617	452	In Prinz	KHS 147 F-1960
-618	-328	Gassendi	KHS 14 F-1960
-618	-347	Gassendi	KHS 139 F-1960
-620	452	Prinz	F-??? 19km-KJD 16km-HDJ. DW/2A/4G-MWH.
-623	452	Prinz	KHS 146 F-1960
-624	445	Prinz	F-??? KJD 13km-KJD
-624	-320	Gassendi	KHS 140 F-1960
-626	498	Krieger	KHS 142 F-1960
-626	257	Bessarion	F-KJD 01/05/66
-627	436	In Prinz	KHS 144 F-1960
-630	155	Kepler	F-Patrick McIntosh 11km-McIntosh. 8km-KJD DW/2A/4F/7J-MWH.
-632	430	Prinz	F-HDJ Vague-HDJ
-634	432	In Prinz	KHS 145 F-1960
-643	651	Rümker	F-??? Cluster of domes. 65km. F2-A LAC 23 IV-163
-672	472	Krieger	KHS 143 F-1960
-679	-145	Letronne	F-HDJ KJD calls undome-like (11/24/66)
-700	430	Aristarchus Uplift	F-??? 209km-HDJ. Entire uplift
-701	430	Aristarchus Uplift	F-JEW 7X10km-JEW. F5-E LAC-38
-717	345	Herodotus	F-Leif Robinson 13km-HDJ
-717	261	Marius C	F-KJD 03/25/64 4km-KJD
-721	359	Herodotus	KHS 148 F-1960
-736	-295	Billy	F-??? 3km
-739	-261	Billy	F-HDJ F6-D
-740	250	Marius C	F-CP 08/22/72 3km Very uncertain-CP
-740	-278	Billy	F-HDJ F6-D
-741	374	Herodotus A	F-MWH 07/23/72 DCW/2D/4G
-742	401	Herodotus	KHS 149 F-1960
-744	399	Attached to -742+401	KHS 150 F-1960
-747	212	Marius	KHS 155 F-1960
-770	205	Marius	KHS 152 F-1960
-773	155	Reiner	F-KJD 01/23/67 20km-KJD 19km-CP. DW/3D/4F/7- MWH.
-773	127	Reiner	F-HDJ Seen-JEW MWH (DW/1A/5F). 5km-HDJ
-775	076	Suess	F-JEW LAC-56 7km. F4-D
-776	207	Marius	F-MWH 07/23/72 DW/1D/4G-MWH
-777	253	Marius C	F-CP 08/22/72 4km-CP Flat & circular
-777	057	Suess	F-JEW LAC-56 5km-JEW. F4-D
-778	195	Marius	F-CP 08/22/72 2km-CP Oval & flat
-781	246	Marius	F-CP 06/24/72 5km-CP
-781	208	Marius	F-MWH 07/23/72 DW/2A/5F
-782	172	Reiner	F-JEW LAC-56 Confirmed-HDJ F4-D. 3X6km-JEW
-782	119	Suess	F-JEW LAC-56 Confirmed- HDJ F4-D. 3X5km-JEW
-783	197	Marius	Wilkins & Moore, *The Moon* KHS 153
-785	141	Reiner H	F-MWH 07/23/72 DW(?)/2A/6F
-788	227	Marius	F-CP 08/22/72 5km-CP. Flat & circular
-789	163	Reiner	F-CP 08/22/72 8km-CP Sharp summit
-790	191	Reiner	F-JEW (LAC-56) 5km-JEW. Confirmed-HDJ F4-D.
-791	183	Reiner	F-JEW (LAC-56) 5km-JEW. Confirmed-HDJ F4-D.
-793	461	Briggs	F-??? 43km
-793	133	Reiner	F-CP 08/22/72 5km-Circular & flat
-802	158	Reiner	F-JEW (LAC-56) Seen-HDJ F4-D. 5km
-803	-094	Fused w/-812-096 & -814-096	KHS 158 F-1960
-804	-365	de Vico	F-Leslie Rae 14km-KJD LAC 92
-812	-096	Fused w/-814-096 & -803-094	KHS 156 F-1960
-813	141	Reiner	F-CLR Confirmed-JEW& CP 7km. KJD says 3:1 aspect
-814	-096	Fused w/-812-096 & -813-094	KHS 157 F-1960
-819	134	Reiner	KHS 154 F-1960
-827	-418	Byrgius	F-KHS (Uncataloged)
-840	161	Reiner	F-??? Seen-JEW
-863	-176	Sirsalis	F-HDJ
-884	-326	Darwin	F-Elmer Reese 45-50km-KJD
-885	046	Hevelius	F-CP 10km
-888	055	Hevelius	F-CP Low, Irreg. 13km
-891	-182	S. of Grimaldi	F-HDJ F5-E
-892	-188	S. of Grimaldi	F-HDJ F5-E
-893	-051	Grimaldi	F-HDJ F5-E
-894	-333	In Darwin	KHS 159 26KM
-895	059	Hevelius	ABJC May run into -888+055
-896	-185	S. of Grimaldi	F-HDJ F5-E
-898	-199	S. of Grimaldi	F-HDJ Seen-T. Hansen 11/30/71. F5-E
-899	-171	S. of Grimaldi	F-HDJ F5-E
-900	144	Cavalerius	BAA 37km-LAC-56
-900	005	Cavalerius	ABJC 20X25km-KJD
-901	-168	S. of Grimaldi	F-HDJ
-901	-175	S. of Grimaldi	F-HDJ F5-E
-901	-178	S. of Grimaldi	F-HDJ F5-E
-902	-185	S. of Grimaldi	F-HDJ F5-E. Seen-T. Hansen
-903	-170	S. of Grimaldi	F-HDJ F5-E
-904	-176	S. of Grimaldi	F-HDJ F5-E
-906	-168	S. of Grimaldi	F-HDJ F5-E
-908	-049	Grimaldi	F-HDJ F5-E
-908	-167	S. of Grimaldi	F-HDJ F5-E
-912	-030	Grimaldi	F-HDJ F5-E
-921	038	Hevelius	F-HDJ 2km
-922	-061	Grimaldi	F-KJD ACIC
-923	012	Hevelius	F-HDJ 6km
-929	-078	Grimaldi	F-KJD ACIC
-930	140	Cavalerius	F-???
-931	-071	Grimaldi	F-KJD F5-D LAC-74 shows double (28km & 17km)
-933	-082	Grimaldi	F-KJD ACIC
-935	-088	Grimaldi	F-HDJ
-947	-313	Veris Alpha	F-JEW 9km

Notes

Xi and **Eta** are E-W and N-S lunar rectangular coordinates, in thousandths of a lunar radius. The right-hand column gives the observer who discovered the dome and the date of discovery, when known. **F** stands for "found." Codes in the format **DW/1D/4G** are dome classifications as described in: Westfall, J. (1964), "A Generic Classification of Lunar Domes," *J.A.L.P.O.*, *18*, Nos. 1-2 (July), 15-20. Entries in the form **F4-D** refer to plates in: Kuiper, G.P. (1960), *Lunar Photographic Atlas* (Chicago: U. of Chicago Press); **LAC** refers to Lunar Aeronautic Charts. Dome diameters are given in km; heights in m. The abbreviations used for observers are: ABJC = A.L.P.O.-B.A.A. Joint Catalog; AKH = Alika K Herring; CLR = Charles L Ricker; CM = Craig MacDougal; CP = Chet Patton; HDJ = Harry D Jamieson; JA = Joseph Ashbrook; JEW = John E Westfall; JHP = James H Phillips; JO = José Olivarez; KHS = Kenneth H Schneller (with his catalog number); KJD = Kenneth J Delano; MWH = Marvin W Huddleston; RCP = Roy C. Parish; RJW = Richard J Wessling; and WLR = W L Rae (BAA).

COMING SOLAR-SYSTEM EVENTS: OCTOBER-DECEMBER, 1992

WHAT TO LOOK FOR

This column is intended to alert our readers about upcoming events in the Solar System; giving visibility conditions for major and minor planets, the Moon, comets, and meteors. You can find more detailed information in the 1992 edition of the *A.L.P.O. Solar System Ephemeris*. (See p. 144 to find out how to obtain this publication.) Celestial directions are abbreviated. All dates and times are in Universal Time (UT). For the time zones in the United States, UT is found by adding 10 hours to HST (Hawaii Standard Time), 9 hours to AST (Alaska Standard Time), 8 hours to PST, 7 hours to MST, 6 hours to CST, and 5 hours to EST. Note that this addition may well put you into the next UT day!

