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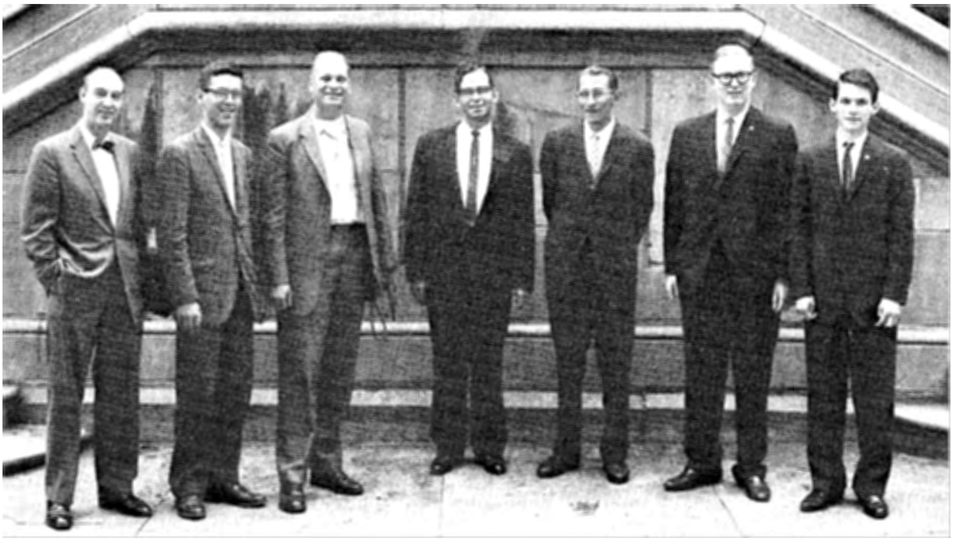


Twenty-five years ago the A.L.P.O. held their 10th Convention in Montreal, Quebec. This photograph, taken then by William E. Shawcross, shows the following A.L.P.O. staff members from left to right: Phil Glaser, Jupiter Recorder; Clark Chapman, Lunar Training Program; Joel Goodman, Saturn Recorder; Walter Haas, Director-Editor; Ernst Both, Mars Recorder; Geoffrey Gaherty, Jr., Mercury Recorder; and Kenneth Chalk, Lunar Meteor Search Recorder.

THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS
c/o Dr. John E. Westfall
P.O. Box 16131
San Francisco, CA 94116 U.S.A.

ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO
Founded In 1947

IN THIS ISSUE

THE A.L.P.O.'S FORTIETH BIRTHDAY

By: John E. Westfall, Director/Editor

History

Not so very long ago, we lived in a world where:

--No human being had traveled faster than sound;
--No manmade object had left the atmosphere;
--The World's largest telescope was on Mount Wilson;
--People argued whether the Moon's craters were volcanic or meteoritic; what was on the Moon's farside was a guess;
--Some astronomers thought that canals existed on Mars; a few thought that they were artifical;
--The fastest color film had a speed rating of 10;
--A computer was a person with a slide rule.

This was the world of early 1947, when the Association of Lunar and Planetary Observers was founded. Few amateurs or professionals then studied tne Moon and planets, and sending space probes to them was a distant dream.

A few dozen people thought that we could find out more, though, and they formed a small group. It began informally, with the chief communication between members being a mimeographed publication, "The Strolling Astronomer." The founder and chief source of energy was Walter H. Haas, and the group was centered--although that's too strong a word--in Albuquerque, New Mexico.

The motivations of the 44 charter members were mixed. Some were passive types and were content to read of the work of others, learning more about our Solar System in the process. Others observed and enjoyed the spectacle of the motions and phenomena of the Earth's neighbors. Several were more interested in technology, which then meant building telescopes or modifying them for effective lunar and planetary use. Finally, there were those who wanted to contribute to human knowledge, learning new techniques and pushing their instruments to the limit. Several of the latter were young persons who developed their interests in the A.L.P.O. and went on to careers in planetary astronomy. It is of interest that 10 of the original 44 members are still with us--Walter H. Haas, Charles A. Federer, James Q. Gant, Walter Scott Houston, Lyle T. Johnson, Allen C. Montague, Elmer J. Reese, Milton Rosenkotter, J. Russell Smith, and Clyde W. Tombaugh!

Put in such general terms, not much has changed in the intervening 40 years; I think that our members still fall in the above groups. Of our about-700 members, perhaps a fifth are either professional astronomers or are pre- or semi-professionals, while the remainder are "pure" amateurs. About 20 per= cent live overseas, and 4 percent in Canada and Mexico, while the members in the United States are spread throughout that nation, with about half on each side of the Mississippi.

Certainly our technology has changed--we have computers, and also larger telescopes and better equipment in general--but our emphasis is still on getting out and observing. Reducing observations and doing theoretical studies, are important and are are carried by several of our members, but this activity is secondary. Also, we are still informal, being unincorporated, although we do have annual business meetings.

There have been a few changes. The founder is still active in our organization, but has turned some of the tasks over to the writer. We still publish "The Strolling Astronomer," but we also call it the "Journal, A.L.P.O." It is now offset rather than mimeographed; the pages per year have increased, although its frequency has dropped from monthly to quarterly. The membership-subscription cost has increased from $1.00 to $12.00 for six issues.

Communication at a distance has its drawbacks, though, and in 1956 we began to hold conventions at least once a year, usually with either the Western Amateur Astronomers (W.A.A.) or with the Astronomical League (A.L.). The front cover shows a group of A.L.P.O. staff members at our 10th convention, held in 1962 in Montreal, Canada. Our 37th convention was just held in Claremont, California, with both the A.L. and the W.A.A., as well as the Astronomical Society of the Pacific.

Our observing projects appear to give their participants some pleasure, while others like to read about their results. The professional astronomical community uses results from several of our projects. When compared with the observatory-based research professional, the association has some advantages--plenty of telescopes and observing time, and a wide geographic distribution of observers.

Prospects

Most of the developments in Solar System astronomy in general, and in the A.L.P.O. in particular, in the last 40 years were surprises, so it would take more nerve than I have to predict the next 40! In the shorter term, it is clear that our emphasis on personal observation of the Solar System will not change. Visual observing, including the making of drawings, will continue to be important simply because the eye gives unrivaled definition at the telescope. The trend toward greater use of astrophotography will continue, driven chiefly by technical improvements in films, and because this medium provides permanent and objective results. A trend just beginning is "electronic observation," whether using photoelectric photometry, video cameras, or "CCD's" (charge-coupled devices). Personal computers will come to be used to process and interpret such "imagery," as they are already being used for predictions and for the reduction of observations.

The organization of the A.L.P.O. into observing Sections has worked well and will doubtless continue, although, as in the past, individual Sections may occasionally come and go. This writer feels it desirable that the one-man "headquarters" of the A.L.P.O. be expanded so that several persons share the necessary tasks that serve the entire group. No one person can do all these tasks as they should be done. As a start, this writer will propose at our business meeting (now just past) that a Membership Secretary be appointed. Besides the routine processing of renewals and new memberships, this person will also work on membership recruitment and on providing information to new members in the form of a "membership kit." We feel it important both to foster the observation of the Solar System and also to reach all such observers via membership in our organization. Although our membership total is roughly constant, our median age appears to be increasing, with fewer young persons joining our ranks--a development boding ill for the future.

The Director hopes that the delegation of duties will not stop here. After the Membership Secretary, probably the most pressing need is for an Editor for our annual Ephemeris, a publication that is growing in length, complexity, and popularity! Forty years of past issues of the <u>Journal, A.L.P.O.</u> need to be indexed as a whole and the possibility of their republication (perhaps in microform) investigated. Also, editorial assistance with our <u>Journal</u> will improve its quality and increase its frequency.

A perennial question at our business meetings is that of legal incorporation as a non-profit corporation. So far, we have remained informal and have not done this, although it means that we have no legal existence. The disadvantages of the change would be the cost and some additional "red tape" (e.g., a Board of Directors that would have to meet annually). The advantages would be the ability to receive money from wills, gifts, and grants, possible tax deductions for staff expenses, and reduced mailing costs. Incorporation may or may not occur, but we do need further dialog.

In fact, we need more discussion about all the matters above. Please feel free to write the Director with your opinions and ideas. Better yet, come to our conventions and speak out at the business meetings! Also, we need more than opinions--we need capable and interested persons to take on some of the managerial and staff work necessary to make the A.L.P.O. a more effective organization.

A CONVERSATION WITH THE FOUNDER OF THE A.L.P.O.

By: David H. Levy, A.L.P.O. Comets and Meteors Recorder

One recent afternoon, Walter H. Haas, the Founder and Director Emeritus of the A.L.P.O., sat down with me to reflect on his forty years with the organization.

DAVID: Why did you decide to start the A.L.P.O.? And When?

WALTER: March, 1947, to take the easy question first. In the years following World War II, I felt that there was a need to improve communication among the small number of active lunar and planetary observers. I also thought--and that has turned out to be a tremendous fallacy--that a newsletter or bulletin would reduce the need for correspondence among all the observers. For the first two or three months there were only about 50 subscribers to the "Strolling Astronomer," as the Journal was originally called, and the number of active observers was far less than that.

At the time, I was an instructor in Mathematics on the faculty of the University of New Mexico, under Lincoln La Paz. It turned out that during the A.L.P.O.'s first years he acted as Counselor for the organization.

From the beginning, the A.L.P.O. was an individual, private effort whose success depended heavily on the number of observers who subscribed to the "Strolling Astronomer," and took part in the projects discussed therein.

DAVID: Your wife Peggy was a neighbor of Professor William H. Pickering. He had been on the Harvard Observatory staff until 1924 and then remained in Jamaica.

WALTER: Yes, we first met in 1935, when I spent a summer studying under Professor Pickering and Peggy did occasional typing jobs for him. After she and I were married in 1953, she frequently helped with typing letters and the "Strolling Astronomer." Peggy also took care of a small library which the A.L.P.O. maintained at one time. She deserves great thanks for the indulgences shown to a husband whose major priorities might include observing Jupiter at three o'clock in the morning.

DAVID: To devote 40 years of your life to the A.L.P.O. is a really monumental achievement. Do you think that the A.L.P.O. has followed the course that you had set for it at the start?

WALTER: Yes, to a considerable extent. It still serves, through the Journal, the annual meetings, and correspondence, to inform observers of what other observers are doing, and to provide a record of planetary phenomena for those having a scientific interest in them. It has provided training for young amateurs, a few of whom have become important professional scientists, and it has indicated worthwhile programs of observation and has offered guidance in pursuing them.

DAVID: Let's talk about some of the people who began their planetary careers through the A.L.P.O.

WALTER: One of the best known is Clark Chapman. I first met him in a summer institute in which I was teaching. Clark was one of the youngest student members of that institute. He already had an intense interest in planetary science and later served for some time on the A.L.P.O. volunteer staff. There are also William Hartmann, Dale Cruikshank, Jose Olivarez, Stephen Maran, Steve Larson . . . I am sure I am forgetting many others who have left their mark on this challenging field.

DAVID: You appear to have a deep satisfaction with the way the organization has evolved.

WALTER: The A.L.P.O. has always been a major activity in my life, and were I to live it again, I would want the A.L.P.O. as part of it. The A.L.P.O. correspondence has given me a lot of pleasure. On several occasions I have received letters from enthusiastic youngsters requesting <u>all</u> information about astronomy, space, and the universe, and further demanding a quick reply!

DAVID: How did the system of Recorders evolve?

WALTER: It is an imitation of the system of the British Astronomical Association, which they have used successfully for nearly a century. Loosely speaking, the first Recorders were appointed to take charge of studies of a particular planet or program. The group of Recorders grew as time passed. The staff has always done the work as volunteers. The quality of A.L.P.O. observing programs and of its Journal owes a very great debt to the dedicated and generous efforts of those many persons who have assisted as Recorders over the years. Some of these people have served a long time, including Chick Capen who ran the Mars Section for 17 years. Dave Barcroft and J. Russell Smith have given invaluable help as Secretaries over the 40 years.

DAVID: How have we subsisted?

WALTER: The A.L.P.O. has operated on minimal finances over the years, and without government subsidies. Subscription rates have been raised at intervals as substantial postal hikes and other expenses generate deficits. A considerable number of helpful members have voluntarily contributed essential financial support as Sustaining Members and Sponsors. Their help has been vital to our survival. Advertising from a small number of companies and persons has also been helpful.

DAVID: Our people are as special as our work. What of the future?

WALTER: No one can pretend to foresee the science and technology of coming years. I would like to see those amateurs who want to do regular and systematic work have continuing opportunities to observe, and also to see professionals who are sympathetic to their efforts. I am delighted to note that the Hubble Space Telescope has offered a small portion of its time to observers of the A.L.P.O. and other amateur groups.

I am glad that the A.L.P.O. has appealed to younger people; we have tried to schedule our annual meetings during school and university holidays so that these younger members can participate.

The A.L.P.O. has an international flavor. Even in its first months, active observers in Germany, Japan, Canada, and elsewhere became members. It has been very gratifying that perhaps 20 percent of the members live outside the United States and have been important contributors of observations and Journal articles. Sometimes domestic members have generously made it possible for foreign members to belong.

There have been many changes in astronomy and its devotees since 1947. The amateur of 40 years ago had (mostly) limited funds and often improvised his own equipment. He had few technical magazines to read and travelled little in pursuit of his hobby. The progress of Solar System astronomy since then has been extraordinary. In 1947 the appearance of the surfaces of satellites other than the Moon was totally conjectural. There was no accepted model for the physical structure of comets. A little later, one properly famous astronomer pontificated that Cassini's Division was the only gap in Saturn's Rings. The cratering revealed by space probes on Mars, Mercury, and many smaller bodies came as a surprise to most astronomers. The surface of Venus could be permissibly conjectured to be either a planet-wide desert or an all-encompassing ocean.

In our older years, we are often obsessed with thoughts upon how we are to be remembered, if at all. Perhaps the pyramids of Egypt are the supreme example of human vanity of this kind. James Lick once considered a pyramid on Market Street in San Francisco as his possible future monument. I consider myself extremely fortunate in that John Westfall has taken over the supervision of the A.L.P.O. It is a pleasure still to play a minor role in its activities, and I wish it many years of success under his guidance.

THE VORACIOUS MOSQUITO COMPARED TO THE COMPANIONABLE SKUNK AS A TELESCOPIC ACCESSORY

By: David H. Levy, A.L.P.O. Comets and Meteors Recorder

A truly unique and remarkable achievement regarding The Strolling Astronomer is that it had but one Editor, Walter Haas, during its first 38 years of existence. Also, during that lengthy period a number of today's foremost planetary scientists got their start from its pages. I was looking at some early editions of the Journal when I noticed this somewhat unconventional request for an article, the first request (or item of any sort) ever to appear in the Journal, A.L.P.O. :

> ...and if he wishes to write an article for this leaflet about "The Voracious Mosquito Compared to the Companionable Skunk as a Telescopic Accessory," or even some other subject--we shall be glad to receive his manuscript.
>
> [Journal, A.L.P.O. , 1 , No. 1 (March, 1947), p. 1]

Sometimes an editor must be patient, but waiting 40 years for a requested article is perhaps a record of some sort. And, as this Journal is intended as a record of observation, and one hopes not fiction, the following events are true.

One summer night, while observing with my 20-cm. reflector, I heard an unnerving rustling sound in some nearby bushes. I jumped away from the telescope when I noticed two pairs of eyes staring at me, and attached to those eyes (it was a dark night) appeared to be the furry black-and-white bodies of two skunks.