PLANETS: SATURN SLIPPING, MARS ASCENDING

Saturn's visibility is now restricted to the evening; it continues to lie in Capricornus, and will disappear into the sunset twilight near the end of the year. The (obviously) Ringed Planet is shrinking and dimming slightly, diminishing from 18" to 16" (" = arc-seconds) in equatorial diameter, and from visual magnitude +0.5 to +0.8 during October-December. The Rings remain well-presented, with the Earth 16-17° above their N face; their major axis shrinks from 40" to 35", and their minor axis from 12" to 10" during this period.

The Remote Planets **Uranus** and **Neptune** are both in Sagittarius, about 25° W of Saturn, and are thus also visible in the evening sky, if only until about the end of November. Uranus is at magnitude +5.7-5.8, about 3".6 in diameter, and should be visible to the naked eye at a dark site. At magnitude +7.9, Neptune requires binoculars to locate. **Pluto** is effectively invisible as it is in conjunction with the Sun on NOV 15.

The planet **Mars** is now worth following (see p. 97 of this issue). In Gemini, the Red Planet rises after midnight in October, but this event occurs earlier each night until Mars rises in the early evening at the end of the year as it approaches opposition on 1993 JAN 07. Mars' northerly declination makes it readily visible from our Northern Hemisphere, and indeed its own Northern Hemisphere is well presented to us as the disk diameter increases from 8" on OCT 01 to 15" by the end of the year. At the beginning of our period, Mars' phase is quite obvious (87 percent illuminated) but gradually becomes 100 percent "Full" by year's end as its magnitude brightens from about +0.3 to -1.4.

Venus is finally gaining respectable altitude in the evening twilight, with its solar elongation increasing from 29° E on 1992 OCT 01 to 46° E at the end of December. During the same period, the disk diameter increases from 12" to 20", as its phase drops from 87 percent illuminated to 60 percent, and the planet brightens slowly from magnitude -3.9 to -4.3.

Jupiter is now in Virgo and begins to be observable in the predawn sky in November. During November and December, the Giant Planet's disk grows from 32" to 36" in equatorial diameter and brightens slightly from magnitude -1.7 to -1.9.

Two apparitions of **Mercury** occur in these three months. The first is an evening one, and is favorable for observers in the Southern Hemisphere. It is centered on 1992 OCT 31, the date of Greatest Eastern Elongation (23°.7), although the planet will be at least 15° from the Sun between OCT 07-NOV 14, with dichotomy (half-phase) *predicted* for NOV 05, 20h. Mercury's second apparition is a morning one, but favorable for Northern-Hemisphere observers. Greatest Western Elongation is on 1992 DEC 09, with the planet then 20°.9 from the Sun, and at elongation 15° or greater from NOV 30-DEC 27; and dichotomy is predicted for DEC 05, 23h.

There are no truly close planetary conjunctions during this period, although there are three "binocular conjunctions": (1) Venus (Mag. -4.1, 41° E of the Sun) passes 1°.9 S of Uranus (Mag. +5.8) on NOV 26, 12h; (2) One day later, NOV 27, 13h, Venus (Mag. -4.1, Elong. 41° E) passes 3°S of Neptune (Mag. +7.9); and (3) Venus (Mag. -4.2, Elong. 45°E) passes 1°.1 S of Saturn (Mag. +0.8) on DEC 21, 16h.

MINOR PLANETS

Three of the brighter **minor planets** reach opposition during 1992 OCT-DEC. Their 10-day ephemerides are given in the 1992 edition of the *A.L.P.O. Solar System Ephemeris*, and their opposition data are given below:

	Opposition Data		
Minor Planet	1992 Date	Stellar Magnitude	Declination& Constellation
39 Laetitia	NOV 15	+9.6	2°N Cet
349 Dembowska	DEC 02	+9.7	30°N Tau
3 Juno	DEC 28	+7.7	0° Mon

Besides the objects above, two of the remaining "Big Four" minor planets, **1 Ceres**, and **4 Vesta** will be brighter than Mag. +10 during at least part of the current period.

In early December, the minor planet 4179 Toutatis passes unusually close to the Earth, moving rapidly across the sky and brightening to 9th or 10th magnitude. Its ephemeris is given for every day for most of December and every 2 days for most of January in the 1992 *A.L.P.O. Solar System Ephemeris* (p. L-4).

THE MOON

During the current period, the schedule for the Moon's **phases** is:

New Moon	First Quarter	Full Moon	Last Quarter
SEP 26.4	OCT 03.6	OCT 11.8	OCT 19.2
OCT 25.9	NOV 02.4	NOV 10.4	NOV 17.5
NOV 24.4	DEC 02.3	DEC 10.0	DEC 16.8
DEC 24.0	*JAN 01.2*	*JAN 08.5*	*JAN 15.2*

The underlined dates indicate eclipses, described later, while those in italics fall in 1993. The four lunations listed above constitute Numbers 863-866 in Brown's series.

The other significant lunar visibility condition is the Moon's **librations**, or E-W and N-S tilts in relation to the Earth. Extreme librations occur on the following dates:

North	East	South	West
SEP 26	OCT 01	OCT 10	OCT 16
OCT 23	OCT 29	NOV 06	NOV 11
NOV 19	NOV 25	DEC 03	DEC 08
DEC 17	DEC 22	DEC 30	*JAN 05*

Our lunar E and W directions follow the usage of the International Astronomical Union, with Mare Crisium near the *east* limb.

Favorable libration-lighting conditions for viewing the E limb occur on SEP 30-OCT 04 and OCT 28-31. The SW limb will be well-presented on OCT 11-12, NOV 09-11, and DEC 09. Worthwhile dates for viewing the lunar S polar area are OCT 07-13 and NOV 03-09. Besides the favorable southerly libration on those dates, the Sun will lie about 1°.5 S of the Moon's equator during the first period, and 1°.0 S during the second; a condition helpful in illuminating the south polar region. Note also that the librations tabulated in the ephemerides are *geocentric*, and can differ by up to 1° from the *topocentric librations* that one sees from a particular observing location.

PLANETARY AND LUNAR OCCULTATIONS

Major and minor planets will occult 13 stars in 1992 OCT-DEC. *Table 1* (below) lists the date, occulting object, visual magnitude of planet followed by that of the star, and *possible* zone of visibility for each occultation.

For the lucky observers who happen to lie in the occultation tracks under night skies, the NOV 25 event will be visible in binoculars, and the NOV 23 occultation of Omicron Leonis will be visible to the naked eye!

The Moon passes in front of two planets in two days; both events are visible from approximately the same area. The first occurs on OCT 27, near 15h when the waxing crescent Moon occults Mercury; the planet will be at Mag. -0.2, 23°E of the Sun. The occultation track includes the E United States and Canada, the Caribbean, N and W Africa, and southernmost Europe; only the easternmost portions of the track will witness the event after sunset. The table below gives information for three selected locations. Note that it will be hard to find a place where both disappearance and reappearance can be seen with the Sun down!

Lunar Occultation of Mercury, 1992 OCT 27.—

Site	Disappearance UT	Disappearance Alt.☽	Disappearance Alt.☉	Reappearance UT	Reappearance Alt.☽	Reappearance Alt.☉
	h			h		
New York	13.3	-2°	+19°	14.4	+8°	+28°
Tripoli, Libya	16.1	+12°	+2°	17.0	+4°	-9°
Athens, Greece	16.2	+2°	-9°	17.0	-6°	-18°

For those suitably located, the next day's occultation (OCT 28, ca. 15h) will be easier to

Table 1. Occultations of Stars by Planets, 1992 OCT-DEC.
(For further information, consult the A.L.P.O. Solar System Ephemeris: 1992 or Sky & Telescope, January, 1992, p. 76.)