With their proud tails held high, these animals rushed up to the telescope and started chasing each other around it. While I stood by at what I hoped was a safe distance, Mars ran after Venus (as I christened them) for over a minute before Venus, not to be outdone, suddenly turned tail and started chasing Mars in the other direction. After another minute, both Venus and Mars realized that I had been trying to sniff out variable stars instead of planets, and so they left my telescope stand, in an odorless huff, threatening to form a pier review committee to evaluate my use of telescope time.

During the same year, my friend Leo Enright attempted to observe with his 20-cm. Schmidt-Cassegrain. As he removed a low-power eyepiece and prepared to insert one of high magnification, four mosquitos flew into the optical system!

Both Leo and I were stung by the loss of observing time, but while the mosquitos were a source of annoyance and possible telescope damage, I'll never forget the night that my two small friends forced me to respect the universe in black and white.

SYNOPTIC REPORT FOR THE 1981-82 APPARITION OF THE PLANET JUPITER

By: P. Karl Mackal, ALPO Assistant Jupiter Recorder,
with the assistance of Régis Néel.

Introduction

The 1981-82 Apparition of the planet Jupiter covered the period between Jupiter's conjunctions with the Sun on 1981 OCT 14 and 1982 NOV 13. Jupiter was in opposition to the Sun on 1982 APR 26, at declination -12°.0 with an apparent disk diameter of 44".45 equatorial and 41".49 polar. The Earth's zenocentric declination was then 3°.3 south, and that of the Sun was 3°.0 south.

Figure 1 (p. 54) shows the standard nomenclature of the permanent and semipermanent features of the Giant Planet and should be referred to in order to help interpret the text, where the names of features are often abbreviated. Other abbreviations used are "p.e." for preceding (celestial west) end, "f.e." for following (celestial east) end, "Sp" for South preceding, "Sf" for South following, "Np" for North preceding, "Nf" for South following, and "CM" for Central Meridian (the north-south line that passes through the center of the apparent disk). This report also consistently expresses dates and times in Universal Time (U.T.).

During this apparition, Jupiter was extensively studied by the following observers in the United States, Europe, Japan, and Africa:

Table 1. A.L.P.O. Jupiter Observers, 1981-82 Apparition.

		Number of Observations		
Observer Name and Location	Telescope Aperture and Type	Full-Disk Drawings	Strip Sketches	Photographs
Leo Aerts (Belgium)	15-cm. Refractor	8	-	-
Claus Bagger (Denmark)	20.3-cm. Reflector	13	-	-
Phillip Budine (New York)	10-cm. Refractor	-	2	-
Mark Daniels (Kansas)	20-cm. Reflector	15	-	-
Jean Dragesco (Bénin)	35.5-cm. Reflector	57	-	47
Ray Fabre (Hawaii)	20-cm. Reflector	1	-	-
Alan Heath (England)	30-cm. Reflector	1	-	-
Richard Hill (Arizona)	23.5-cm. Refractor	13	-	-
Mike Morrow (Hawaii)	41-cm. Reflector	-	18	-
Jose Olivarez (Kansas)	(Various Telescopes)	5	9	-
Toshihiko Osawa (Japan)	32-cm. Reflector	19	-	-
Donald Parker (Florida)	32-cm. Reflector	-	-	7
Clay Sherrod (Arkansas)	(Various Telescopes)	7	3	-
Dan Troiani (Illinois)	25-cm. Reflector	5	6	-
Wayne Wooten (Florida)	20-cm. Reflector	4	-	-
TOTAL		148	38	54

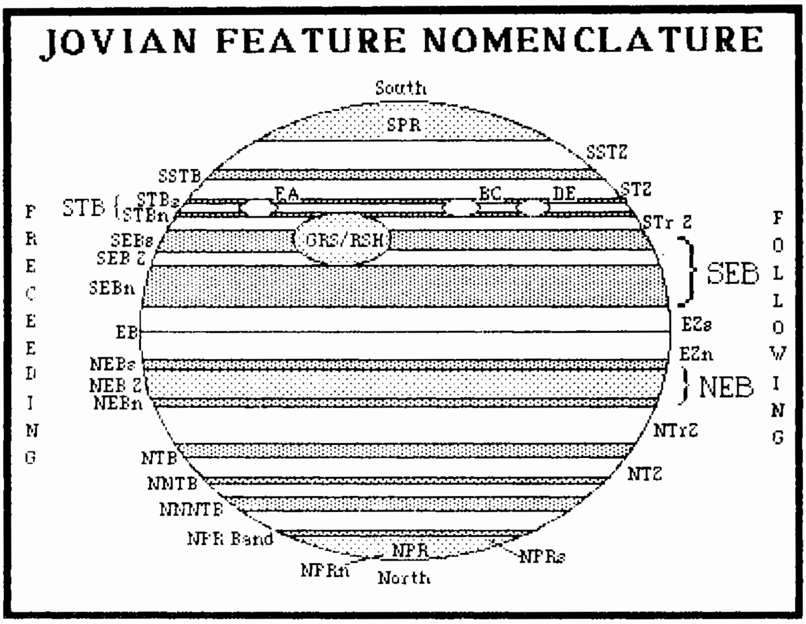


Figure 1. Standard nomenclature for the permanent and semipermanent features of the planet Jupiter that are mentioned in the text, oriented with south at the top and preceding to the left. The meanings of the abbreviations, from south to north, are: SPR = South Polar Region, SSTZ = South South Temperate Zone; SSTB = South South Temperate Belt; STZ = South Temperate Zone; STB = South Temperate Belt, often divided into a South Component (STBs) and a North Component (STBn); STrZ = South Tropical Zone; SEB = South Equatorial Belt, usually divided into a South Component (SEBs), a North Component (SEBn), and a Zone separating the two components (SEB Z); EZ = Equatorial Zone, with a South Component (EZs) and a North Component (EZn); Equatorial Belt (EB); NEB = North Equatorial Belt, divided into a South Component (NEBs) and a North Component (NEBn), separated by a Zone (NEB Z); NTrZ = North Tropical Zone; NTB = North Temperate Belt; NTZ = North Temperate Zone; NNTB = North North Temperate Belt; NNNTB = North North North Temperate Belt; NPR = North Polar Region, sometimes divided into a South portion (NPRs) and a North portion (NPRn) and bounded by a dark band (NPR Band). Other features are the Great Red Spot (GRS) or Red Spot Hollow (RSH) and the three STZ or STB White Spots, "BC", "DE", and "FA." This report consistently uses the abbreviations "Tr" for "Tropical" and "T" for "Temperate." Note that longitudes on Jupiter are referred either to "System I," for the EZ, the south edge of the NEB, and the north edge of the SEB, or to "System II," which is used for the remainder of the disk; the south edge of the NTB rotates closer to System I than to System II, however, while the SEB Z often is intermediate between the two Systems.

Resumé

Although the NEB was in its single aspect during 1981-82, it was inactive, with our data indicating no NEB Disturbance during January-March, 1982. How was this possible? The NEB's single aspect occurs only when one or the other of its two components (NEBs or NEBn) dominates the entire belt. Therefore, activity must commence in both components for there to be a real eruption on the same scale as in the SEB. In contrast, the SEB was far more conspicuous than the NEB throughout the apparition. Although the SEB was in its single aspect, it was still quite active, and the SEB had been in this active phase since 1977-78. First, this belt erupts more forcefully over a single component than does the NEB as a whole. Second, because the SEBn is often active, only the re-emergence of the SEBs is usually required for there to be a full-fledged SEB Disturbance. This is in contrast to the NTB, which is an old "tired" belt, while the SEBs is a new young belt in the making. Perhaps the NEB is also a somewhat older feature. Whenever both SEB components are active, as they were in this apparition, they appear to merge due to their darkness rather than to the cessation of activity in either component, as is the case for the NEB. SEB Z festoons following the GRS during April, 1982, remained stationary in System II longitude. We doubt that a minor SEB Disturbance occurred there at that time. Activity in the STrZ was diminishing, of course. Unlike the case with the events of 1979-80 and 1980-81, it is doubtful that sparse activity in that zone heralded anything similar to a STrZ Disturbance. Such isolated events (mostly dusky gray columns) either were the remnants of previous features or were due to the fragmentation of the SEBs itself, rather than the STB. There was no other activity in this zone, except for a white rift (or spot), because the SEB was in its single aspect.

In the remainder of this report, when possible, features are described in south-to-north order, progressing from the SSTZ to the NPR.

Southern Hemisphere Synopsis

According to Néel, the SSTZ was rather veiled throughout the apparition, and Dijon's disk drawings (not contributed to the A.L.P.O.) showed this area as relatively clear over the portion between FA and BC [Néel, 1984]. The SSTB was very faint during 1981-82, resembling a clearly drawn line, not unlike the appearance of the northern or the southern component of the STB. However, the visibility of the SSTB varied somewhat over particular System II longitude ranges according to the French observing group. In fact, the SSTB was somewhat darker than normal up to the area of the GRS at the time of the GRS-FA conjunction. On 1982 JAN 19 Dragesco could not detect the SSTB at all near 237° II. On FEB 19 he photographed its f.e. very near 211° II, and on APR 12 he also photographed the p.e. of this belt very near 337° II.

The STZ was quite wide over some regions and rather narrow over the remainder. Dragesco recorded many bright patches, which sometimes resembled white ovals, in this zone. On 1981 DEC 27 Parker photographed a dusky portion of the STZ between two elongated white ovals, as shown in Figure 3 [p. 62]. Also, on 1982 JAN 23 Dragesco depicted another dusky portion of this zone. On MAR 05 he noticed a p.e. of the STZ near 136°II. Finally, on MAR 09 he photographed another STZ p.e. near 325°II [see Figure 9 , p. 63].

The conjunction of FA with the GRS occurred from 1982 APR 24 to MAY 09. Throughout this apparition, FA appeared indistinct, or without its usual dark hood. Oval DE was slightly less conspicuous than BC although both ovals were clearly delineated in brightness and extent. On 1981 DEC 06 Dragesco detected a faint STB, starting at 113°II (just preceding FA) and continuing thereafter in a following direction [see Figure 2 , p. 62]. On DEC 21 he traced the f.e. of this faint section all the way to 223°II (near BC). On DEC 27 a black-and-white photograph by Parker [reproduced here as Figure 3 , p. 62] confirmed this last impression of the STB.

The STBs was somewhat darker than the STBn over a span of 110° in System II longitude. According to Néel, the less influential long-enduring oval FA, and the more disruptive long-enduring oval BC, not only produced the faint STB between them, where the STBn was absent, but without doubt caused the section where the STBs was darker than the STBn. Perhaps the immediate cause of this difference was the injection of a white haze over the fainter region. Indeed, only the edges of the STB could be seen over the longitude span in question.

On 1982 JAN 30 Dragesco depicted the same faint section as then starting near 080° II and ending, of course, near 211° II, so that this faint section now extended for 131° in System II longitude; the drift rate of its p.e. was -19°.1 II every 30 days, giving a rotation period of 9h 55m 14.5s. Indeed, on FEB 06 Troiani noticed the faint section between 154° and 170° II. On FEB 16 Dragesco confirmed the earlier impressions of the STB near 130° II with a black-and-white photograph [see Figure 5 , p. 62]. By then, the faint section was getting longer because its f.e. was rotating more slowly than its p.e.; the former showed a drift rate of -13°.4 II every 30 days, or a period of 9h 55m 22.5s.

Three observers reported visual numerical intensity estimates, colors, or both for the GRS (or RSH) in the 1981-82 Apparition. The intensity scale used is such that 0 represents completely black shadow and 10 is the brightest possible white tone. These results are given in Table 2 below.

Table 2. Intensity Estimates for the GRS (RSH) in the 1981-82 Apparition.

Date 1982	Observer	Intensity	Filter Used	Color Noted
FEB 16	Morrow	7.0	Blue	---
MAR 22	"	6.7	Blue	---
APR 24	Heath	---	Red	Red
MAY 03	Olivarez	---	White	Pink
MAY 04	Heath	7.0	White	---
" "	"	8.5	Red	Red
" "	"	5.0	Blue	---
MAY 10	Morrow	8.5?	Blue	---
MAY 16	Heath	5.0	Blue	---
" "	"	8.5	Red	Red
" "	"	7.0	White	---
JUN 10	Morrow	8.0	Blue	---
JUN 15	"	8.0	Blue	---
JUL 05	Olivarez	---	White	Pink
AUG 03	"	---	White	Pink

The reader should recall that the GRS revived toward the end of the previous apparition, in May, 1981 [Mackal, 1985, p. 64], at the same time as the decline of the STrZ Disturbance by 1981 MAY 20. The GRS remained prominent from 1982 JAN 02 through MAY 10; thereafter, the RSH reasserted itself until observations ended on SEP 06.

The STrZ had been already very perturbed in the 1979-80 Apparition and erupted significantly in 1980-81. Throughout 1981-82 small bright white ovals, slanted dusky gray columns, and dark brown Sp and Sf festoons dotted the entire zone. This activity was actually superimposed on a continuation of the 1980-81 eruptive activity. In the 1981-82 Apparition STrZ activity reflected a vigorous interaction of an enlarged SEBs with the STrZ. Without the SEBs being active in this region, there would have been no such activity. "Region One" of this residual activity extended from the position of DE (moving from 287° II in March to 267° II in May) up to and including the GRS (which itself moved from 025° II in March to 022° II in May). According to Néel, four plumes in the STrZ moved at a mean rotation period of 9h 55m 32.4s. "Region Two" was centered upon BC (i.e., at 173°.5 II on opposition day, APR 26). There was very little activity in the STrZ portion that fell between the GRS and BC, however, as was also the case for the region between BC and DE. In the event of a re-eruption of the STrZ Disturbance, activity would be expected in these intervening portions of the zone. Dragesco noted Bogus activity on 1982 JAN 23, following the CM at 117° II, near the following limb of the planet. On 1981 DEC 08 he had also detected a small white oval in the STrZ, just preceding the GRS. Dragesco depicted another white oval on 1981 DEC 21, following the CM at 208° II (near BC), which was followed by a Sf festoon. On the next day, he reobserved the oval of DEC 08, which by then was preceding the GRS by about 45° II. On 1982 JAN 19 Dragesco reobserved the festoon of DEC 21, now slightly preceding of the CM at 237° II. On JAN 26 he reobserved the oval of DEC 21, by then very close to 213° II. On FEB 17 Dragesco detected another

Sf festoon in the STrZ, near DE, which was followed by another small white oval near the following limb. On 1982 MAR 06 he photographed the STrZ region just preceding DE. This photograph, reproduced here as Figure 8 [p. 62], shows a narrowing of the zone starting at 256°II. Finally, on MAR 09 Dragesco confirmed this narrowing of the STrZ following DE, as well as at 325°II, with another black-and-white photograph [see Figure 9, p. 63].

In addition to all this activity, another such event transpired, involving the STB and its flanking zones, resulting in a rift or a white clear bright furrow connecting the STrZ to the STZ. This marking was photographed first by Dragesco on 1982 MAR 22 when it was following the GRS [see Figure 10, p. 63], and again by him on APR 24 [as shown on Figure 19, p. 64], when it was alongside the GRS. Based on Néel's data, this feature drifted by -12° II in 30 days, giving a rotation period of 9h 55m 24.1s. On MAR 23 Sherrod noticed a dusky section that was invading the STrZ, extending from the f.e. of the GRS to about 35° beyond that point. On APR 12 Dragesco noted another small white oval on the preceding side of the planet, which was followed by a slanted grey column, with a smaller white oval on the CM at 321° II. This last oval was itself followed by a second slanted grey column, which appeared on the following side of the disk. On APR 18 he photographed a small bright white oval on the CM at 211°II. Then, on APR 22 Dragesco photographed two humps in the STBs which extended into the STrZ near DE, on the following side of the planet. Oval DE was then apparently at the center of a thickening part of the SEBs, with a single plume that lay immediately southward in the STZ. On JUN 12 Dragesco depicted a faint band in the STZ, issuing from behind the following limb, with a small white oval situated between it and the STB. On JUL 27 Daniels saw this STZ band as connected to the STBs, near BC, at about longitude 133°4 II [see Figure 35, p. 67].