1992 UT Date	Occulting Object	Visual Mag. Object	Visual Mag. Star	Predicted Visibility Zone
OCT 26.13	**532 Herculina**	+11.3	+9.2	SW Canada, W U.S.A.?
29.89	**164 Eva**	+10.8	+8.5	Siberia, Cen. Asia, China
30.57	**1 Ceres**	+9.0	+8.8	SW-Cen.-N Australia
31.30	**455 Bruchsalia**	+12.3	+9.5	Canada, Alaska
NOV 12.36	**524 Fidelio**	+12.7	+9.5	N U.S.A.
23.38	**248 Lameia**	+14.7	+3.5	Alaska, N Canada, NW Africa
25.01	**41 Daphne**	+13.0	+6.4	India, Cen. Africa, Cen. South America
26.93	**105 Artemis**	+12.9	+9.4	NE U.S.A., Spain, Portugal
DEC 06.75	**41 Daphne**	+12.9	+9.1	SE Asia, Africa
07.01	**VENUS**	-4.1	+9.1	Cen North America, South America
17.13	**36 Atalante**	+11.8	+8.1	Cen. U.S.A., Canada, N Atlantic, N & E Europe, Middle East
17.48	**MERCURY**	-0.5	+8.0	NE U.S.A., SE Québec
28.07	**324 Bamberga**	+12.9	+9.1	CIS (former USSR), Turkey, Africa

see. It involves Venus, at Mag. -4.0 and 35°E of the Sun. The Caribbean; northernmost South America; W, central, and E Africa; and the Arabian Peninsula will see this event. Again, only those in the eastern part of the track will see the occultation under twilight or dark skies. The following table summarizes the particulars of this occultation for a few selected places.

Lunar Occultation of Venus, 1992 OCT 28.—

Site	Disappearance UT	Disappearance Alt.☽	Disappearance Alt.☉	Reappearance UT	Reappearance Alt.☽	Reappearance Alt.☉
	h			h		
Arecibo, P.R.	12.5	-8°	+27°	13.4	+3°	+38°
Lagos, Nigeria	14.4	+59°	+42°	16.2	+45°	+17°
Cairo, Egypt	15.9	+12°	-10°	16.4	+8°	-16°
Jerusalem	16.0	+8°	-14°	16.4	+4°	-20°
Riyadh	15.8	+4°	-22°	16.9	-8°	-36°

More information about these and other occultations can be had from the International Occultation Timing Association (IOTA), 1177 Collins Ave., SW, Topeka, KS 66604, U.S.A.

COMETS

The column by Don E. Machholz, "Comet Corner," on pp. 121-122, and the *A.L.P.O. Solar System Ephemeris: 1992* list eleven known comets that will be visible during at least part of this period. Of these, **Shoemaker-Levy (1991a1)**, **P/Ciffréo**, and **P/Schaumasse** may be as bright as at least 12th magnitude and thus should be readily visible in amateur instruments under dark skies.

The above is a conservative statement of comet visibility as it of course does not take into account any discoveries that may be made after this column is written! ***[For example, see page 140 for the recovery announcement about Comet P/Swift-Tuttle.]***

METEOR SHOWERS

(Contributed by Robert D. Lunsford, A.L.P.O. Meteors Recorder; October data added by Editor)

October: Near the beginning of the month, conditions will be favorable for the **Annual Andromedids**, whose maximum on OCT 03 occurs with a 7-day Moon that will set about midnight. Sadly, the same cannot be said for the **North Piscids** because a 17-day waning gibbous Moon occurs on their maximum date, OCT 13. However, occasional meteors from either of these two showers can be expected throughout the first part of the month.

The major October shower, though is the **Orionids**, which peak on OCT 21.4 with a waning crescent (25-day) Moon. This is a brief shower, with only a 2-day span, but with zenithal rates often reaching 15 per hour. These meteors tend to be fast (66 km/sec) and often leave long-lasting trains.

November-December: The **Leonids** reach maximum activity on NOV 17 this year. Unfortunately, a bright last-quarter Moon will be located close to the radiant, reducing the number of meteors visible that morning. To see the highest rates, face N with the Moon at your back and catch the Leonids that are visible in that portion of the morning sky.

The **Geminids** peak in activity on DEC 14 with a bright waning gibbous Moon spoiling the show. Your best bet may be to face W with the Moon behind you. Under these conditions you may expect to see up to 50 meteors per hour should your skies be transparent.

Conditions for the **Ursids** are very favorable this year. Stream members are visible from DEC 17-26 with maximum activity occurring on the morning of the 22nd, near New Moon. The radiant lies close to the bright star Beta Ursae Minoris (Kochab). Data are scarce for this show, so any observations obtained this year would be valuable.

Looking ahead to 1993, North America is very well situated for the **Quadrantid** shower, expected to peak near 10h UT on 1993 JAN 03 with rates exceeding 100 per hour for those able to escape the areas affected by light pollution. Face the NE portion of the sky, and start counting once the waxing gibbous Moon is low enough so as not to interfere.

PARTIAL SOLAR ECLIPSE

There are *two* eclipses in December, and the total lunar one is described in some detail in the next article. However, there is also a **partial solar eclipse**, falling on DEC 23-24. The eclipse zone includes the N Pacific Ocean, E China, Korea, Japan, NE Asia, and W Alaska. The maximum eclipse occurs in Siberia at 155°45'E/65°42'N. At that point, the *eclipse magnitude* will be 0.843 (which means that the maximum encroachment of the Moon into the solar disk will equal 84.3 percent of the Sun's apparent diameter).

The table below gives data for the maximum phase of this eclipse for selected locations:

Partial Solar Eclipse: 1992 DEC 23-24

Location	Maximum Eclipse UT		Sol. Alt.	Mag.
DEC 23	h	m	°	%
Taipei, Republic of China	23	10.0	+6	14.9
Shanghai, P. R. of China	23	15.0	+4	28.8
Beijing, P. R. of China*	23	21.8	-3	42.2
Seoul, South Korea	23	25.9	+6	47.2
Vladivostok, Russia	23	37.5	+7	60.5
Tokyo, Japan	23	38.2	+17	53.7
DEC 24				
Anchorage, Alaska**	01	23.3	-4	62.2
Kodiak, Alaska†	01	25.9	-1	60.0

Notes:

* Sunrise occurs at 23h 34.0m, with an eclipse magnitude of 39.9 percent.

** Sunset occurs at 00h 42.5m, with an eclipse magnitude of 34.4 percent.

† At sunset, taking refraction into account.

THE TOTAL LUNAR ECLIPSE OF 1992 DEC 09-10

On 1992 DEC 09-10, much of the world will see the first total lunar eclipse since February, 1990. At the middle of this eclipse, the Moon will be overhead as seen from Algeria; what this means is that observers throughout the Arctic, eastern Canada, Africa, Europe, the Middle East, and most of the CIS will be able to see the entire eclipse. Besides those areas, India, central Asia, eastern South America, and the eastern United States can at least watch all of the total phase. The remainder of the Americas and Asia will see the partial and penumbral phases only. Although this may be disappointing for many observers in the United States and east Asia, note that people in those locales will be able to see the eclipsed Moon low in the east after sunset (Western Hemisphere) or in the west before sunrise (Eastern Hemisphere); some spectacular photographs can be expected.

At mid-eclipse, the *umbral magnitude* will be approximately 1.276. That means that the Earth's umbral shadow will cover the entire Moon and indeed extend 0.276 lunar diameters outside the limb of the Moon. For total lunar eclipses, the Universal Times of seven eclipse events are usually tabulated:

Penumbral Phase Begins	DEC 09, 20h 55.4m
Partial Phase Begins	DEC 09, 21h 59.4m
Totality Begins	DEC 09, 23h 06.8m
Middle of Eclipse	DEC 09, 23h 44.1m
Totality Ends	DEC 10, 00h 21.5m
Partial Phase Ends	DEC 10, 01h 28.8m
Penumbral Phase Ends	DEC 10, 02h 32.7m

The beginning and ending penumbral phases are essentially unobservable, except by a photometer. Do not expect to see faint penumbral shading on the Moon's east limb (celestial east and west are used here) until about 21:30-40 UT on DEC 09, and on the west limb after about 02:00-10 UT on DEC 10.

The partial phase begins with *First Umbral Contact* on the lunar east limb. When the *Second Umbral Contact* occurs, on the northwest limb, the total phase begins. At *Third Umbral Contact*, on the northeast limb, the total phase ends. Finally, the partial phase comes to an end at *Fourth Umbral Contact*, on the lunar west limb.

To some extent, the size and the darkness of the penumbra and umbra vary unpredictably from eclipse to eclipse; the times above assume that the Earth's atmosphere causes a 2-percent enlargement from what simple geometry would predict. In order to find out more about the variation of the umbra between eclipses, its diameter can be fairly accurately by timing the actual times of the four umbral contacts. These events can be timed in binoculars, but a small telescope magnifying 40-100X and showing the entire Moon in the eyepiece field is really the ideal instrument for these and many other eclipse observations.