For some System II longitude ranges, either the SEBn or the SEBs was the more prominent SEB component. Over the remainder of its extent, the SEB as a whole was intensely dark and conspicuous. For the most part, the SEB was in its single aspect. During 1981-82, the SEBn was active just following the GRS, up to and including the region in conjunction with BC. Both SEB components were active from the region nearest BC to the region nearest DE. The SEBs was active just preceding the GRS. On 1981 DEC 06 Dragesco detected a p.e. of a darker portion of the SEBn at 113°II, shown here on Figure 2 [p. 62]. On 1982 JAN 02 Parker photographed a bright SEB Z just following the GRS, a condition that lasted throughout the apparition. On JAN 20 Aerts delineated two components of the SEB at 014° II [see Figure 4, p. 62]. On JAN 23 Dragesco depicted the darker section of the SEBn at 117°II. On FEB 15 he detected a darker section of the SEBs at 338°II. On MAR 03 Dragesco photographed a very dark SEB at 206° II [Figure 7, p. 62], and on MAR 06 he photographed a similar state of affairs at 256°II [see Figure 8, p. 62]. A photograph by Dragesco on MAR 26 showed that the same SEBs darker section was present at longitude 021° II. Finally, a black-and-white photograph by Parker on APR 16 showed this feature at 018°II [see Figure 17, p. 64].

According to Néel, during the course of this apparition, both the EZs and the EZn appeared to be veiled by a single white hazy sheet, so that the entire region was monotone. Residual activity in the STrZ was mirrored in the EZs, due to the vigorous interaction with it of an enlarged SEBn. On 1981 DEC 06 Dragesco depicted a small white oval at 173°I [Figure 2, p. 62]. On DEC 21 he also noticed a dusky patch in the EZ near 026°I. On 1982 JAN 01 Dragesco detected another small white oval on the following limb of the planet. On JAN 20 Aerts noted a dusky gray column near 060°I [Figure 4, p. 62]. On JAN 23 Dragesco noticed a similar type of residual activity in both the STrZ and the EZs. This activity took the form of a Sp festoon to the south, followed by a small white oval on the following limb. However, to the north there was a small white oval followed first by a Np festoon and s econd by another small white oval near the following limb. On JAN 26 Dragesco showed a Nf festoon on the preceding side of the planet, followed by a small white oval just preceding the CM at 304°I, with another small white oval following it. On MAR 23 Sherrod observed two small white ovals in the EZ, the first at 206° I and the second one near 258°I. On JUN 02 Dragesco detected a Np festoon near 020°I. On JUN 04 he confirmed this feature near 029°I with a black-and-white photograph. On JUL 04 Dragesco depicted a white oval on the preceding limb and another small white oval on the CM at 147°I.

Alan Heath furnished a series of visual numerical intensity measures for the STrZ and the EZs, which are given in Table 3 (p. 58).

Table 3. Intensity Estimates by A. Heath for the STrZ and the EZs in the 1981-82 Apparition.

1982 Date	CM Longitude Sys. II	Sys. I	A.L.P.O. White Light Intensity STrZ	EZs	Red Light Duskiness STrZ	EZs	Blue Light Duskiness STrZ	EZs
FEB 15	036°	272°	8.5	8.5	---	---	---	---
APR 13	182°	148°	9	8.5	0.5	0.5	2.5	1
15	050	030	9	8.5	2	1	---	2
16	261	249	9	9	1.5	0.5	3.5	1
18	199	203	9.5	9.5	0.5	0.5	2	1
19	346	357	9	8.5	1	1	4	2
23	230	272	9.5	9	1	0	3	1
24	030	080	9	9	0.5	0.5	2.5	1
MAY 03	204°	321°	9.5	9	1	0.5	3	1
04	061	186	9.5	9	2	0	3.5	1
05	196	329	9.5	9.5	0.5	0	2	1
08	299	095	9.5	9	1.5	0.5	3	1
09	118	272	9.5	9	1	0.5	3	1
11	017	200	9.5	8.5	1.5	0	3	1
13	313	147	9.5	8.5	1.5	0	3.5	1
14	104	305	9.5	9.5	0.5	0.5	1	1
16	044	261	9.5	9	1	0.5	---	1
25	335	261	9.5	9	0.5	0.5	2	1
29	235	191	9	9.5	0	0.5	2	1
JUN 29	200°	033°	9.5	9	---	---	---	---
JUL 03	075°	298°	9.5	9	---	---	---	---

NOTES: A.L.P.O. intensities are on the 0 (darkest) - 10 (brightest) scale used in Table 2. Duskiness is measured on a inverse scale, with 10 the darkest and 0 the brightest. A Wratten 25 Filter was used for the red light estimates, and a Wratten 47 Filter was used for blue light.

Overall, the brightness of the STrZ was 9 while that of the EZs was 9.3, according to Heath. It is clear from the above table that the STrZ was darker (more dusky) than the EZs in both red and blue light. On 1982 APR 15 Heath described the STrZ as "dull and yellowish" at 050° II and the EZs as "off white" at 030° I. Intensity estimates for the SEB, along with those for the NEB, are given in Table 4 [p. 59].

Northern Hemisphere Synopsis

A false EB that was reported appeared actually to be an envelope of the south ends of festoons which issued southward from the NEBs, just north of the equator. Nineteen features were observed in the EZn, each differing slightly from its neighbors in terms of drift rate. The mean rotation period was found by Neel to be 9h 50m 29.9s. As already indicated, in 1980-81 there appeared to be a stationary wave controlling the North Equatorial Current. During the 1981-82 Apparition, there was considerable activity in the NEBs, but not in the NEBn. The correlation of concurrent events in both components was rather low. There was clear-cut evidence for the revival of the NEBs and the EZn, although activity in the latter was apparently absent from 1982 APR 14 to JUN 04. On 1981 DEC 06 Dragesco detected an active NEBs at 173°I [see Figure 2 , p. 62]. On DEC 27 Parker photographed a large white oval in the EZn on the preceding side of the planet [Figure 3 , p. 62]. Dragesco depicted a NEB Z near 023°I on 1982 FEB 16 [Figure 5 , p. 62]. On FEB 19 he noticed a small bright white oval in the EZn near 126°I [see Figure 6 , p. 62]. Dragesco photographed another active EZn component at 286°I on MAR 06 [Figure 8 , p. 62]. On MAR 09 he rephotographed a fabulous festoon with a square base near

017°I [see Figure 9 , p. 63]. On MAR 14 Parker confirmed "the box" in the NEBs [Figure 11 , p. 63]. On MAR 26 Dragesco photographed a large white oval in the EZn just preceding the CM at 209°I. On JUN 04 he photographed another active EZn component at 029°I. On JUN 06 Dragesco photographed two intersecting festoons on the following side of the planet [see Figure 30 , p. 66]. On JUL 03 Daniels noted two small barge-like features [dark oblong spots] in the NEBs following the CM at 157°I. Olivarez perceived the same two features on JUL 04, following the CM at 166°I. Finally, on the same day, Dragesco photographed the active component again, at 034°I.

Three types of formation corresponding to three distinct regions occurred in the NEBn, according to Néel. Two rifts connected the EZn and the NTrZ via the NEB Z. Next, spots moved along the edge of the NEBn up to the main NEB Z-NTrZ rift. These spots appeared to be borne by the wake of this very rift and of another one following it, which connected the EZn to the NEB Z. This entire region became stretched out in the following direction. Finally, there were two dark elongated barges, one 12° in length and the other 15°. On 1982 APR 05 Dragesco photographed both these barges in the NEBn, on opposite sides of the CM. These two barges appeared identical to those observed in 1978-79, 1980, and 1981. Their mean drift rate was -8°.7 per 30 days, giving a rotation period of 9h 55m 28.6s. On APR 16 Parker photographed a single NEB up to and including the CM at 018°II, followed by a dual NEB [see Figure 17 , p. 64]. On APR 24 Dragesco photographed another blackish feature in the NEBn, on the preceding side of the planet [see Figure 19 , p. 64]. On APR 29 he depicted another such barge on the following side of the planet. On JUN 02 Dragesco could still see the first feature. On JUN 12 he could still see the second barge as well. Table 4 below, gives intensity estimates for the NEB, along with those for the SEB.

Table 4. B.A.A.-Scale Intensity Estimates by A. Heath for the NEB and the SEB in the 1981-82 Apparition.

1982	CM Longitude		B.A.A.-Scale Intensity Estimate*					
			White Light		Red Light		Blue Light	
Date	Sys. I	Sys. II	NEB	SEB	NEB	SEB	NEB	SEB
FEB 15	272°	036°	5.5	5.5	---	---	---	---
APR 13	148°	182°	5	5.5	4	4.5	6	7.5
15	030	050	5.5	5.5	4.5	4.5	7	7.5
16	249	261	5	5.5	4.5	5	7	7.5
18	203	199	5	5.5	4.5	5	7	7.5
19	357	346	5	5.5	4.5	5	7	7.5
23	272	230	5	5.5	4.5	5	7	7.5
24	080	030	5	5.5	4.5	4.5	7.5	7.5
MAY 03	321°	204°	5	5.5	4.5	4.5	7	7.5
04	186	061	5	5.5	4.5	4.5	7	7
05	329	196	5	5.5	4.5	5	7	7.5
08	095	299	5	5	4.5	4.5	7	7
09	272	118	5	5	4.5	4.5	7	7
11	200	017	5	5.25	4.5	4.5	7	7.5
13	147	313	5	5	4.5	4.5	7	7
14	305	104	5	5	4.5	4.5	7	7
16	261	044	5	5.25	4.5	4.5	7	7.5
25	261	335	5	5	4.5	4.5	7	7
29	191	235	5	5.5	4	4.5	7	7.5
JUN 29	033°	200°	5	5.5	---	---	---	---
JUL 03	298°	075°	5	5	---	---	---	---

* Note that the B.A.A. intensity scale runs from 0 as brightest to 10 as darkest and is thus the inverse of the A.L.P.O. scale.

The B.A.A. and A.L.P.O. intensity scales are complements of each other. The A.L.P.O. scale estimates brightness, the B.A.A. darkness, so both scales are useful. On the average, the NEB was 0.31 points brighter than the SEB in white light, 0.2 points brighter in red light, and 0.35 points brighter in blue. The B - R duskiness index (the difference between B and R intensities) was 2.50 for the NEB and 2.68 for the SEB, according to Heath, giving an overall difference in duskiness between the NEB and SEB of 0.18 points.

On 1981 DEC 21 Dragesco detected a small white oval in the NTrZ just preceding the CM at 208°II. The next day, he depicted another small white oval folloWing the CM at 001°II. On 1982 JAN 19 Dragesco spotted another such oval on the preceding side of the disk. On JAN 23 he detected another small white oval following the CM at 213°II. On JAN 30 Dragesco noticed yet another such oval on the preceding side of the planet, which he detected again on FEB 06. On FEB 17 Dragesco noted still another small white oval on the preceding side of the disk. On MAR 21 he photographed a bright NTrZ at 241°II. On MAR 23 Sherrod delineated two consecutive columns in the NTrZ, just preceding the CM at 046°II. Finally, on APR 12 Dragesco detected a small white oval just preceding the CM at 321°II.

As regards the NTB, Heath described it as grayish and variable in tone. At times it was difficult to see, but at other times it could be seen quite well. In any case, this belt was a weak feature in the 1981-82 Apparition, and sometimes it could hardly be distinguished from the NPR. Indeed, on 1982 FEB 16 Dragesco could not even photograph the NTB at 130°II [see Figure 5 , p. 62]. On FEB 19 he photographed a small white oval in this belt on the following side of the planet [Figure 6 , p. 62]. On MAR 03 Dragesco confirmed the absence of the NTB, at 206°II, on a black-and-white photograph [see Figure 7 , p. 62]. According to Neel, this gap extended as far as longitude 248°II. On MAR 06 Dragesco photographed a faint NTB at 256° II[see Figure 8 , p. 62]. Parker photographed this belt as connected to the NPR Band on the preceding side of the planet on MAR 14 [Figure 11 , p. 63]. On MAR 21 Dragesco photographed two small white ovals in the NTB on the following side of the disk. On MAR 26 he photographed a faint NTB at 021°II, but Heath could not see the NTB at 017°II on MAY 11. Bagger noted the NTB as connected to the NPR Band on the following side of the planet, near 158°II, on MAY 14 [Figure 24 , p. 65].

Turning to the NTZ, Dragesco detected a bright zone at 113°II on 1981 DEC 06 [Figure 2 , p. 62]. On 1982 JAN 02 Parker photographed a dusky NTZ at 312°II. On JAN 23 Dragesco depicted a dusky zone at 117°II, while he noticed a light haze over the NTZ at 213°II on JAN 26. On FEB 06 he noted the same haze at 054°II. On FEB 16 Dragesco photographed a dusky zone at 130°II [Figure 5 , p. 62]. The following day, he spotted a large white oval in the NTZ at 270°II. Dragesco also photographed a light haze over this zone at 211° II on FEB 19 [Figure 6 , p. 62]. On MAR 05 he photographed a swarthy section of the NTZ at 142°II, when the NTZ had virtually disappeared. On MAR 09 the same observer photographed a light haze over the zone at 325°II [see Figure 9 , p. 62]. On MAR 23 Sherrod also observed a light haze over the NTZ at both 046° II and 098°II. On APR 05 Dragesco photographed a light haze over this zone at 353°II and on APR 15 a dusky section at 149°II [Figure 16 , p. 64]. He photographed two white ovals imbedded in an otherwise dusky section of the NTZ at 221°II on APR 28 [Figure 21 , p. 64]. On JUN 04 he photographed a light haze over this zone at 027°II. On JUN 07 Dragesco photographed a dusky section at 174°II, together with a slanted grey column on the following side of the planet, connecting the NTB with the NPR Band. On JUL 04 he photographed a mottled zone at 164°II.

Regarding the NPR, Dragesco detected a rod [a highly elnogated condensation] in this region on the following side of the planet on 1981 DEC 22. On 1982 FEB 06 he depicted a thin clear NPR Band at 054°II. He photographed a fragment of this band at 211°II on FEB 19 [Figure 6 , p. 62], as well as at 206°II on MAR 03 [Figure 7 , p. 62], which could still be seen as a fragmented band on MAR 05 at 142°II. On MAR 06 Dragesco photographed a dark rectangle in the NPR following the CM at 256°II [Figure 8 , p. 62]. On the following day he was unable to photograph the NPR Band at 047°II, although he was able to photograph it on MAR 09 at 325°II [Figure 9 , p. 62]. On MAR 11 he noticed the south edge of the NPR Band followed by a small white oval. (The south edge of this band can be associated with the NNTB.) Immediately thereafter, Dragesco noted the rectangle, first observed on MAR 06, at 261°II, followed by the north edge of the NPR Band. (The north edge of this band can be associated with the NNNTB. However, according to Néel, features in both components of the NPR Band moved at -2°25 II per 30 days, yielding a rotation

rotation period of 9h 55m 37.5s, which is typical of the North North Temperate Current.) On MAR 21 Dragesco photographed the f.e. of this band on the preceding side of the disk. On MAR 26 he photographed a gap in the NPR Band at 021° II. He detected this band at 066° II on APR 08 and at 321° II on APR 12. His photograph of APR 14 shows the north edge of the NPR Band at 304° II, when a fragment of the south edge followed it on the preceding side of the disk. Dragesco photographed both edges of the NPR Band at 149° II on APR 15 [Figure 16 , p. 64], while Parker photographed the band at 018° II the next day [Figure 17 , p. 64]. On APR 18, on the preceding side of the planet, Dragesco photographed the south edge of the NPR Band as connected to its north edge. On his APR 24 photograph, the NPR Band was not detected on the preceding side of the disk [Figure 19 , p. 64], although he did detect it at 072° II on APR 29. On MAY 09 he confirmed the NPR Band at 088° II on a black-and-white photograph. He photographed two rods in this band on MAY 15 at 290° II, one on the north edge and one on the south edge of the band [Figure 25 , p. 65]. On JUN 02 he depicted a rod in the NPR Band following the CM at 034° II. Dragesco photographed the two edges of the band on the preceding side of the planet on JUN 06, followed by a rod at 307° II on the following side [Figure 30 , p. 66]. On JUN 12 he recorded the NPR Band at 112° II. Finally, Olivarez on JUL 04 showed the following ends of both edges of this band at 301° II, although no associated rod was seen.

Rotation Periods

Régis Néel of France has kindly computed the following drift rates and rotation periods for Jovian features in the 1981-82 Apparition. Readers may wish to compare these values with those computed by Jupiter Recorder Phillip Budine for the same period [Budine, 1983].

Table 5. Summary of Drift Rates and Rotation Periods, 1981-82 Apparition.

Region	Drift Rate (30 Days)*	Rotation Period	Name of Current; Remarks
	°	h m s	
STZ	-29.7	9 55 00	May have been influenced by the SSTB.
	°		
FA	-14.5	9 55 21	
BC	-13.4	9 55 22	STB Current
DE	-13.1	9 55 23	
GRS	- 0.8	9 55 40	
	°		
STrZ	- 3.6	9 55 36	
SEB Z (A)	- 4.8	9 55 35	SEB Current
SEB Z (B)	-36.3	9 54 51	Current Uncertain
	°		
NEBs	- 0.06	9 50 30	NEB Current A; in System I.
NEBn	-30.5	9 54 59	NTrZ Current B
NTrZ	- 8.8	9 55 29	NTrZ Current A
?	+ 4.35	9 55 47	NTrZ Current C
NTB (Center)	+18.0	9 56 05	NTB Current A
	°		
NPRs	- 2.25	9 55 38	NNTB Current A
NPRn	- 2.25	9 55 38	NNTB Current A

* All drift rates are in terms of System II except for the NEBs, which is in System I.

References

Budine, Phillip W. (1983). "Jupiter in 1981-82: Rotation Periods." J.A.L.P.O. 30 , Nos. 1-2 (June), 17-23.

Mackal, P. Karl (1985). "Synoptic Report for the 1980-81 Apparition of the Planet Jupiter." J.A.L.P.O. 31 , Nos. 1-2 (Feb.), 2-10; Nos. 3-4 (Oct.), 64-69.

Néel, Régis (1984). "La Planete Jupiter en 1981-1982." l'Astronomie (July-August), 315-331.

SELECTED DRAWINGS AND PHOTOGRAPHS OF JUPITER DURING ITS 1981-82 APPARITION
(1981 DEC 06 - 1982 MAR 06)

[Note: In the captions for these illustrations, "Refl." stands for reflector, "Refr." for refractor, "S" for seeing on a 0-10 scale, and "T" for transparency on a 0-5 scale. South is toward the top in all views, as in the nomenclature diagram [Figure 1 , p. 54]. These figures are arranged in chronological order. Refer also to the text.]

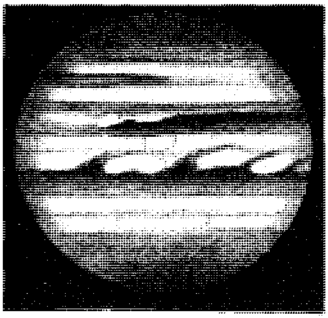


Figure 2. Drawing by Jean Dragesco. 1981 DEC 06, 05h 20m U.T. CM(I) = 180°; CM(II) = 116°. 35.5-cm. Refl., 244X. Seeing and transparency average. Note NEBs activity.

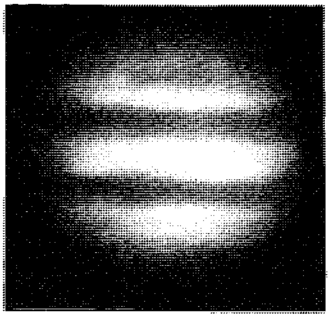


Figure 3. Photograph by Donald Parker. 1981 DEC 27, 11h 10m U.T. CM(I) = 106°; CM(II) = 241°. 32-cm. Refl. TP 2415 Film, 3 sec. at f/110. S = 8-10, T = 4.5.

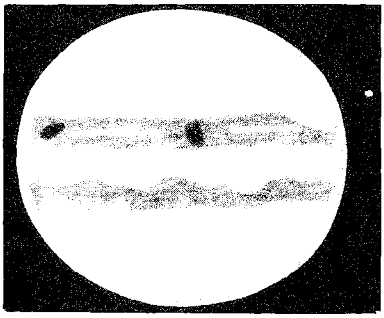


Figure 4. Drawing by Leo Aerts. 1982 JAN 20, 04h 45m U.T. CM(I) = 060°; CM(II) = 014°. 15-cm. Refr., 180X. S = 6-7. Note satellite Europa to the right.

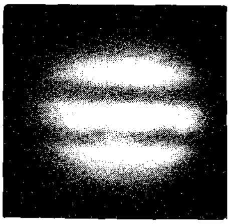


Figure 5. Photograph by Jean Dragesco. 1982 FEB 16, 05h 16m U.T. CM(I) = 023°; CM(II) = 130°. 35.5-cm. Refl.

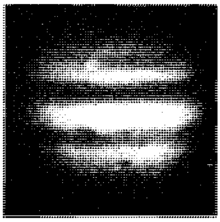


Figure 6. Photograph by Jean Dragesco. 1982 FEB 19, 04h 59m U.T. CM(I) = 126°; CM(II) = 211°. 35.5-cm. Refl. Note shadow of Europa below center.

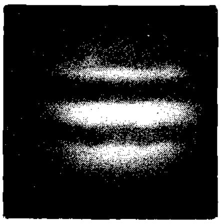


Figure 7. Photograph by Jean Dragesco. 1982 MAR 03, 04h 44m U.T. CM(I) = 213°; CM(II) = 206°. 35.5-cm. Refl.

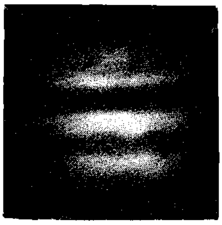


Figure 8. Photograph by Jean Dragesco. 1982 MAR 06, 03h 37m U.T. CM(I) = 286°; CM(II) = 256°. 35.5-cm. Refl. Note shadow of Io below and to right of center.

SELECTED DRAWINGS AND PHOTOGRAPHS OF JUPITER DURING ITS 1981-82 APPARITION
(1982 MAR 09 - APR 14)

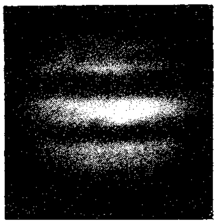


Figure 9. Photograph by Jean Dragesco. 1982 MAR 09, 03h 00m U.T. CM(I) = 017°; CM(II) = 325°. 35.5-cm. Refl. Note festoon below center.

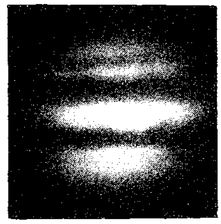


Figure 10. Photograph by Jean Dragesco. 1982 MAR 14, 03h 06m U.T. CM(I) = 091°; CM(II) = 000°. 35.5-cm. Refl.

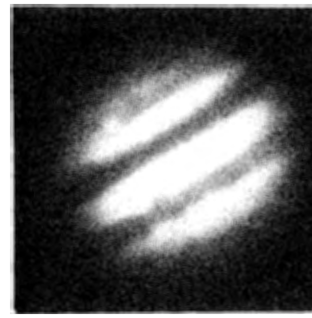


Figure 11. Photograph by Donald Parker. 1982 MAR 14, 08h 42m U.T. CM(I) = 296°; CM(II) = 204°. 32-cm. Refl. TP 2415 Film, 3 sec. at f/110. S = 10, T = 4.5

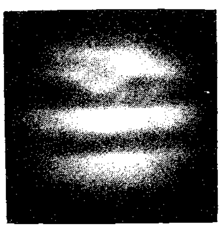


Figure 12. Photograph by Jean Dragesco. 1982 MAR 22, 01h 09m U.T. CM(I) = 204°; CM(II) = 053°. 35.5-cm. Refl . Note "furrow" to right of GRS, connecting the STZ to the STrZ.

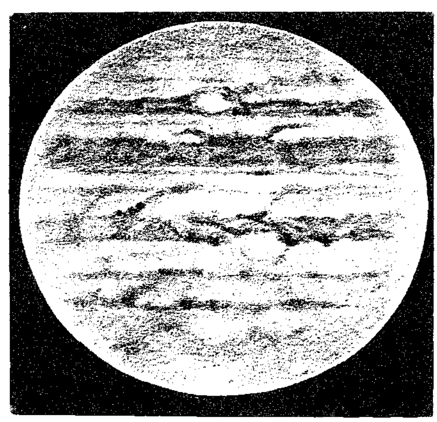


Figure 13 (to right). Drawing by Toshihiko Osawa. 1982 MAR 27, 16h 55m U.T. CM(I) = 130°; CM(II) = 296°. 32-cm. Refl., 391X. S = 6 - 4, T = 4.5.

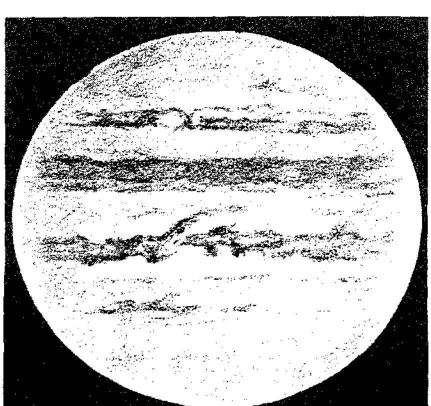


Figure 14. Drawing by Toshihiko Osawa. 1982 APR 10, 18h 30m U.T. CM(I) = 241°; CM(II) = 299°. 32-cm. Refl., 335X. S = 4-5, T = 4.

Figure 15. Drawing by Toshihiko Osawa. 1982 APR 14, 18h 05m U.T. CM(I) = 138°; CM(II) = 166°. 32-cm. Refl., 335X. T = 2-3.

SELECTED DRAWINGS AND PHOTOGRAPHS OF JUPITER DURING ITS 1981-82 APPARITION
(1982 APR 15 - 28)

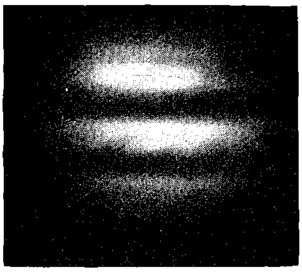


Figure 16. Photograph by Jean Dragesco. 1982 APR 15, 23h 24m U.T. CM(I) = 130°; CM(II) = 149°. 35.5-cm. Refl.

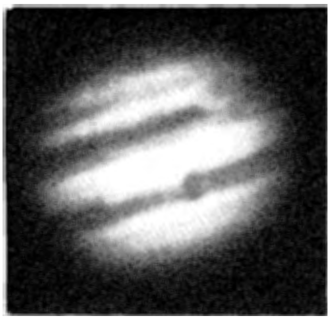


Figure 17. Photograph by Donald Parker. 1982 APR 16, 05h 43m U.T. CM(I) = 002°; CM(II) = 018°. 32-cm. Refl. TP 2415 Film, 3.5 sec. at f/110. S = 8, T = 4.

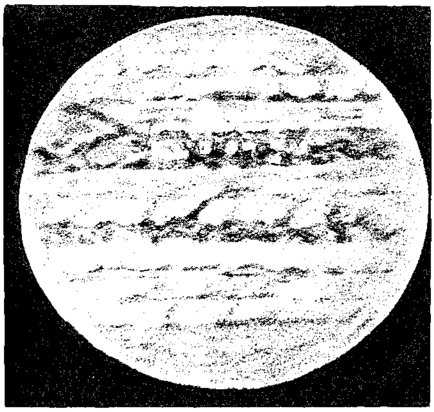


Figure 18. Drawing by Toshihiko Osawa. 1982 APR 21, 16h 55m U.T. CM(I) = 121°; CM(II) = 096°. 32-cm. Refl., 335X. S = 5 - 4, T = 4.5

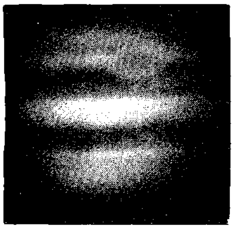
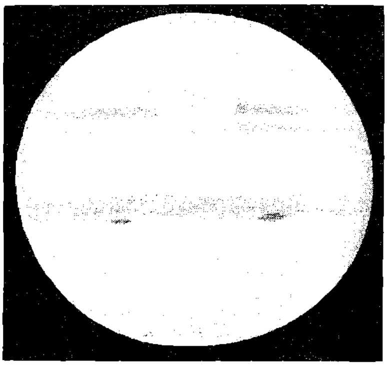


Figure 19. Photograph by Jean Dragesco. 1982 APR 24, 22h 50m U.T. CM(I) = 092°; CM(II) = 042°. 35.5-cm. Refl. Compare with Figure 20, drawn only 10 minutes later.



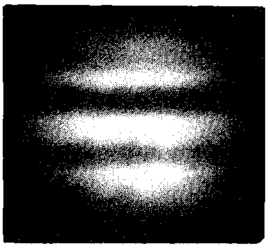


Figure 21. Photograph by Jean Dragesco. 1982 APR 28, 21h 06m U.T. CM(I) = 30P ; CM(II) = 221°. 35.5-cm. Refl.

Figure 20 (to left). Drawing by Alan Heath. 1982 APR 24, 23h 00m U.T. CM(I) = 098°; CM(II) = 048°. 30-cm. Refl., 190X. S = 3.

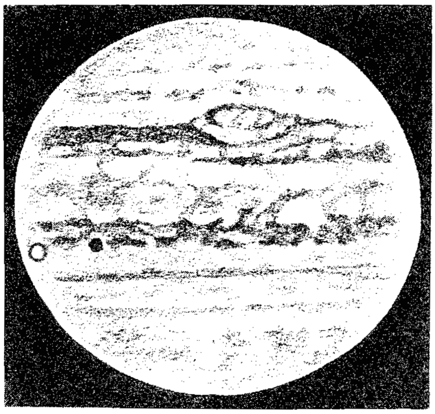


Figure 22. Drawing by Toshihiko Osawa. 1982 MAY 10, 16h 10m U.T. CM(I) = 216°; CM(II) = 047°. 32-cm. Refl., 391X. S = 4 - 5, T = 3.5. Note satellite Io and its shadow to left slightly below center.

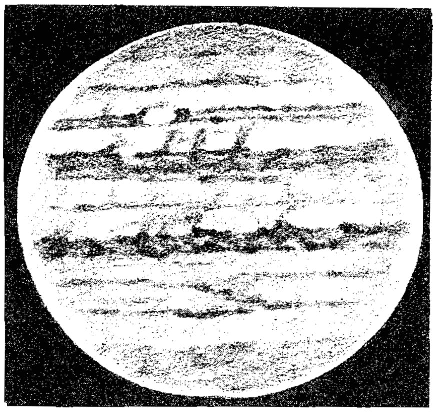
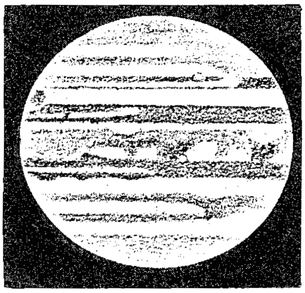


Figure 23. Drawing by Toshihiko Osawa. 1982 MAY 13, 14h 40m U.T. CM(I) = 275°; CM(II) = 083.° 32-cm. Refl., 335X. S = 5 - 3, T = 3 at best.