Observers with such instruments can further refine our umbral diameter measurements by timing when the umbral edge crosses selected craters, which is best done by timing when the shadow edge touches each side of the crater and taking the mean of those two times. To help plan such timings, below is a table of recommended umbral-timing craters, with the *approximate* Universal Times of crater disappearance into ("Dis."; all on DEC 09) and reappearance from ("Rea."; on DEC 10) the umbral shadow. To ensure correct crater identification, consult a lunar map before and during the eclipse if you are uncertain.

Crater	Dis.	Rea.	Crater	Dis.	Rea.
Grimaldi	22:05	00:30	Aristoteles	22:55	00:50
Aristarchus	22:25	00:30	Eudoxus	22:55	00:55
Kepler	22:20	00:40	Manilius	22:40	01:00
Copernicus	22:25	00:45	Menelaus	22:45	01:05
Pytheas	22:30	00:45	Plinius	22:50	01:10
Timocharis	22:35	00:45	Taruntius	22:55	01:20
Tycho	22:20	01:00	Proclus	22:55	01:20
Plato	22:50	00:40			

It is likely that the DEC 09-10 lunar eclipse will be an unusually dark one because the volcanic aerosols in our stratosphere that blackened the umbra in the 1992 JUN 15 partial lunar eclipse will probably still be present. Thus, records of the umbra's tone and color will be quite valuable.

Such records include drawings and photographs, as well as video or digital CCD images. Be prepared to make long exposures, however!

Even written comments on the brightness of the eclipsed Moon can be valuable. One standard means to do so is to make a numerical estimate using the *Danjon Luminosity Scale (L)* at mid-eclipse, as follows:

L = 0: *Very dark eclipse; Moon almost invisible, especially at mid-eclipse.*

L = 1: *Dark eclipse, gray or brownish coloration; details distinguishable only with difficulty.*

L = 2: *Deep red or rust-colored eclipse, with a very dark central umbra and the outer edge of the umbra relatively bright.*

L = 3: *Brick-red eclipse; usually with a bright or yellow rim to the umbra.*

L = 4: *Very bright copper-red or orange eclipse; with a bluish very bright shadow rim.*

It is also possible to make measurements of the brightness of the lunar disk as a whole by comparison with other celestial objects whose magnitudes are known. The problem here is to make the disks of the Moon and the comparison object similar in size. If you are very nearsighted, just remove your glasses and you can compare the out-of-focus disks of bright stars directly with the similar-sized lunar disk. Some observers have used the Moon's reflection in a convex mirror, which

makes the Moon appear star-like but which must be calibrated through experiment. Otherwise, you might view the Moon through reversed binoculars, which will both shrink and dim the Moon's disk. If we allow a 25-percent light loss in the binoculars (.24 magnitudes), binoculars of the following magnifications will dim the Moon's brightness by the following amounts, as expressed in magnitudes:

7× ... 4.5 Mag.
8× ... 4.8 Mag.
10× ... 5.3 Mag.
11× ... 5.5 Mag.
16× ... 6.3 Mag.
20× ... 6.8 Mag.

If the comparison object and the Moon are at significantly different elevations, one must correct for *differential extinction*. At this point, we suggest that you obtain a copy of the *A.L.P.O. Lunar Eclipse Handbook* (at $4.00 cost, including postage) from Francis G. Graham, our Lunar Eclipse Recorder (address on inside back cover). This publication also gives information on other forms of lunar eclipse observation.

Naturally, lunar eclipse photometry is impossible without knowing the magnitudes of comparison objects. *Figure 28* (to right) shows the brighter stars, and the planet Mars, in relation to the Moon during this eclipse. If the eclipse is very dark, you may need to try to compare the Moon with the fainter stars shown in *Figure 29* (bottom), which is on a larger scale.

Whatever form your lunar eclipse observations take, they will be of value only if communicated to others; particularly to our Lunar Eclipse Recorder, Mr. Graham.

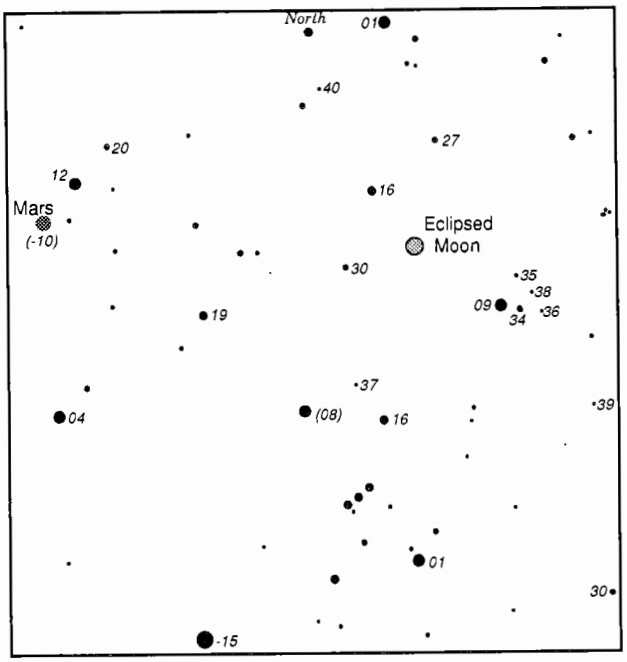


Figure 28. The sky in the vicinity of the totally eclipsed Moon on 1992 DEC 09-10. The magnitudes of selected objects are given in tenths of magnitudes without decimal points (e.g., "16" means +1.6.). The mean magnitudes of objects of variable brightness are shown in parentheses. North at top.

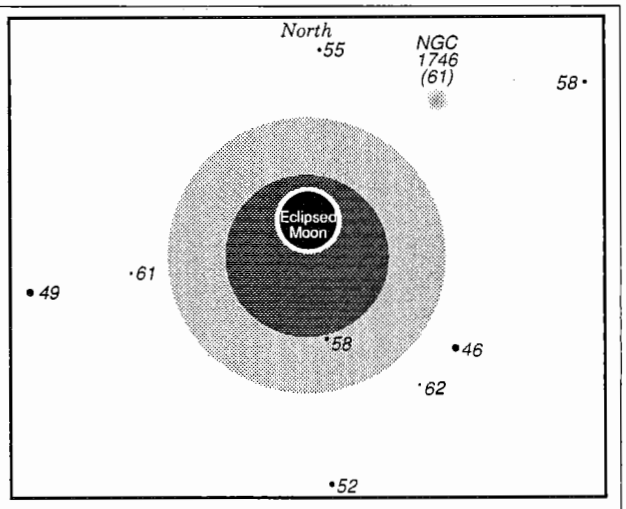


Figure 29. Detailed view of the vicinity of the Moon at mid-eclipse, 1992 DEC 09, 23h 44.1m UT, showing stars to magnitude +6.2 and the open star cluster NGC 1746. Magnitudes are shown as in *Figure 28*. The extent of the Earth's umbra is indicated by dark shading; that of the penumbra by lighter shading; both in scale with the disk of the Moon. North at top.

OUR READERS SPEAK: SCHMIDT-CASSEGRAINS AND MARTIAN CRATERS

(As always, these letters have been slightly edited for style; but for content only in terms of deleting comments about particular brands of instrument; this means that the letter writers are responsible for their opinions, not the A.L.P.O.)

Dear John:

I have followed with interest the commentary about telescope selection in recent issues of the *Strolling Astronomer*. The material shows the writers' high levels of knowledge, and the information is valuable to your readers.

In the July issue, however, there is a comment by Rodger Gordon that refers to the review of Schmidt-Cassegrain telescopes I wrote in *Sky & Telescope*. Rodger mentions a test done some years ago by a Japanese magazine that pitted several S-C's against a 4-inch apochromat. The test involved photographing a variable-contrast target near a light source. The apochromat won hands down. And by his own admission, Rodger uses this report to discourage interest in S-C's. He also notes that *Sky & Telescope* did not conduct this type of test, and by implication suggests we may not have done a thorough job in our review.

First of all, old test data are not a good criterion for judging the telescopes made today. Even though my review is less that three years old, I'm increasingly uncomfortable about referring people to it, since the telescopes I tested have changed. As a case in point, the problem in optical baffling that Rodger mentions was corrected years ago. Even the S-C's I tested in late 1989 had no such problems.

Second, the Japanese test *should* show the apochromat as the winner, since the test concentrated on image contrast. With their moderate-to-large central obstructions, S-C's cannot compete with an unobstructed refractor.

Last, everyone should be careful when interpreting test results. I could surely concoct a test where the S-C's would "trash" the apochromat—how about one specifically for chromatic aberration or a test to determine the limiting magnitude photographed in a star cluster with a 1-minute exposure?