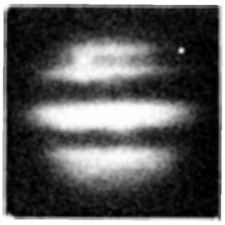


Figure 25. Photograph by Jean Dragesco. 1982 MAY 15, 22h 00m U.T. CM(I) = 140°; CM(II) = 290°. 35.5-cm. Refl.

Figure 24 (to left). Drawing by Claus Bagger. 1982 MAY 14, 21h 40m U.T. CM(I) = 330°; CM(II) = 128°. 20.3-cm. Refl.

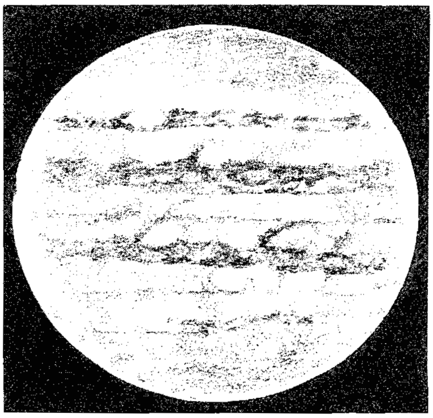


Figure 26 . Drawing by Toshihiko Osawa. 1982 MAY 17, 13h 55m U.T. CM(I) = 160°; CM(II) = 298°. 32-cm. Refl., 335X. S = 4 - 5, T = 3.5 - 2.

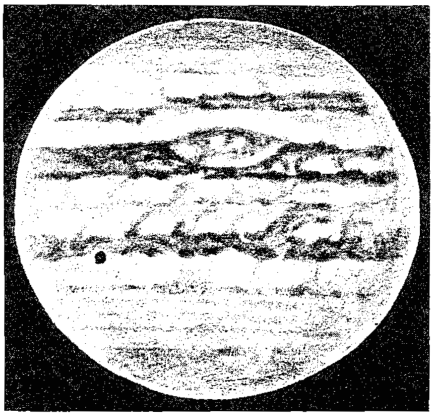


Figure 27. Drawing by Toshihiko Osawa. 1982 MAY 22, 16h 10m U.T. CM(I) = 312°; CM(II) = 051°. 32-cm. Refl., 335X. S = 6 - 3, T = 3 - 2.5.

SELECTED DRAWINGS AND PHOTOGRAPHS OF JUPITER DURING ITS 1981-82 APPARITION (1982 MAY 22 - JUL 08)

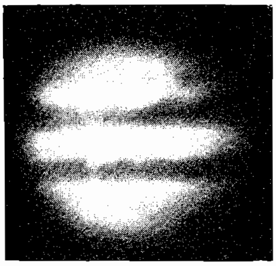


Figure 28. Photograph by Jean Dragesco. 1982 MAY 22, 21h 55m U.T. CM(I) = 162°; CM(II) = 259°. 35.5-cm. Refl.

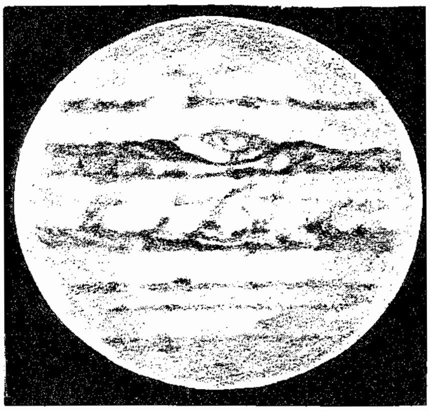


Figure 29. Drawing by Toshihiko Osawa. 1982 JUN 04, 11h 55m U.T. CM(I) = 050°; CM(II) = 051°. 32-cm. Refl., 391X. S = 5-3, T = 3.5.

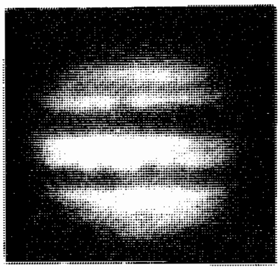


Figure 30. Photograph by Jean Dragesco. 1982 JUN 06, 20h 38m U.T. CM(I) = 324°; CM(II) = 307°. 35.5-cm. Refl.

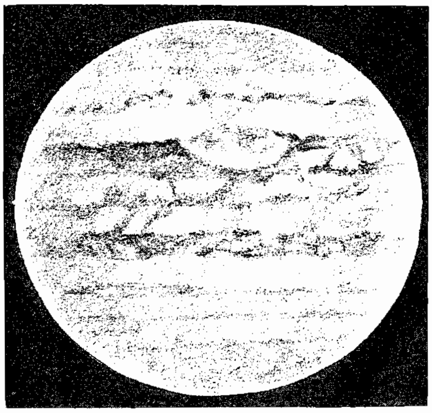


Figure 31. Drawing by Toshihiko Osawa. 1982 JUN 21, 10h 50m U.T. CM(I) = 174°; CM(II) = 046°. 32-cm. Refl., 335X. S = 5-3, T = 2.5.

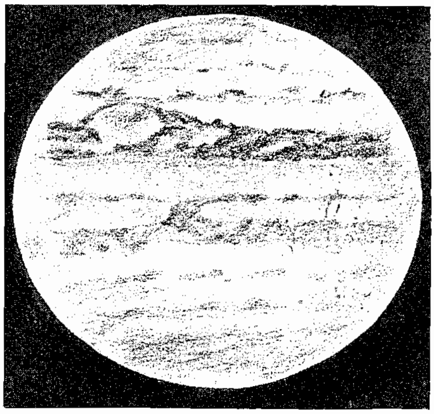


Figure 32 (to left). Drawing by Toshihiko Osawa. 1982 JUN 26, 11h 05m U.T. CM(I) = 252°; CM(II) = 086°. 32-cm. Refl., 335X. S = 4-5, T = 3-3.5.

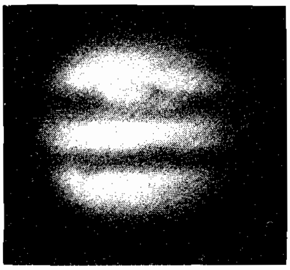


Figure 33. Photograph by Jean Dragesco. 1982 JUL 08, 20h 22m U.T. CM(I) = 326°; CM(II) = 064°. 35.5-cm. Refl.

SELECTED DRAWINGS AND PHOTOGRAPHS OF JUPITER DURING ITS 1981-82 APPARITION
(1982 JUL 22 & 27)

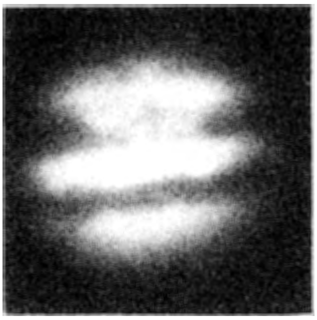


Figure 34. Photograph by Donald Parker. 1982 JUL 22, 02h 18m U.T. CM(I) = 073°; CM(II) = 071°. 32-cm. Refl. TP 2415 Film, 3.5 sec. at f/110. S = 6, T = 3.5.

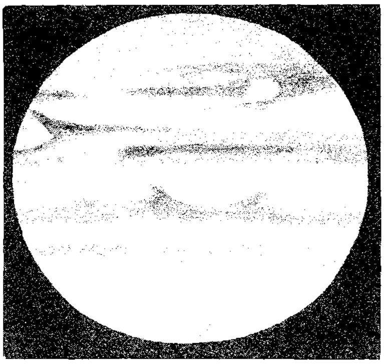


Figure 35. Drawing by Mark Daniels. 1982 JUL 27, 02h 45m U.T. CM(I) = 159°; CM(II) = 118°. 20-cm. Refl., 180X. Fair conditions.

LUNAR DOMES--FIRST OBSERVED BY JOHANN HIERONYMUS SCHROETER

By: James H. Phillips, M.D., A.L.P.O. Lunar Dome Survey Recorder

Robert Barker brought attention to lunar domes with his discovery in 1932 of the large dome within the crater Darwin, using a 12.5-in. reflector (Moore, 1953, p. 72). Accordingly, he is often cited in the literature as the earliest discoverer of lunar domes. Little is said of observations of lunar domes prior to 1932, although Moore does mention in an article in Sky & Telescope (1958) that some domes were known prior to Barker's discovery. W.L. Rae, in an article in the Journal of the British Astronomical Association (1966), mentions that domes were seen by T.G. Elger and J.N. Krieger, but "usually with little or no comment and when they were the term 'mound' was usually applied."

Prior to Mr. Barker's discovery, W. Goodacre, the second Director of the B.A.A. Lunar Section, President of the B.A.A. for 1922-1924, and Fellow of the Royal Astronomical Society, published a 72-inch map of the Moon in 1910. An examination of a reproduction of this map in Hutchinson's Splendor of the Heavens (1923) shows domes near Arago in Mare Tranquillitatis (p. 839), north of Hortensius in Oceanus Procellarum (p. 847), and west of Kies in Mare Nubium (p. 849).* His text refers only to the two domes near Arago, "There are two dome-shaped hills, one outside the E. [west] wall and the other to the N." (p. 840) The domes near Hortensius and Kies, while on the map, are not referred to. Goodacre's book, The Moon With a Description of Its Surface Formations (1931), contains a similar reproduction of this map with a descriptive summary of surface formations. Here he writes concerning Arago, "One diameter to the N. is a large round-topped dome-like hill, and a similar one will be found at about the same distance outside the E. [west] wall." (p. 74) [See Figure 36, p. 68.] Of the region near Hortensius he notes, "A little distance to the S. [/sic./; should be "N."] is a group of low round-topped hills on each summit of which R. Schlumberger, of Mulhouse, has found a crater pit, 1930, 8 Apl." (p. 128) [See Figure 37, p. 68.] Regarding the Milichius area, "On the plain, 40 miles to the E. [west] is crater A, possessing all the characteristics of Milichius, and between them a long ridge and some hills, one of which is a

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* The historical references use east and west in the classical or celestial sense (i.e., with Mare Crisum in the Western Hemisphere). The preferred convention recommended by the International Astronomical Union (IAU) places Mare Crisium in the Eastern Hemisphere and Gassendi in the Western. Classical directions quoted here are followed by the IAU direction in brackets.

round topped dome-like elevation, of which class of elevation but few are found on the Moon's surface." (p. 129) Finally, about the Kies dome he notes, "About 10 miles outside the E. [west] wall is a curious round-topped mountain, E, with a crater on its summit. Pickering has called attention to its resemblance to a terrestrial volcano, a type of formation of which very few examples have been found on the Moon." (p. 147) It is noteworthy that the dome near Milichius is shown on Goodacre's map as published in 1931 but is not shown on the 1923 version in Hutchinson's Splendour of the Heavens. [The long ridge and a small crater NW. of A are also missing from the 1923 map but are shown on the 1931 version. Ed.] I have not had opportunity to examine his original map published in 1910. Most interesting is the fact that in his introduction under "Surface Formations" there is a paragraph devoted to "Isolated Mountains" (p. 22) where Goodacre states, "Another class of elevations which, though few in number are of the highest interest, exist. These are the dome or bubble-shaped hills, some of which have crater-like openings on their summits. Several instances are referred to in the following pages. Two of these will be found between the craters B and C, East [west] of Schroeter. Two others [are] close to Arago, one on the West [sic. ; IAU west] and the other on the North side. The nature of these objects is at present obscure."

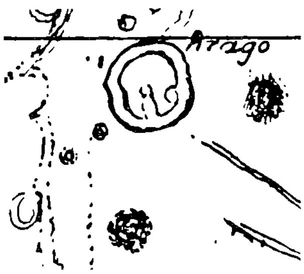


Figure 36. The region of Arago in the Goodacre map (1931, Section II, p. 70). The two Arago domes are shown by dark stipple patterns. South is at the top and classical west to the left in Figures 36-44.

Figure 37. Drawing of Hortensius and the domes to its north by R. Schlumberger on April 8, 1930, reproduced in Goodacre (1931, p. 127). Note the summit craters on five of these lunar domes.

Other mounds, rounded hills, or dome-like objects are referred to near Römer (p. 94), Linné (p. 106), Euler (p. 114), Parry (p. 129), and Hesiodus (p. 144). A photograph placed as the frontispiece to Section II (p. 72) labeled "Portion of the Mare Tranquillitatis From a Paris Photograph" clearly shows the two prominent domes near Arago.

At least two other observers detected lunar domes in the early years of this century. W.H. Pickering's discovery of the dome west of Kies in 1906 has already been mentioned; he concluded that this feature was a small shield volcano. Although I was unable to review J.N. Krieger's Mond Atlas (1912), the dome west of Arago is present on Plate 30 of this work, as is seen on the reproduction on page 262 of Joseph Ashbrook's Astronomical Scrapbook (1984).

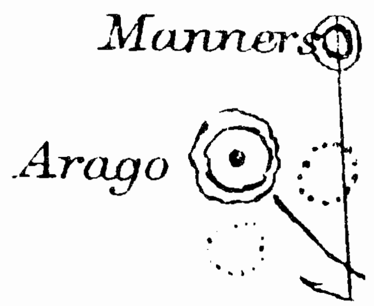


Figure 38. Region of Arago, showing the two nearby domes as dotted outlines. From T. Gwyn Elger (1895), following p. 38.

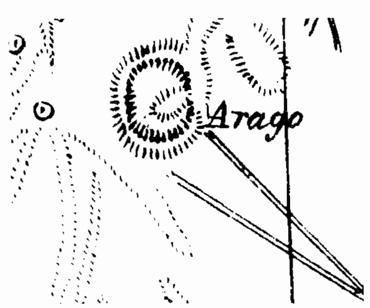


Figure 39. The Arago area as mapped by E. Neison (1876). The dome to Arago's west is shown as a plateau above the name of that crater.

In 1895, T. Gwyn Elger, the first Director of the B.A.A. Lunar Section, published The Moon. A Full Description and Map of Its Principal Physical Features. In it is a map of the Moon, divided into four quadrants, which shows the domes near Arago the First Quadrant (following p. 38) [see Figure 38 to the left.] He states, "There are two curious circular protuberances on the mare E. [west] of Arago..." (p. 48) and, on the Mare E. [west] of Kies is a curious circular mound..." (p. 108), although the dome near Kies is not drawn on Elger's map.