Surely the contrast test mentioned by Rodger is important to planetary observers. And I clearly stated in my S-C review that if the goal is to have the best in planetary imaging, then something other than a S-C might be in order. But the foremost concern of our reviews is to look at products from the perspective of what the product is intended to do. And in the case of the S-C, we looked at it as a general-purpose telescope. Indeed, as was stated in my review, S-C's are quite possibly the best general-purpose telescope ever manufactured.

Dennis di Cicco

Associate Editor, Sky & Telescope
P.O. Box 9111, Belmont, MA 02138-1200

September 2, 1992

Dear John:

It appears that an entertaining new controversy has been raised by William Sheehan's article in the July, 1992 issue of Sky & Tele*scope* concerning the visibility of Martian craters in earthbound telescopes. In that article, Sheehan discussed John Mellish's claim that both he and E.E. Barnard actually saw craters as such on Mars in the early years of this century using the 36-inch and 40-inch refractors at Lick and Yerkes Observatories, respectively. Additional fuel was provided by Rodger Gordon's letter in the October issue of *S&T*, in which he cites other observers of Martian craters, referring to three articles he wrote on the subject, all of which, alas, appeared in the post-Mariner era. Is this yet another egregious example of clairvoyance after the fact?

In assessing the observational record, we must be absolutely clear about the distinction between "speculating," "predicting," or "surmising" that dark spots on Mars might be craters, certainly a reasonable premise, and actual observational verification of that premise. Sheehan points out that none of the dark oases in Barnard's drawings correspond to known craters, although several do correspond to the huge volcanos along the Tharsis Ridge. Of particular significance, the sketches by Barnard in the *S&T* article do not, by any stretch of the imagination, portray the prominent oases as craters or volcanos. They are simply drawn as conspicuous dark circular features, much the way many of us have seen them with more modest equipment. Nor has any reference to "craters" been found in Barnard's observing notes. If Barnard really did draw craters, those sketches have apparently been lost.

It appears to have been Mellish who really championed the notion of Martian craters, claiming to have seen them with the 40-inch Yerkes refractor at 750× in November of 1915, when Mars was still about 3 months from an aphelic opposition and must have subtended an angle of only 6-8 arc-seconds! This feat seems truly herculean, even allowing for ideal seeing conditions and the enhanced relief of features near the terminator of a gibbous disk. A 40-inch aperture in those circumstances would have resolution equivalent to 10-12 inch telescopes when the Martian disk is about 24 arc-seconds in diameter, which occurs during the most favorable oppositions. Of course, Mellish embellished his description of the craters by calling them water-filled, which has a distinctively Lowellian flavor and renders suspect his reliability as an observer. Be that as it may, either his imagination or his visual acuity must be credited for his clairvoyant description of Martian craters.

The above notwithstanding, the fact remains that there are no known drawings of Mars that depict craters as such. Does anyone actually know of the existence of pre-Mariner sketches or notes that unambiguously show or describe craters or volcanos on Mars? That remains the pivotal question if the issue is to be taken from the realm of speculation.

Finally, Rodger Gordon comments in his letter that he can't understand why astronomers were surprised by the Mariner-4 images of the Martian surface, given the prior observations of craters on Mars. Come on Rodger, give us a break! The surprise was not the revelation of craters (after all, Earth has craters, too), but their extreme density and the strong indication that we are looking at a very ancient, lunar-like surface. I don't know of anyone who anticipated quite that scenario in 1965, but then I suppose only a fortunate few possess Rodger's remarkable prescience.

Joel W. Goodman

3053 Pine Street, San Francisco, CA 94115

September 11, 1992

JUPITER UPDATE

Prepared By: José Olivarez and Isao Miyazaki

QUANTITATIVE REPORT ON JOVIAN LONG-LIVED FEATURES

By: Isao Miyazaki

11 May, 1992

Dear Jose:

Today I sent you by separate post my recent Jupiter photographs obtained from 1992 MAR 01 to APR 23 (Photo. I.D. JWB110-92 - JWB154-92) and drift charts of rapidly-moving NTeB spots and a tiny dark spot in the SEB. During the period from March to April, the weather was rather bad at Okinawa.

The south edge of the NTeB continues to be very active from November, 1991. I observed 13 dark spots (or projections) on the NTeBs. They had moved with the North Temperate Current C. Some of them were very short-lived.

A tiny dark spot has been observed in the SEB since November, 1991. It was approaching the p. [preceding] end of the Red Spot at +0°.25 per day in System II longitude (i.e., at a velocity, **u**, of -7 m/s in System III) from 1991 NOV 18 to 1992 JAN 28, and was expected to reach the Red Spot Bay by the end of February. However, it reduced speed in February and began to prograde [decrease] in System II longitude after the middle of March. From 1992 MAR 21 to APR 17, this spot's System II longitude decreased by -0°.32/day (**u** = +1 m/s). The mean zenographic latitude ("Lat.") of this spot was measured as follows, along with the System II daily drift rate ("Drift"):

	1991 NOV 18-1992 JAN 28	1992 FEB 21-MAR 14	1992 MAR 21-APR 17
Lat.	-17°.5±0°.8	-15°.8±0°.9	-15°.6±0°.3
Drift	+0°.25	+0°.10	-0°.32

I think that this spot moved along the Red Spot Bay and drifted to lower latitudes, so it was caught by the other progressive current. During the first half of the apparition, the south part of the SEB preceding the Red Spot had been fainter than the part that followed. It appeared that the Red Spot prevented the extension of the faded SEB area. The movement of this SEB spot distinctly indicates that the Red Spot blocks the flow in the middle SEB. [Below are Mr. Miyazaki's longitude and latitude measures of selected Jovian features.]

Table 1. Photographic Latitude and Longitude Measurements by Isao Miyazaki, 1991 OCT 11-1992 APR 20

Note: **p**, **c**, and **f** refer to the preceding end, center, and following end of features, respectively. Photograph identifications all have the prefix "JBW" and the suffix "-92." Latitudes and longitudes are in degrees.

A. GREAT RED SPOT.

1991-1992 UT Date and Time	System II Longitude p	c	f	Lat.	Photo.
OCT 11 20:51	015.0	026.8	038.3	-22.9	005
NOV 09 20:05.5	-	029.7	-	-21.5	011
NOV 21 20:09.5	015.3	028.8	040.6	-22.2	015
NOV 21 20:20	015.2	028.5	040.3	-22.9	017
DEC 05 21:25.5	022.3	032.4	042.5	-22.0	024
JAN 11 16:56.5	021.5	032.0	042.6	-22.8	042
JAN 21 15:28	020.6	031.5	042.2	-23.5	052
JAN 28 16:04	023.4	033.6	043.9	-22.5	060
FEB 14 15:21	023.0	033.4	043.2	-23.4	069
FEB 21 15:45	024.8	034.8	044.8	-23.5	073
FEB 26 15:07	024.6	034.4	044.1	-22.5	087
FEB 29 12:21.5	021.5	033.2	045.0	-22.1	104
MAR 09 15:15.5	023.4	034.6	045.1	-21.4	115
MAR 12 12:55.5	023.2	034.5	044.9	-21.8	119
MAR 14 13:38.5	023.4	034.1	045.2	-21.4	126
MAR 21 14:46	024.5	035.2	046.0	-21.9	131
APR 14 14:46	026.4	036.3	046.0	-22.0	138
APR 17 11:22	025.4	035.8	046.8	-22.5	145

B. OVAL FA.

1991-1992 UT Date and Time	System II Longitude p	c	f	Lat.	Photo.
OCT 13 20:48	-	347.6	-	-32.1	006
NOV 18 21:15	320.1	324.6	328.6	-34.4	013
NOV 30 20:25	-	324.1	-	-34.1	019
DEC 07 20:36	314.9	320.1	324.6	-33.9	037
JAN 28 14:06	-	299.0	-	-32.4	058
JAN 30 14:52.5	295.,3	298.8	302.3	-32.5	065
FEB 21 13:21.5	284.0	288.5	293.0	-33.3	070
FEB 26 12:10.5	281.5	287.0	292.4	-33.9	080
FEB 27 17:02	-	286.,2	-	-34.0	102
MAR 01 15:08	279.8	284.3	288.8	-33.4	112
MAR 14 10:31	277.3	281.0	284.9	-33.3	123
MAR 21 12:23	-	277.9	-	-33.4	129
APR 04 12:53	268.8	272.5	276.2	-32.6	132
APR 14 11:55	-	267.8	-	-33.1	135
APR 16 12:51	262.4	266.8	271.0	-33.1	141

C. OVAL BC.

1991-1992 UT Date and Time	System II Longitude p	c	f	Lat.	Photo.
DEC 06 21:29	193.4	198.2	202.9	-33.1	033
JAN 11 21:18	178.6	182.7	186.7	-32.2	047
JAN 22 15:57	172.8	177.9	183.0	-33.8	054
JAN 27 14:54	-	176.7	-	-32.6	057
JAN 29 15:28	170.4	174.9	179.3	-33.7	062
FEB 03 14:19	-	174.0	-	-32.9	066
FEB 25 12:33	-	164.5	-	-33.6	076
FEB 26 18:13	158.9	163.6	168.4	-33.9	094
FEB 27 14:01	159.4	163.7	168.3	-34.2	097
FEB 29 15:10	158.0	163.5	169.3	-33.3	109
MAR 12 15:54	152.6	157.3	161.9	-32.5	122
APR 20 12:22.5	135.5	140.2	144.8	-32.4	150

(Continued on p. 137)

D. Oval DE.

1991-1992 UT Date and Time	System II Longitude p	c	f	Lat.	Photo.
Dec 04 21:16.5	-	214.3	-	-33.6	022
Jan 11 21:18	196.1	200.5	204.5	-32.5	047
Jan 22 15:57	-	193.1	-	-34.6	054
Jan 27 14:54	-	193.1	-	-34.6	057
Jan 29 16:40.5	-	192.2	-	-33.1	063
Feb 26 19:10	178.0	182.4	186.6	-33.0	095
Feb 27 15:00.5	177.6	181.7	185.8	-33.5	098
Mar 12 15:54	171.2	176.2	181.3	-32.8	122
Mar 20 12:22.5	155.4	159.9	164.7	-32.5	150

E. Long-Lived STrZ White Spot.

1991-1992 UT Date and Time	System II Longitude p	c	f	Lat.	Photo.
Nov 03 20:25.5	-	223.1	-	-21.8	009
Dec 04 21:16.5	224.5	232.1	238.6	-20.8	022
Dec 07 19:19.5	222.6	230.0	236.9	-21.6	034
Jan 20 16:03	-	238.5	-	-20.8	051
Jan 22 16:50	237.0	242.0	247.2	-20.4	055
Jan 29 16:40.5	-	243.5	-	-19.7	063
Jan 30 13:44.5	-	243.0	-	-21.1	064
Feb 25 15:01	244.6	249.3	253.9	-19.4	078
Feb 27 17:02	243.1	248.6	254.0	-20.0	102
Mar 01 14:13	-	251.1	-	-18.5	111
Mar 14 10:31	-	254.4	-	-18.8	123
Mar 21 10:40	-	256.8	-	-19.8	128
Apr 14 11:55	-	260.7	-	-18.5	135
Apr 16 12:51	-	261.6	-	-19.1	141

F. Small Dark Spot in the SEB(S).

1991-1992 UT Date and Time	System II Longitude c	Sep. from RSp	Lat.	Photo.
Nov 18 21:15	351.7	-	-16.9	013
Nov 30 21:33	353.7	-	-18.1	020
Dec 05 21:11	354.7	27.6	-17.0	024
Dec 24 21:06.5	002.5	-	-19.0	040
Jan 11 16:20	007.1	14.4	-18.3	041
Jan 12 21:27	007.6	-	-17.0	049
Jan 21 15:28	009.9	10.7	-16.7	052
Jan 28 16:04	012.1	11.3	-17.3	060
Feb 21 15:45	015.8	9.0	-16.8	073
Feb 26 14:16.5	016.9	7.7	-16.9	084
Feb 29 12:21.5	016.5	5.0	-15.0	104
Mar 09 14:08.5	017.6	5.8	-15.8	114
Mar 12 12:55.5	018.4	4.8	-15.1	119
Mar 14 13:38.5	017.9	5.5	-14.9	126
Mar 21 13:29	015.6	-	-15.6	130
Apr 04 15:04	010.9	-	-15.9	134
Apr 14 13:55	008.3	18.1	-15.3	137
Apr 16 15:04	007.7	-	-15.4	143
Apr 17 11:22	006.1	19.3	-15.0	145

Figure 30 (upper right) graphs the System II longitude changes of the Great Red Spot and the SEB Dark Spot. Notice that the SEB Dark Spot approached the preceding edge of the Great Red Spot until early March, 1992, and then moved away. The latitude variations of the SEB Dark Spot are graphed for about the same period in *Figure 31* (lower right).

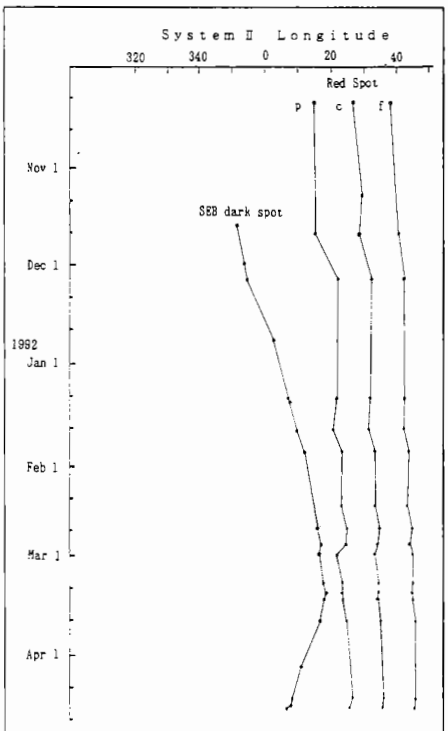


Figure 30. Variations in System II longitude of the Great Red Spot and the SEB Dark Spot, October, 1991 - April, 1992. Based on photographic measurements by Isao Miyazaki.

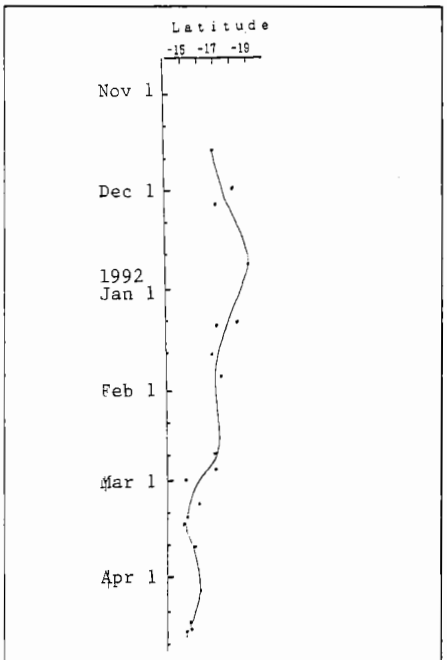


Figure 31. Latitude variations of the SEB Dark Spot, November, 1991 - April, 1992. Based on photographic measurements by Isao Miyazaki.

BOOK REVIEWS

Edited by José Olivarez

Solar Astrophysics. By Peter Foukal.
John Wiley & Sons, Inc., 605 Third Avenue,
New York, NY 10158. 1990. 475 pages.
Price $64.95 cloth (ISBN 0-471-82935-3).

Reviewed by Richard E. Hill

For years, the textbook by Dr. M. Zurich was the only technical treatise commonly available that exhaustively covered the astrophysics of the Sun. *Solar Astrophysics* by Peter Foukal now provides a second such text, although aimed more at the graduate student.

Dr. Foukal has been a user of our Solar Section's data, and so I looked forward to reading this book, which is definitely not for casual reading. It is complex and comprehensive, taking the reader to the forefront of solar research. I have heard stellar astronomers jokingly say that the problem with solar astronomy is that "there's too much data." After reading this book, one can certainly understand this sentiment! However, as Foukal points out many times throughout the book, there are many things yet unknown that offer rich research opportunities. This is undoubtedly why he continually brings us to the limits of current research, offering various theories as explanations for phenomena, yet not dogmatically presenting his favorite. I suspect that he does so in order to stimulate further investigation. Certainly it is very inspirational!

Each chapter begins with a preview of its topics, and ends with exercises and several lists of supplementary reading material, grouped by the topics dealt with in the chapter. Two aspects of the format of the book could be improved. First, the book is crammed full of highly technical astrophysics. It would be better served with a more detailed index, although this is a minor point. Second, this book cries for a glossary. Many complicated technical terms and acronyms are presented and are only sometimes defined. If the book is put down for a few days, these terms can be forgot, causing the reader to have to flip through the chapters to refresh his memory.