Edmund Neison in 1876 at the age of 25 published his work, The Moon , with an accompanying map in 25 sections. While lunar domes are neither specifically referred to nor recognized as being curious or unusual, as they were by Elger and Goodacre, close scrutiny of his map still shows the presence of lunar domes. One of two prominent domes mear Arago is plotted on Map II (facing p. 157) [reproduced to the left as Figure 39]. Referring to the area around Arago, Neison states, "...whilst south-east [southwest] is a low plateau rising into a peak on one side." (p. 169) The dome near Kies is also plotted, on Map XIV (following p. 365) and is described, "From the east [west] side of Kies A extends a straight ridge towards Campanus, ending in a small peak before reaching so far." (p. 381) He also refers to the "hill-land" to the north of Schroeter as "...covered with an immense number of small hills and ridges." (p. 300)

Finally, an examination of the plates drawn by Johann H. Schroeter and published in his Selenotopographische Fragmente (1791, 1802) shows that this pioneer in selenography first drew the lunar domes. His drawings of Mersenius and Hevel [see Figures 40 and 42 on pp. 70 and 71, respectively] may be criticized as showing only convex floors rather than true domes. Certainly, these features are not typical lunar domes, but neither is the large dome present within Darwin. Schroeter's two drawings certainly show dome-like crater floors, and Figure 41 [p. 70], a drawing of Mersenius by J.W. Durrad made in 1879, confirms Schroeter's impression of that crater. Schroeter's drawing of Hevel (along with his drawings of Aristarchus and Gassendi) is published in The Wonders of the Heavens by Duncan Bradford (1836) with the following comment, "Fig. 3 is a spot called Hevelius [Hevel], containing an annular cavity, and a broken elevation resembling an egg." (p. 142) Also of interest is Schroeter's drawing of Furnerius [see Figure 43 on p. 71]. This crater south of Petavius is drawn by Schroeter as having a dome-like object on the southern portion of its floor. Neither Neison, Elger, Goodacre, nor Wilkins and Moore made any mention of a dome or a dome-like object on the floor of Furnerius. This writer's inspection of this area as shown in the

[Text continued on p. 72.]

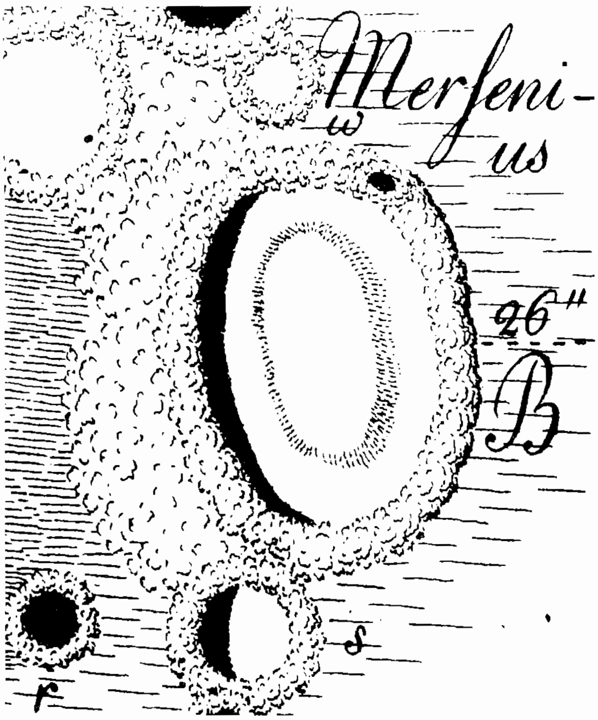
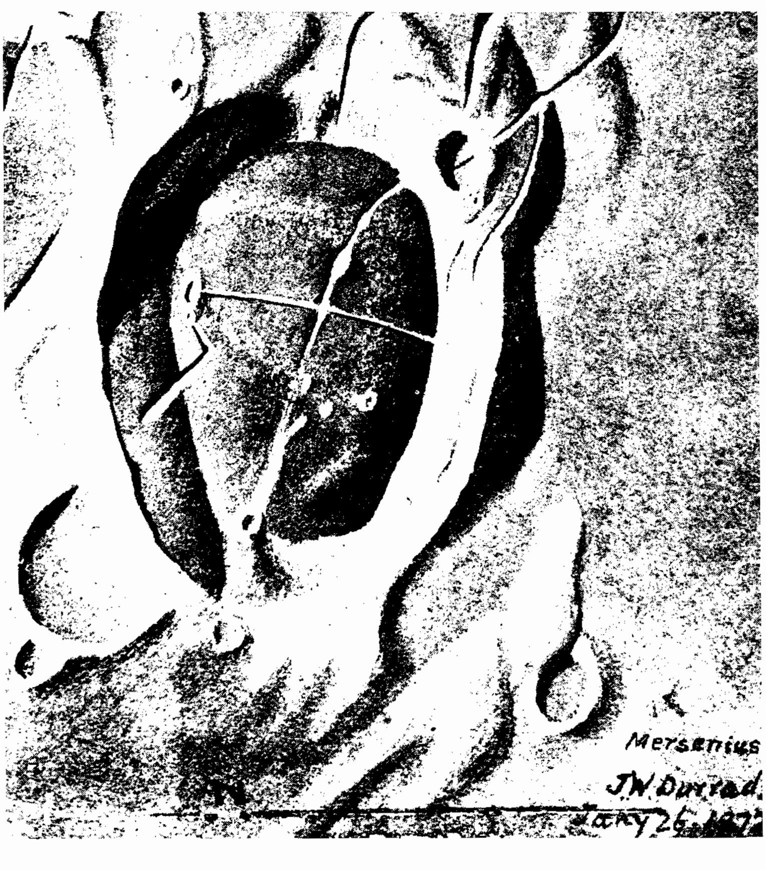


Figure 40. The crater Mersenius as drawn by Johann N. Schroeter (1791), showing the dome-like appearance of its convex floor.

Figure 41 (below). Mersenius as drawn in 1879 by J. W. Durrad (Goodacre, 1931, p. 292), confirming Shcroeter's interpretation in Figure 40.



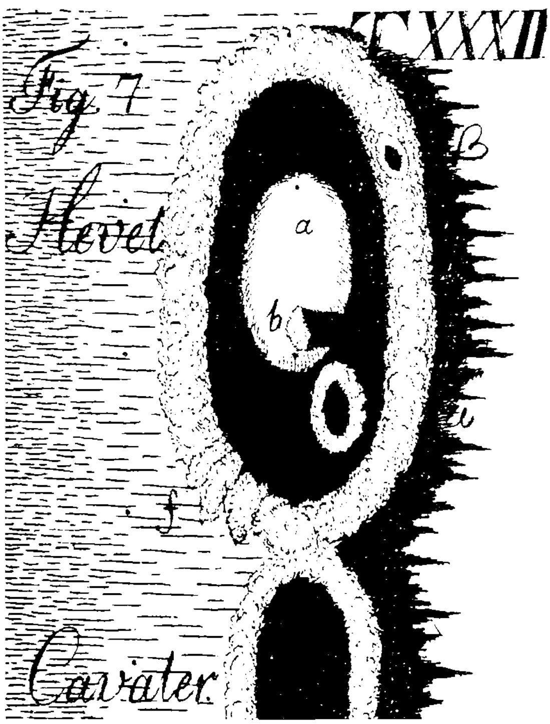
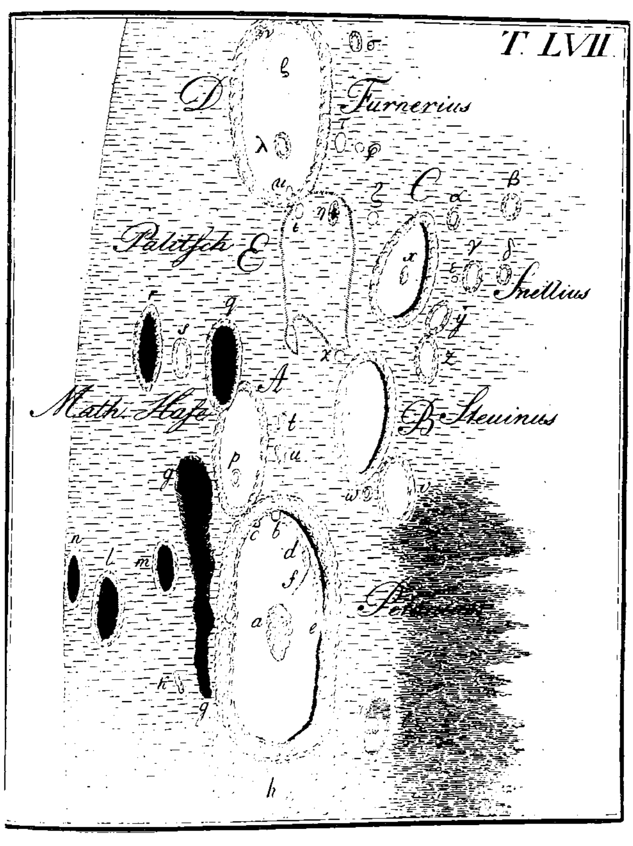


Figure 42. The crater Hevel, drawn by J.H. Schroeter (1791) under a low sun that highlights the dome-like convexity of its floor.

Figure 43 (below). The Petavius-to-Furnerius region, drawn by Schroeter (1791). In the southern (upper) portion of the floor of Furnerius is the dome-like elevation zeta. (ζ). Note that the names Stevinus and Snellius are reversed.



[Text continued from p. 69.]

Times Atlas of the Moon (1968), based on the U.S. Air Force Lunar Aeronautical Charts, includes only a small portion of Furnerius; and no conclusions may be drawn from it. Turning to A New Photographic Atlas of the Moon by Zdenek Kopal (1971), we can compare the region drawn by Schroeter [Figure 43 , p. 71] to a photograph made under similar lighting conditions [Figure 44 , below]. In the southern portion of Furnerius one can easily see a low dome-like swelling occupying slighty less than one-third of the crater floor, as is present in Schroeter's drawing. It is sometimes stated that Schroeter was a poor draftsman. Close comparison of his drawing [Figure 43 , p. 71] with the photograph below, made on January 7, 1966, using the 43-inch reflector of the Pic-du-Midi Observatory, suggests otherwise. Certainly Schroeter was correct in drawing the dome-like feature on the floor of Furnerius, a feature missed by many later observers.

In summary, the first drawings of lunar domes were made by J.H. Schroeter and were published in his Selenotopographische Fragmente. Neison drew objects on his lunar maps that are lunar domes, although he gave no special attention to them. Elger not only drew lunar domes on his maps but also mentioned them specifically as "curious circular mounds." Finally, Goodacre drew greater numbers of domes and actually classified them under "isolated mountains" in the introduction to his book, The Moon , and used the terms "domes" or "domelike" to describe them.

Figure 44. A photograph of the region between Petavius and Furnerius (Kopal, 1971; Pl. 63, p. 125). Compare this photograph with Schroeter's drawing of the same area on the previous page.

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A.L.P.O. SOLAR SECTION OBSERVATIONS FOR ROTATIONS 1761 - 1770 (1985 APR 17 TO 1986 JAN 14)

By: Richard E. Hill, A.L.P.O. Solar Recorder

Introduction

The period covered by this report showed very little sunspot activity. Many days saw sunspot numbers of zero, and the highest count for any day in this report was 85 (1985 07 09). [4] While this value exceeds the high for the last reporting period, it should be remembered that this report covers more rotations (10 versus 7). [13] Changes in sunspot numbers during this reporting period are graphed in Figure 45 below.

Sunspot groups or activity regions remained generally inactive with most not developing past Zurich Class C (the earliest class in which spots show penumbrae). There was one notable exception where four regions (each seen during a different rotation) could be related to the same position and may in fact have been the same group.

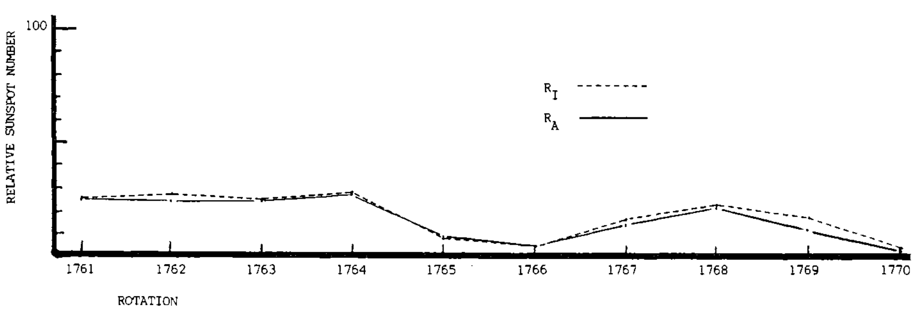


Figure 45. Graph of rotation means of R_I (The International Sunspot Number) and R_A (The American Sunspot Number) for Solar Rotations 1761 through 1770.

The term sunspot "group" is used here to refer to white light collections of sunspots only. A "region" refers to the entire feature in all wavelengths. Regions are enumerated by the Space Environmental Services Center (SESC) in Boulder, Colorado.

Times given in this report are Universal Time (U.T.). Directions are heliographic unless otherwise noted and are abbreviated (N, SW, etc.). Other terms and information in this report are defined in The Handbook for the White Light Observation of Solar Phenomena, available from the writer for $US 4.00.

The observers who contributed to this report are:

Observer	Telescope Aperture (cm.)	f-ratio	Type	Stop (cm.)	Location
Benavides, A.	20	f/13.8	Refractor	?	Venezuela
Blackburn, N.	15	f/15	Refractor	7.5	Missouri, U.S.A.
Garcia, G.	20	f/10	Schmidt-Cass.	---	Illinois, U.S.A.
Hill, R.	6	f/13	Refractor	---	Arizona, U.S.A.
" "	20	f/10	Schmidt-Cass.	---	" "
Lopez, R.	20	f/13.8	Refractor	?	Venezuela
Maxson, P.	18	f/24	Reflector	---	Arizona, U.S.A.
" "	20	f/6	Newtonian	17.8	" "
" "	20	f/20	Schmidt-Cass.	---	" "
Melello, F.	20	f/10	Schmidt-Cass.	7.5	New York, U.S.A.
Perez, M.	20	f/13.8	Refractor	?	Venezuela
Quintana, C.	20	f/13.8	Refractor	?	Venezuela
Tatum, R.	17.5	f/15	Refractor	9	Virginia, U.S.A.
Timerson, B.	30	f/4	Newtonian	10	New York, U.S.A.
Young, S.	20	f/10	Schmidt-Cass.	7.5	California, U.S.A.

Rotation 1761 (1985 04 16.57 to 1985 05 13.81)

Sunspot Number [1, 2]	Mean	Maximum (date)	Minimum (date)
R_I	26.2	56 (05/09)	0 (04/17)
R_A	25.5	49 (05/09)	8 (04/17)

There was a sudden increase in activity when compared with Rotation 1760, the end of the last report, when $\bar{R}_I$ = 6.2 and $\bar{R}_A$ = 6.1, with activity then strongly concentrated in the middle two weeks of that rotation. [1, 2, 3]

The first feature of this rotation was SESC 4647, shown on 04/21 in drawings by Young and Garcia. This region was located at the same position as SESC 4637 of the previous rotation. A photograph by Tatum on the same date, in H-alpha, showed large chromospheric loops connecting the spots of the region. Garcia also made an H-alpha observation, reporting a large plage area with some flares spotted in the H-alpha center line.

Good coverage of this region began on 04/24, and a drawing of SESC 4647 made on that date by S. Young is shown below (Figure 46). From 04/24 to 04/25 the penumbral area nearly doubled with respect to the umbra. Invasions of photospheric material occurred in several places on the NW and SE sides. A Melello H-alpha photograph on 04/26 showed decreased plage regions, but they were bright again on the next day. Also on 04/27, the region had a different appearance in white light. The largest spot was cut into three main segments by light bridges with a few outlying spots. From this day on the region decayed. First the small spots dissolved as the entire group began a slow decrease in area. SESC 4647 left the disk on 05/01 with its exit well shown in two excellent photographs by Maxson (on 04/30 and 05/01; the 04/30 view is shown on p. 75 as Figure 47).

Figure 46. Drawing by S. Young, made on 1985 04 24 at 15h 11m U.T., using a 20-cm. f/10 Schmidt-Cassegrain telescope, stopped to 7.5-cm., at 80X. The large sunspot group is SESC 4647. North at top.

There was one other rather notable group, SESC 4652, which came onto the disk on 05/07 and reached its maximum area in two days. Though this group had good coverage, it only served to verify the decline of this region. By the time it left the disk the region was reduced to a solitary round spot. Even in H-alpha, little activity was seen.