In general, the book moves from an interior to an exterior view of the Sun, after a brief but comprehensive historical review of solar astronomy in the first chapter. One is not so much taught a history lesson as given a tour of the milestones in solar research.

Solar Astrophysics abruptly slows down in the next few chapters as the author begins to take the reader outward. The reader is also taken from the microcosmic to the macrocosmic; in terms of physical structure and energy production and transfer. For the observational amateur astronomer, Chapters 2 through 4 will be slow going, perhaps too slow for some. At the beginning of each chapter, and throughout the rest of the book, are a few paragraphs that may help understanding, outlining topics covered in the chapter. However, if you are not well-schooled in physics and mathematics, especially calculus, it may be better to skip to Chapter 5 at this point.

The remainder of the text is much more descriptive, and the amateur observational astronomer will probably enjoy Chapters 8-10 and 13 the most. Chapter 8 deals with the white-light activity that is observed by most solar amateurs. Unfortunately, the author uses the old Zurich Classification System for sunspots. Most solar researchers, particularly in the United States, have gone over to the McIntosh Classification System, which contains a modified Zurich Classification System. The reasons for this change have been explained in many publications by now, and are well founded. It is a pity that the newer system is not even mentioned in the book.

In Chapter 9, the author maintains the outward movement of the book, and begins with a section on the chromospheric features, followed by one on the coronal features. In both sections, the observational viewpoint is first presented, then the physics and the dynamics. Chapter 10 stays in the same general region by studying the nature and dynamics of prominences and flares. Here I was again slightly disappointed because there was no good discussion of sunspot group development and flare frequency. This problem is related to the one noted in the previous paragraph. This is not a minor point because the development of the McIntosh System has allowed the assessment of flare probability in a given sunspot group with a very high degree of accuracy.

In Chapter 13, a broader view is explored; of our Sun as one of the many billions of stars, with the topics of solar evolution and variability. In keeping with the usual format of the book, this is the last chapter, being the most external view of our star which is possible. This was probably the easiest reading of all the chapters.

The author's technique of bringing the reader to the edge of research makes speedy obsolescence inevitable in terms of the theoretical aspects of this book. This is common in textbooks, and a side-effect of educating students in such a dynamic science. Even so, the book is well illustrated; full of tables and graphs that will serve as excellent reference material for years to come.

There is no question that this book is a significant addition to solar literature. However, I do not recommend it for the occasional solar observer, or for those content to simply count sunspots. It is a serious work, designed for those intending to make solar astronomy a life's work; not a book to curl up with on those cloudy days. Nonetheless, it is a superior reference for the serious solar student.

Unusual Telescopes. By Peter L. Manly. Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211. 1991. 221 pages. Price $39.95 cloth (ISBN 0-521-38200-9).

Reviewed by Richard E. Hill

No book, or any publication, since *Telescope Optics* by Rutten and van Venrooij has fired my imagination and telescope-making drive as much as this book. But while Rutten and van Venrooij were quite technical and fairly dry reading, this book is delightful light reading while not sacrificing technical detail.

The book is intelligently organized into chapters that describe related designs. Even the format of the book is well done, with footnotes placed on the page in which they are referenced, rather than at the end of the chapter or the book. This made for smoother reading and easier understanding. The footnoting was also quite extensive, with rarely a page lacking a footnote, and nearly all references being to *Telescope Making*, *Sky & Telescope* magazine, *The Telescope* by L. Bell, or to *The History of the Telescope* by H.C. King.

The volume is illustrated well with photographs and drawings throughout. These, combined with the author's clear and concise writing, never left me with a problem of visualizing the instrument being discussed. Many of the photographs were published for the first time in this book, which will make it a reference of value for some time to come.

Manly's sly sense of humor comes through in many spots. The introduction is quite witty, as are the many short comments such as this one in the discussion of the Schiefspiegler telescopes on page 34,

> "My children call the schiefspiegler a sheep sprinkler."

or on page 109,

> "Lower frequency vibrations require more elaborate devices such as the one developed by Brown University. If, however, you live in California and the very ground you stand on shakes, then the solution is to move to Arizona."

A further example is his entire Chapter 9, entitled "Whimsy," which is on the lighter side of telescope design. This made for reading that was not only informative, but actually highly enjoyable.

The body of the book opens with a chapter on unusual telescope optics. It is the longest chapter, as it should be because optics are the heart of any telescope. From here on Manly has chapters on mountings, various drives, and various other concerns, including transportability. I was pleased to see, in the tradition of the classic three-volume "ATM" (*Amateur Telescope Making*) series of books, that this author did not favor only those solutions to problems that involved the expenditure of kilobucks. Many devices, drives, and mountings that are covered are done on nickel-and-dime budgets. In Manly's own words concerning one telescope,

> "There are numerous plumbing fixtures visible on the telescope and the control system is a collection of 'available parts.'"

Even the relative merits of different tangent-arm drive systems are discussed, showing several that can be made from "available parts" found in many a workshop.

Telescope design and construction is a dynamic field. So, *Unusual Telescopes* is a book that will probably require periodic revisions. My only criticism of the book is the steep price that may dissuade potential readers from purchasing this thought-provoking and entertaining book. But even so, on a scale of 1 to 10, there is no doubt in my mind that *Unusual Telescopes* rates a solid 10!

Venus: Geology, Geochemistry and Geophysics. Edited by V.L. Barsukov, A.T. Basilevsky, V.P. Volkov and V.N. Zharkov. The University of Arizona Press, 1230 North Park Ave., Suite 102, Tucson, AZ 85719. 1992. 421 pages, Appendices. Price $75.00 cloth (ISBN 0-8165-1222-1).

Reviewed by Richard W. Schmude, Jr.

This book summarizes our understanding of Venus up through the Venura 16 Mission. It is broken down into three sections: *Geology*, *Geochemistry*, and *Geophysics*.

The first section, *Geology*, is divided into nine chapters: "Volcanism," "Hot-Spot Structures," "The Lakshmi Phenomenon," "Tesserae," "Ridge Belts on Plains," "Impact Craters," "Evidence on the Crustal Dichotomy," "Global Tectonic Style," and "Resurfacing." In this section, the reader is exposed to many of the geological features on Venus, including several unusual ones.

The *Geochemistry* section contains three chapters: "Venusian Igneous Rock," "Chemical Processes on the Planetary Surface," and "Volatiles in Atmosphere and Crust." These three chapters deal with the chemical composition of the rocks and atmosphere of Venus, and are based largely on spacecraft data.

The third section, *Geophysics*, has nine chapters, and focuses mainly on the nature of the interior of Venus. Models of the interior are developed based on the planet's physical characteristics. Many of these chapters contain equations describing the thermodynamics of planetary interiors.

Next are two large appendices. The first is an "Atlas of Venus Surface Images," consisting of 98 black-and-white radar images. The second, "Names of Topographical Features on Venus," contains the names and locations of almost 400 geological features. The book ends with a list of 427 references.

My overall impression of this book is that it is both illustrated well and written well. It is tailored for the planetary scientist, but the well-informed lay person should also find this book informative.

A.L.P.O. AFFAIRS

1992 A.L.P.O. Convention.—As stated in our last issue, the 43rd A.L.P.O. Convention will be held in Las Cruces, New Mexico. The dates selected for the meeting are Thursday-Saturday, August 5-7, 1993. Our tentative plans are for paper sessions and workshops for Thursday morning and afternoon and Friday morning, the Board/Business Meeting on Thursday in the early evening, a short field trip Friday afternoon, a banquet Friday evening, and a longer field trip on Saturday. More detailed information, including lodging and meals, will be published later. David Levy is in charge of the program and can be contacted c/o the A.L.P.O. Director. Elizabeth Westfall will handle logistics (meals, lodging, and field trips) and can be reached c/o of the same address.

Temporary Changes in the Mars Section.—Sixty percent of our Mars Section staff—Jeff D. Beish, Carlos E. Hernandez, and Donald C. Parker—live in the Miami, Florida, area; and their lives and homes suffered considerable disruption due to Hurricane Andrew. Fortunately they and their families (and their telescopes) were unhurt, but it will be some time before they can give Mars the attention it deserves. Thus: **Until further notice, all Mars Section correspondence should be addressed to: Daniel M. Troiani, 629 Verona Ct., Schaumberg, Illinois 60193.**

Solar Section Staff Changes.—Due to the demands of his new employment, Solar Recorder Richard E. Hill has regretfully stepped down as Solar Recorder and now has the title Acting Assistant Recorder ("Acting" until confirmed by the A.L.P.O. Board of Directors). Richard Hill will continue to work on the Solar Section Handbook and will aid the Section in other ways as well. We take this opportunity to thank Mr. Hill for his major efforts in founding the A.L.P.O. Solar Section and shepherding it through its formative years until it has become the respected solar-research organization we see today.

The previous Solar Co-Recorder, Paul Maxson, has generously agreed to move up to the position of Acting Solar Recorder, and general Section correspondence should be addressed to him. (Both Recorders' addresses are on the inside back cover.) Mr. Maxson has served the Solar Section for eight years, and will be familiar to solar observers because of his crucial role as Editor of the *Solar Rotation Report*, producing this report every 25.38 days.

Instrument Section Statement.—The Acting Recorder of the new Instrument Section, Michael Mattei, has furnished us with the following statement:

> "The Instrument Section was formed to help members with problems they may have with their telescopes and optics. The Recorder expects to provide an optical testing service for the members. He has the equipment to test mirrors using the Foucault Test and auto-collimation for up to 10-inch mirrors. As for refractor optics, built into the Foucault tester is a monochromatic light source set for the green line of mercury. Also, diagonal flats up to 4 inches in diameter can be tested. Refiguring mirrors may be possible; if a mirror is bad enough, it can be refigured to give the fine optical performance expected of good planetary optics.
>
> "I will need to charge a fee for this service in order to cover the replacement insurance cost for mirrors that may be damaged during testing, although I certainly hope that this will not happen. Naturally, the member is expected to pay all shipping costs.
>
> "If you wish more detailed information, or have comments, please write to me at the address on the inside back cover of this Journal. I may also be reached on CompuServe through E-Mail; my CompuServe address is 73747,2321. I would like to hear from you."

COMET SWIFT-TUTTLE RECOVERED

Last seen on 1862 OCT 31, Comet 1862III P/Swift-Tuttle has now been recovered. This confirms the 130-year period postulated by Brian Marsden, with its 1992 DEC 12 perihelion date just 17 days later than he predicted. Searches for the return of this comet, which is associated with the Perseid meteor shower, began in 1980. The actual recovery was made on 1992 SEP 26 by the Japanese comet hunter, Tsuruhiko Kiuchi, with 6-in, 25× binoculars. To the right are its predicted coördinates in the evening sky through November. The comet may be brighter than forecast, reaching naked-eye visibility in late November and December. Note that we may have a spectacular Perseid shower in 1993!

UT Date (0 hours)	2000.0 Coördinates Right Ascension		Declination		Pred. Mag.
1992	hr	min	°	'	
OCT 15	14	10.3	+57	17	+8.1
20	14	56.0	+54	46	
25	15	40.5	+50	57	+7.5
30	16	21.4	+45	54	
NOV 04	16	57.7	+39	47	+6.8
09	17	29.0	+32	59	
14	17	55.6	+25	52	+6.6
19	18	18.4	+18	54	
24	18	37.5	+12	21	+6.6
29	18	54.9	+06	16	

(Based on Information provided by Donald Machholz, A.L.P.O. Comets Recorder)

OTHER ACTIVITIES IN THE SOLAR SYSTEM

Six More Amateurs to Use Space Telescope.—The Director of the Space Telescope Science Institute, Dr. Riccardo Giacconi, has for the second time allotted several hours of the Director's Discretionary Time to amateur observers. For "Cycle Two" there are six amateurs with five projects: (1) *Are Asteroids Old Comets?*, Harald Schenk and Jim Secosky; (2) *The Dynamics of Binary Asteroids*, Benjamin Weiss; (3) *Titan's Atmosphere and Evolution*, George Lewycky; (4) *Morphology of Galaxy-Quasar Association Displaying an Anomalous Redshift*, Karl Hricko; and (5) *The UV Emission Spectrum of an HII Region*, Nancy Cox. The A.L.P.O. is proud to sit on the Amateur Astronomy Working Group that reviewed these proposals. Please note that three of the five topics deal with Solar-System objects.

Twenty-Fourth Annual Lunar and Planetary Science Conference.—An annual major lunar and planetary conference is held at the Lunar and Planetary Institute, NASA Johnson Space Center, Houston, Texas. The next one will be on March 15-19, 1993, with January 8, 1993, as the deadline for paper submissions. More details will be given in an Announcement to be mailed in November; to receive it and other information, write to: 24th LPSC, Lunar and Planetary Institute, 3600 Bay Area Blvd., Houston, TX 77058-1113.

National Young Astronomer Award.—This major new award is sponsored and organized by the Louisville Astronomical Society on behalf of the Astronomical League. It will be given to a high school-aged astronomer based on involvement in any of the following areas: research, observing, astrophotography, CCD imaging, telescope and equipment development and modification, academic performance, public education, and junior activities. For instructions and applications materials, write to: Chuck Allen, Award Coordinator, 1007 Rollingwood Lane, Goshen, KY 40026.

Solar Astronomy Congress.—Members who attended our 1991 Convention in La Paz, Baja California Sur, Mexico, should have fond memories of that city, which will host a Solar Astronomy Congress. Held on April 5-7, 1993, it will be presented by the Centro de Investigación en Astronomía Solar (CIAS). The Congress will be bilingual; in Spanish and English. Some topics are: results of the total solar eclipse of July 11, 1991; preparations for the annular solar eclipse of May 10, 1994; techniques of solar observation, including solar eclipses and H-α studies; the upcoming transits of Mercury and Venus, 1993-2012; developments in solar research; and mesoamerican archaeology. Papers in Spanish or English are solicited, ideally 10-30 minutes in length. A Memoir of the Congress will be published. For more information, write: José Javier Farah de Anda, Coordinator, 2nd Solar Astronomy Congress, Centro de Investigación en Astronomía Solar, La Paz Station, Calle Purísima 119, entre Boulevard Forjadores y San José de Comondú, C.P. 23055, La Paz, Baja California Sur, México (FAX 91-682-2-72-62).

UNIVERSE '93.—Many A.L.P.O. members attended UNIVERSE '92 at Madison, Wisconsin, on June 20-25, where we were a cosponsor. The Astronomical Society of the Pacific plans a similar meeting next year: UNIVERSE '93, at San Diego State University, San Diego, California, on the weekend of July 10-11, 1993. We will give more information in future issues; or you can write to: A.S.P., 390 Ashton Ave., San Francisco, CA 94112.

A.L.P.O. VOLUNTEER TUTORS

Some time ago, the A.L.P.O. Membership Secretary, Harry D. Jamieson, began an informal effort to recruit advanced amateur astronomers who would be willing to assist less experienced A.L.P.O. members in mastering observing techniques. These voluntary tutors are available to correspond with members interested in their specialities; there is no better way to learn than by such one-on-one education. Below are listed the tutors who have volunteered to date, with their specialities. When you write, be sure to enclose a SASE.

Dr. Julius Benton, Jr.
305 Surrey Road
Savannah, GA 31410
Instrumentation and Equipment Selection

Mr. Richard Hill
4632 E. 14th St. Tucson, AZ 85711-4216
Solar

Mr. Harry Jamieson
P.O. Box 143, Heber Springs, AR 72543
Lunar; Instrumentation and Equipment Selection; Software—Astronomical Programming

Mr. Andrew Johnson
1 York Lane
Knaresborough
North Yorkshire
HG5 0AJ
United Kingdom
Lunar; Drawing Skills

Mr. Michael Mattei
11 Coughlin Rd.
Littleton, MA 01460
Drawing Skills; Telescope Making or Enhancement

Mr. Frank Melillo
14 Glen Hollow Dr., Apt. E-16
Holtsville, NY 17742
Solar; Photometry

Mr. José Olivarez
1469 North Valleyview Ct., Wichita, KS 67212
Instrumentation and Equipment Selection; General Literature

Mr. Peter Rasmussen
1210 W. Maple, Heber Springs, AR 72543
Instrumentation and Equipment Selection

Mr. Andrew Sorenson
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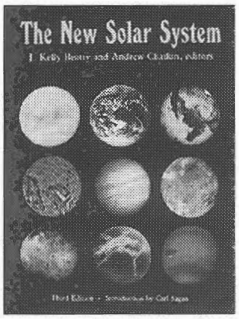

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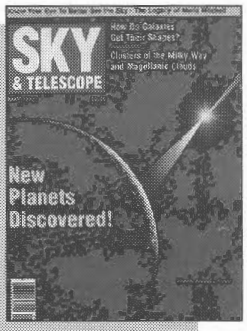

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