Rotation 1762 (1985 05 13.81 to 1985 06 10.02)

Sunspot Number [2, 3]	Mean	Maximum (date)	Minimum (dates)
R_I	27.1	58 (06/10)	0 (06/02)
R_A	24.0	53 (06/10)	0 (06/01 & 02)

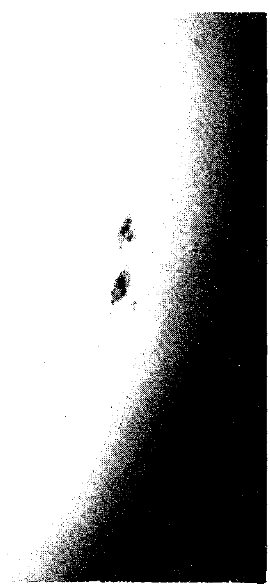
This rotation was only moderately active. It opened with two regions on the disk, SESC 4652 (mentioned under the last rotation) and SESC 4655. The latter was a round spot that formed some smaller attendant spots while decreasing in area all the while. [2, 3, 4]

On 05/17 SESC 4656 came onto the disk. Observations quickly showed it to be declining. H-alpha photographs showed large complex plage areas brightening on 05/17, while Young noted extensive faculae on 05/19.

For the next week (05/27-06/04) the Sun was quiet. Then, during the last week of the rotation, there were five regions on the disk. They were largely short-lived, with several exceptions which were old decaying regions (especially SESC 4662, the probable remnants of 4652 from the previous rotation).

Rotation 1763 (1985 06 10.02 to 1985 07 07.21)

Sunspot Number [3, 4]	Mean	Maximum (date)	Minimum (dates)
R_I	25.5	71 (07/07)	8 (06/27 & 28)
R_A	24.8	67 (07/07)	8 (06/27)



There were no good data until 06/14, and even then there was no significant activity until 07/02. The Sun was quiet even in H-alpha. [3, 4, 5]

The most active region of the rotation was SESC 4671. It was located at roughly the same position as SESC 4662 of the previous rotation and SESC 4652 of the rotation before that. SESC 4671 came onto the disk on 07/02 and was first observed by Maxson. Few faculae were noted. By 07/04 two small collections of umbral spots with rudimentary penumbrae to the NE comprised the region. H-alpha photographs showed a plage region to the N. On the next day the smaller spots were arranged in a semicircle to the N of the largest spot. By 07/06 the group was a collection of three spots in a roughly E-W line, as observed by Garcia. To the S another region had developed, which was being torn into three pieces by light bridges. In the next rotation, beginning on 07/07, events became much more complex. On that day a H-alpha photograph by Tatum showed a bright plage to the S, with

Figure 47. SESC 4647 about to leave the disk as photographed by Paul Maxson on 1985 04 30 at 18h 15m U.T. 20-cm. Schmidt-Cassegrain telescope at f/20, 1/125-sec. exposure on Kodak 2415 Film. North at top.

both regions joined by a large filament. Drawings done on 07/08 by Perez and Quintana showed SESC 4671 and 4672 as merged within one penumbra! The SESC now designated it as one region, SESC 4671. Unfortunately, there was no good detailed coverage of this event, only "before" and "after" observations. This is the type of event that should be recognized by observers when it happens and then recorded in great detail. From this point on, the region decayed until it passed behind the limb. This process was well shown in a remarkable series of full-disk drawings by Benavides, Perez, and Quintana, who noted large facular regions around the spots. The region of SESC 4671 as depicted in their drawings is shown below in Figure 48 . On 07/09, H-alpha photographs recorded plages in and around the spots. The orientation of the region was N-S by then; and, as it went behind the limb on 07/12 (then in Rotation 1764), Quintana showed it beginning to break up into separate spots once again.

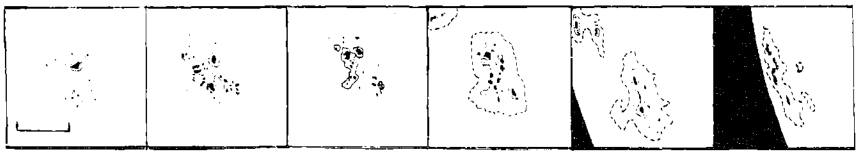


Figure 48. SESC 4671 and vicinity as drawn with a 20-cm., f/13.8 refractor. From left to right, the 1985 JUL U.T. date and time, and observer are as follows: 05d 18h 12m, M. Perez; 08d 19h 03m, M. Perez; 09d 16h 05m, C. Quintana; 10d 20h 54m, M. Perez; 11d 17h 40m, A. Benavides; 12d 21h 30m, C. Quintana. The bar in the left frame represents a length of 0.1 solar radius. North at top.

Rotation 1764 (1985 07 07.21 to 1985 08 03.42)

Sunspot Number [4, 5]	Mean	Maximum (date)	Minimum (date)
R_I	28.9	85 (07/09)	8 (07/15)
R_A	28.3	85 (07/09)	8 (07/15)

As this rotation opened, SESC 4671 dominated the disk. Although activity was low for the most part, with groups often consisting only of umbral spots, this rotation saw the highest daily count of the reporting period. [4, 5, 6]

On 07/28 SESC 4682 came onto the disk, preceded and attended by extensive faculae. The location of this region made it probable that it was the remnant of former regions SESC 4671, 4662, and 4652 from the previous three rotations! This identification easily made this region (in a broader sense) the most long-lived of the reporting period and indeed the longest-lived yet observed by the A.L.P.O. Solar Section.

As SESC 4682 came onto the disk it was seen as a round spot. Occasionally, small umbral spots would form nearby; but, after three rotations of activity, this region was appearing exhausted! A H-alpha photograph taken on 08/03 showed a spiral pattern to the chromosphere around the spot, indicative of an old decaying spot. This pattern persisted out to five spot diameters.

Rotation 1765 (1985 08 03.42 to 1985 08 30.66)

Sunspot Number [5]	Mean	Maximum (date)	Minimum (dates)
R_I	8.3	27 (08/04)	0 (many)
R_A	8.9	21 (08/04)	0 (many)

There was a dramatic decrease in activty when compared with the previous rotation. All groups were small, relatively inactive, and short-lived, rarely getting past Zurich Class C. The only notable region was SESC 4682, which had come onto the disk in the previous rotation. It is interesting to note that no activity was seen at that location towards the end of this rotation. [5, 6]

Rotation 1766 (1985 08 30.66 to 1985 09 26.93)

Sunspot Number [5, 6]	Mean	Maximum (dates)	Minimum (dates)
R_I	4.0	10 (09/18 & 19)	0 (many)
R_A	4.0	14 (09/18)	0 (many)

The decrease in activity continued in this rotation, reaching extremely low levels with 60 percent of the days showing no spots. Observer data were scanty and for the most part verified the spotlessness. One region, SESC 4694, developed as a small group on 09/13, made central meridian passage on 09/18, and then disappeared on 09/21. [5, 6, 7]

Rotation 1767 (1985 09 26.93 to 1985 10 24.22)

Sunspot Number [6, 7]	Mean	Maximum (date)	Minimum (dates)
R_I	16.5	72 (10/22)	0 (many)
R_A	13.8	62 (10/22)	0 (many)

Activity picked up somewhat during this rotation but was still quite low. There were no spots recorded for about half the days with, again, most groups short-lived. Photographs by Maxson on 10/19 and 10/20 showed SESC 4698 and 4699 near their maximum development, but otherwise coverage was poor. [6, 7, 8]

Rotation 1768 (1985 10 24.22 to 1985 11 20.52)

Sunspot Number [7, 8]	Mean	Maximum (date)	Minimum (dates)
R_I	22.1	55 (10/25)	0 (many)
R_A	21.5	50 (10/25)	0 (many)

In this rotation, activity rose to nearly the levels observed at the beginning of this reporting period. Only about 20 percent of the days experienced counts of 0. As the rotation opened, SESC 4698 and 4699 were just past the central meridian. They exhibited large facular regions as they left the disk on 10/27, which were well shown in white-light photographs by Maxson. [7, 8, 9]

There was one other region of interest, SESC 4703. It was born on the disk on 11/13 and passed the central meridian four days later, leaving the disk in the next rotation on 11/22. Unfortunately, probably due to the low activity of the previous three rotations, observers achieved only poor coverage of this region.

Rotation 1769 (1985 11 20.52 to 1985 12 17.84)

Sunspot Number [8, 9]	Mean	Maximum (date)	Minimum (dates)
R_I	17.2	66 (12/16)	0 (many)
R_A	10.9	44 (12/15)	0 (many)

Although the maximum count increased for this rotation, the average activity decreased. This was largely due to an increase in the proportion of days with no spots to approximately 30 percent. There were only two major regions, SESC 4708 and 4709, for which we received only two photographs and no drawings. [8, 9, 10]

Rotation 1770 (1985 12 17.84 to 1986 01 14.17)

Sunspot Number [9, 10]	Mean	Maximum (date)	Minimum (dates)
R_I	4.4	40 (12/19)	0 (many)
R_A	2.6	16 (01/14)	0 (many)

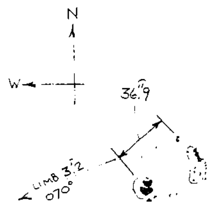


Figure 49. Drawing of SESC 4710 made by R. Hill on 1986 01 13 at 18h 20m-35m U.T., using a 20-cm., f/10 Schmidt-Cassegrain at 242X. The micrometer measures described in the text are shown.

This reporting period closed with activity back to extremely low levels. Over 80 percent of the days of this rotation had no spots! As the rotation began, SESC 4708 and 4709 were on the disk, accounting for much of what little activity there was! The only other notable region was SESC 4710, which formed on the disk on 01/13 and left the disk on 01/15. Its brief appearance was followed by Hill in a series of drawings of the group that included micrometer measures which gave a total length of 36".9. A drawing depicting a micrometer measure is reproduced to the left as Figure 49 . [9, 10, 11]

Conclusion

There were several problems with the data for this report that need to be called to the attention of observers.

First, in order for proper credit to be given to an observer for the data used, the full name and address of said observer must appear on the drawing or photograph. This also aids us in checking on ambiguous information because we then can contact the observer directly.

Second, there were a number of excellent drawings that could not be submitted for publication simply because the penumbrae were shaded in. We receive electrostatic copies of most observations. When observers shade in the penumbrae we have trouble in determining exactly what is going on within the shaded area. During the copying process the shading either darkens or breaks up, making analysis difficult at best. Observers are asked simply to outline the outer boundary of the penumbrae, while making the umbrae and umbral spots solid black, as is done in Figure 49 . Such drawings copy excellently and can then go through the additional stages of copying that are necessary for publication.

Observers are further encouraged to begin intensive observing now, while we are still near sunspot minimum. All too soon the activity levels will be picking up, and then there will be too much going on for the inexperienced observer to record accurately. Record keeping should become familiar and observing sessions routine while the sunspot counts are below 100. Learning these things when the counts are 200 or more can be a formidable task!

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13.) Hill, Richard E. and Maxson, Paul. "A.L.P.O. Solar Section Observations for Rotations 1754 - 1760 (1984 OCT 07 to 1985 APR 17)." J.A.L.P.O. , 32 , Nos. 1-2 (March, 1987), 30-33.

A BRIEF REPORT ON THE 1986 PERIHELIC APPARITION OF MARS

By: J.D. Beish, A.L.P.O. Mars Recorder

The A.L.P.O. Mars Section wishes to thank all the dedicated observers who have contributed many excellent observations during the 1986 Perihelic Apparition of Mars.

The 1986 A.L.P.O. International Mars Patrol (IMP) is composed of 79 individual professional and amateur astronomers located around the Earth--in Africa, Australia, Belgium, Canada, England, France, Hungary, Japan, Mexico, New Guinea, Spain, the Soviet Union, the United States, Venezuela, and West Germany. As of June 5, 1987, the Mars Recorders have received a total of 2077 Mars observations, consisting of 1398 separate visual reports, 507 black-and-white and color photographs, and 172 micrometer measurement reports for the Martian polar caps, and meteorological and surface features. The apparition began with D. Troiani's observation of Mars on 1985 SEP 19 (059° L_s), followed by Beish and Parker with observations on OCT 29 and OCT 31. The last Mars observation was by Walter Haas on 1987 JUN 22 (038° L_s). Thus, the "1986" Apparition spans an observational period of 339° L_s (94 percent of the Martian year, the longest observing span of any A.L.P.O. Mars apparition), with a total count of 242° L_s actually observed (67 percent of the Martian year).

Mars was closer to the Earth than at any time since 1971, but the planet was also further south than at any time since 1907, so that Mars was very low in the sky for northern observers. Because of this last factor, we felt that the number of observations would be much less than for more favorable apparitions. However, to our great surprise, the response has been very high.

In addition, we have received several hundred quality visual and photographic observations from new friends in Australia. B. Adcock of Victoria, Australia has contributed over 125 quality photographs of the Red Planet, which will be very helpful in our ongoing meteorological survey of Mars. Special thanks also go out to Dr. Tadashi Asada of the Oriental Astronomical Association (OAA) in Japan for sending their very informative newsletter, "Communications in Mars Observations," with their many fine observations.

This welcome interest in observing Mars is most rewarding for the Mars Recorders and for the A.L.P.O. at large. We hope that this continued interest will be carried over into the 1988 Mars Apparition, which will prove to be one of the most favorable of this century.

Furthermore, the Mars Recorders have received an overwhelming response from the readers of recent articles that have appeared in the Strolling Astronomer (J.A.L.P.O.), of Chick Capen's article, "An Excellent Year for Mars," in the June, 1986 issue of Sky & Telescope magazine, and of Jeff Kanipe's article, "The Planets of Summer," which appeared in the February, 1987 issue of Astronomy, in which the A.L.P.O. is highly accredited.

A full report on the 1986 Apparition of Mars will be available in the near future. Due to the reorganization of the Mars Section, reports have been delayed, but Part I of the 1983-84 Aphelic Apparition report has been submitted for publication and should appear later this year.

Yes, planetary astronomy is alive and well!

COMET NOTES: X. THE FOURTH AMERICAN WORKSHOP ON COMETARY ASTRONOMY

By: David H. Levy, A.L.P.O. Comets Recorder

The end of February, 1987, brought a renewal of tradition in Pasadena, California, with the Fourth American Workshop on Cometary Astronomy. Sponsored by the International Comet Quarterly, the International Halley Watch, and by the Comets Section of the A.L.P.O., this meeting gathered amateur and professional comet enthusiasts for a day and a half of comet discussion. At the beginning of 1987, there was much to talk about, because January had seen an almost unheard of seven fresh comets, four of which were new discoveries, while the remainder were recoveries. The comets themselves were represented, in a sense, because James V. Scotti, the Assistant Recorder for our Comets Section, was responsible in part for the three recoveries of P/Wild 3, P/Bus, and P/Tempel 2. The new comet 1987a was also represented [and is illustrated in Figure 50 on p. 80]. Not attending were Brian Skiff and Jennifer Wiseman (Wiseman-Skiff, 1987b) and the discoverers of Nishikawa-Takamizawa-Tago (1987c) and of Terasako (1987d). Several of the top comet observers were there, including Steve Edberg, Charles Morris, Alan Hale, and Chris Spratt.

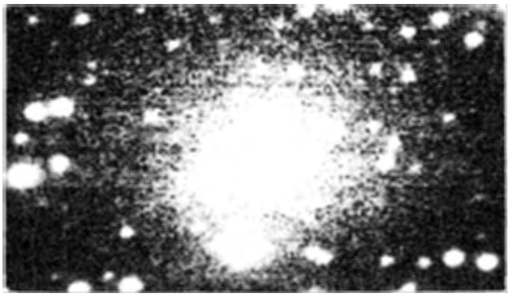

Figure 50. Image of Comet Levy (1987a) obtained on 1987 FEB 01 at 12h 39m U.T. by T. Gehrels using the 0.91-meter Newtonian reflector of the Steward Observatory on Kitt Peak with the Spacewatch CCD system. Image reduced by J.V. Scotti. North is to the top and east to the right, with a field size of 5 X 3 arcminutes. Note the tail structure which extends toward the lower left.

The purpose of the meeting was to bring cometeers together in the wake of the recent Halley campaign, so that results of observations and the observing procedures themselves could be considered. Halley's wake left one massive problem--its rotation period is still unknown. Several lines of evidence, including the frequency of jet appearance, measurements from three spacecraft encounters, and a "breathing" hydrogen halo, point to the 2.2-day period originally postulated from studies of 1910 data. However, photometric measurements by Millis et al. in March and April of 1986 clearly showed a 7.4-day period. It is possible that Zdenek Sekanina's theory of a 7.4-day rotation period on which a precession period of 2.2 days is superimposed may be the solution, but more observations are needed.

With Halley behind us, the late afternoon sessions looked forward to the future, particularly with a special talk about the upcoming Comet Rendezvous Asteroid Flyby (CRAF) mission that has been proposed by JPL. The nominal plan, assuming that the mission is funded as a "new start" next year, would involve a launch from Earth, a gravity assist from Venus, a second gravity assist from Earth, a flyby of an asteroid, and finally the meeting with Periodic Comet Tempel 2 at its aphelion. The spacecraft would follow the comet as the latter approaches the Sun, watching the gas emissions begin and the dust structure develop. Sometime during this period CRAF would send a penetrator to examine the nucleus. The mission would end after Tempel's perihelion passage, around the end of this century.

The second day featured some informal slide presentations and a panel discussion which concentrated on the reporting of comets, both new and returning. Those who attended the Workshop left with renewed enthusiasm for observing; now that P/Halley is backing away, the participants looked toward the future, which surely will provide some exciting comets to view.

OBSERVING METEORS: X

By: David H. Levy, A.L.P.O. Meteors Recorder

Have you ever thought that you had discovered a new meteor shower? Ever gone outside to see meteors falling from an apparently obvious radiant in the sky? Then you would quickly check a list of radiants, see nothing for that time or location, and announce your discovery of a brand-new shower?

It's not quite that simple. A new meteor shower that could grow to be as strong as the Geminids would be nice, but you would be unwise to jump too quickly to conclusions. The first thing to remember is that a number of meteors that appear to be coming from a single radiant may actually not be doing that. If several observers independently report a new radiant, the discovery is much more credible.

Actually, I suspect that, as the Earth pushes its way through the space debris of the inner Solar System, it could contact either new or previously undiscovered streams. Most of these may be very short-lived, meaning that you might see five or six meteors coming from a radiant in an hour; but no one else would notice it, and the episode might never recur.

I am afraid that, in recent years, suspected showers have been announced by observers before sufficient confirmation has been obtained. This may result in other observers, some of them beginners, being asked to go out and confirm the new shower. If the suspected shower is near a known radiant that is active at the time, observers could be confused in deciding to which radiant a meteor belongs. This hurts both the process of confirming the new shower and the needed studies of the known shower.

If you think that you have detected a new stream, even one so small as what I described earlier, I suggest that you send the details to either the Recorder or the Assistant Recorder of the A.L.P.O. Meteors Section (see inside back cover for addresses). What we will do is simply to hold such reports in a database file in order to see if other observers report the same showers. This way, no one is forced, consciously or otherwise, to confirm showers that may or may not exist.

The Astronomical League's Meteor Club

If you are a member of the Astronomical League, you may be interested to know that there is a new meteor club with awards and other incentives designed especially to involve beginning observers in meteor observing. This program has been described in recent issues of the Astronomical League's Reflector newsletter and awards certificates for specific hours of meteor observing. If you are a member of the Astronomical League and are sending observations to our Meteors Section as part of the program, please say so, so that you you may be considered for the certificates.

Now that we have finished with serious matters, this column inaugurates its Cloudy Night Meteor Shower Compendium (CNMSC), which will contain a selection of readers' ideas for meteor showers. Thanks to George Ellis and Steve Edberg for the following:

1. Draculids. Famous telescopic shower of meteors, culminating at midnight local time on October 31st of odd-numbered years at Full Moon. Visible only through refractors.

2. Lurids. A special shower of mostly falling meteors, visible usually late at night, using a blue filter and a small peephole viewing device.

Any other contributions?

COMING SOLAR SYSTEM EVENTS: SEPTEMBER - DECEMBER, 1987

The following notes are intended as brief reminders about upcoming astronomical events. For more information, consult more detailed sources such as the A.L.P.O. Solar System Ephemeris, the Astronomical Almanac, Sky & Telescope magazine, the Observer's Handbook of the Royal Astronomical Society of Canada, and the Handbook of the British Astronomical Association. All dates and times given here are in Universal Time (U.T.).

Planetary Visibility. --There will be two visibility periods for Mercury; the first one in the evening sky in late September-early October (Greatest Eastern Elongation OCT 04 at 26°) is unfavorable in the Northern Hemisphere. A better opportunity, in the morning sky, will be in mid-November (Greatest Western Elongation NOV 13 at 19°). Venus will first be observable in the evening sky in October, rising higher as the year ends and showing a small disk in gibbous phase. In contrast, Mars will be starting to emerge from the dawn twilight in October, and will be visible for several hours before dawn by year's end. Unfortunately, its disk will be too small to show useful detail, reaching only 4".4 in diameter by the end of 1987.

Jupiter will be the planet easiest to observe during this period, reaching opposition on OCT 18, so it will be visible most of the night this Fall. It is relatively close (having reached its perihelion on JUL 10) with an equatorial diameter of 49".7 near opposition, and also is becoming well-placed for Northern Hemisphere observers. Saturn will remain visible in the south and southwest sky after sunset in September-October, but will be too near the Sun to be observed for the last two months of 1987.

Eclipses. --This fall, an annular solar eclipse will be followed by a penumbral lunar eclipse just two weeks later. The annular solar eclipse occurs on SEP 23, with the annular central track beginning at sunrise in Soviet central Asia, crossing into the Yellow River Plain in China, and then crossing Shanghai before passing into the Pacific Ocean where Okinawa is the only sizeable island that experiences the event. The North China Plain is one of the world's most densely populated regions, and the Municipality of Shanghai contains 12 million persons, so this annular eclipse should be extensively observed! Indeed, the partial phases will be visible throughout most of Asia (from Kazakhstan and Iran eastward), Japan, the Philippines, Borneo, New Guinea, northern and eastern Australia, and all but southernmost New Zealand. From the Hawaiian Islands, only a small portion of the Sun's southern limb will be eclipsed, and that will be at sunset. The maximum duration of the annular phase will be 3m 45s at about 2h 40m U.T., to the southeast of Okinawa.

The penumbral lunar eclipse of OCT 07 will be somewhat unusual because the Moon will be entirely within the penumbra (with a penumbral magnitude of 1.012) and will clear the umbra by only a fraction of an arcminute. The first contact of the Moon with the penumbra will be at 01:53 (position angle 102°), and the Moon will leave the penumbra at 06:10 (position angle 201°). Near mid-eclipse (at 04:02) the Moon's southern limb should be definitely shaded, with the darkest shading near position angle 152°, near the south rim of the crater Drygalski. Note also that the planet Jupiter will be only 13° east of the eclipsed Moon. The entire event will be visible from the Americas (except Alaska) and westernmost Europe and Africa. At least the beginning portions can be seen from the remainder of Europe and Africa as well as western Soviet Asia and the Middle East. At least the last part of this eclipse will be visible from Alaska and the central Pacific Ocean.

Lunar Occultations. --The Moon will occult Mars once (SEP 22) and Mercury twice (SEP 25 and OCT 23) during this time period; but only the SEP 25 Mercury occultation, at about 05h, will be far enough from the Sun (24°E) to be readily visible. Mercury will be at 0.0 stellar magnitude at the time, and the event can be watched from South and Southeast Asia, Australasia, and the Indian and the South Pacific Oceans.

The current series of passages of the Moon through the Pleiades star cluster will continue, happening on the following dates: SEP 13, 05h (Moon 67-percent sunlit; visible from North America and the Caribbean); OCT 10, 14h (Moon 86-percent sunlit; seen from Eastern Asia and Alaska); NOV 07, 00h (Moon 98-percent sunlit; seen from Europe and Western Asia); DEC 04, 08h (Moon 99-percent sunlit; seen from North America and Hawaii); and DEC 31, 14h (Moon 88-percent sunlit; seen from Asia, Japan, and Alaska). In addition, there will be four occultations of Antares, three of Spica, and of course many others of fainter stars; check the sources listed above for details.

Occultations by Planets. --Besides several asteroid events, two major planets will occult stars. On OCT 20, at about 06h, Jupiter will occult SAO 109969, visible throughout the Western Hemisphere, although a moderately large telescope will be needed to see the +9.2-magnitude star next to -2.9-magnitude Jupiter. Also, on DEC 25, at about 17h 40m, Venus occults SAO 189335, this event visible in Iberia and West and South Africa; Venus will be at magnitude -4.0 and the star at +6.8.

Meteor Showers. --There are no less than ten recognized meteor showers that peak in the last four months of 1987:

South Piscids	SEP 20, 27-day Moon	(Range AUG 31 - NOV 02)
Annual Andromedids	OCT 03, 10-day Moon	(Range SEP 25 - NOV 12)
North Piscids	OCT 12, 19-day Moon	(Range SEP 25 - OCT 19)
Orionids	OCT 21-25, 28-2-day Moon	---
South Taurids	NOV 03, 11-day Moon	---
North Taurids	NOV 13, 21-day Moon	(Range SEP 19 - DEC 01)
Leonids	NOV 18, 26-day Moon	---
Geminids	DEC 14, 23-day Moon	(2.6-day duration)
Ursids	DEC 23, 2-day Moon	(2-day duration)

The Moon will be a serious hindrance only for the Annual Andromedids, North Piscids, and North and South Taurids. Otherwise, conditions are relatively favorable, particularly because the Orionids, South Taurids, Leonids, Geminids, and Ursids are all considered major showers.

BOOK REVIEWS

Coordinated by J. Russell Smith

Build Your Own Telescope. By Richard Berry. Charles Scribner's Sons, 115 Fifth Ave., New York, NY 10003. 1985. 276 pages, illustrated. Price $ 24.95 cloth (ISBN 0-684-18476-1).

Reviewed by Richard J. Wessling

Richard Berry is to be congratulated for compiling this fine, well illustrated book. He "puts it all together" by filling his readers' requests for detailed information on telescope construction. After all, most books about telescope making do not include telescope plans, and many assume that you have access to a machine shop in order to make a mounting. Richard shows the ways to make mounts with common tools and hardware-store materials. I only wish that this book had been available when I was a teenager building my first telescope.

The Introduction and the first three chapters are about the basics and how they apply to your particular observing needs. Magnification, aperture, resolution, the wave nature of light, diffraction, and how to select a mounting are all covered. The differences between reflectors and refractors are discussed. After reading these chapters you should have enough knowledge to make your first proper selection of telescope and mounting type.

The next five chapters give detailed information for building a 4-inch f/10 reflector, a 6-inch f/8 Dobsonian reflector, a 6-inch f/8 equatorial reflector,a 10-inch Dobsonian reflector,and a 6-inch f/15 refractor. The author has built all these telescopes and shows drawings made and photographs taken during their construction. You even may be able to improve on Richard's designs.

Chapter 9 offers more information on telescope parts such as cells, spiders, focussers, and so on, which will be helpful if you want to make them yourself. Chapters 10 and 11 are about home-brewed optics and testing. It is obvious from the insights given in these two chapters that the author has made many telescope mirrors. However, if you do plan to make your own mirror, I suggest that you buy Jean Texereau's How to Make a Telescope (Second Edition, 1984, Willmann-Bell) for more detailed information. Richard gives the excellent advice to seek out a club or individual who has been successful in mirror making, and who can help you through the rough spots and make the difference between success and failure.

The final chapter is about one of our favorite subjects, observing. Solar System observing is well represented along with the other major areas of observation. Three Appendices complete the book: A, about telescope materials; B, about suppliers; and C, books and further reading. Anyone wanting to build his or her own telescope, but lacking the experience, will surely find this book helpful.

Chariots for Apollo: The Making of the Lunar Module. By Charles R. Pellegrino and Joshua Stoff. Atheneum Publishers, 115 Fifth Ave., New York, NY 10003. 1985. 238 pages, illustrated. Price $ 17.95 cloth (ISBN 0-689-11559-8).

Reviewed by Ken Thomson

Here is a fascinating book about the development of a unique piece of hardware--the lunar module (LM) from which the first human being stepped onto the surface of the Moon.

In retrospect we must stand in a certain degree of awe at the accomplishments of the Apollo program, especially when we consider how little was known about the Moon and about the design of true spacecraft (as opposed to aircraft) when the program's commitment was made. This book is the saga of an engineering triumph.

Early in the program it had become apparent that weight limitations imposed by the launch vehicles available would dictate a "two-piece" design with a discardable descent stage to be left on the Moon. Because the ascent engine could not be tested prior to lunar takeoff, the workmanship had to be flawless. Also, nothing was known about the bearing strength of the lunar surface until the Soviet Luna and American Surveyor Missions in 1966, long after design decisions about the landing gear had to be made. An intelligent guess had to be made; it turned out to be correct but the possibility of the craft's sinking out of sight into the regolith could not be dismissed entirely.

If courageous decisions based on incomplete information had not been made, the Moon would have remained beyond our reach. If every possible hazard had been avoided, we would still be earthbound. The authors repeatedly cite instances to illustrate these points. Equally important was the emphasis on quality control and discipline, thrown into greater prominence by the Apollo 1 cabin fire that claimed the lives of astronauts Grissom, White, and Chaffee. This tragedy forced everyone in the program to reconsider the safety question, and better overall designs resulted.

In an age where uncaring behavior and shoddy workmanship seem to have become more and more acceptable, it is both elevating and comforting to know that competence and craftsmanship are still valued. Those who would point an accusatorial finger in the wake of the Challenger disaster might gain a better sense of balance by reading this book.

Chariots for Apollo is a "nontechnical" book that can be read with equal pleasure by engineer or layperson. The book would have profited by the inclusion of a brief chronology of the significant stages of LM development. The book also lacks an index, which makes it difficult to use as a reference work. It does contain a good bibliography for those who would like to learn more about the Apollo program, and an afterword titled "Where Are They Today," giving personal data about some of the still-living contributors to the project.

Space, Time, Infinity: The Smithsonian Views the Universe. By James S. Trefil. Pantheon Books, 201 E. 50th St., New York, NY 10022. 1985. 255 pages. Price $ 29.95 cloth (ISBN 0-394-54843-4).

Reviewed by Rodger W. Gordon

Space, Time, Infinity is what many would call a "potboiler" book, being an overview of astronomy from early times to the present and an attempt to cover the entire gamut of current astronomical knowledge. Unlike many "potboilers," this one succeeds rather well. After an initial Prologue, the book is divided into four main Parts: Part I: "The Oldest Science," Part II: "Exploding Horizons," Part III: "The Solar System," and Part IV: "Charting Space Though Time." Each part is divided into several subchapters.

It would be pretentious to claim that one can cover the scope of today's (and yesterday's) astronomical knowledge, but this book covers some very important topics in a lucid and clear manner without getting into the technical details. In this respect it is a fine volume for the educated layman or for anyone wanting a quick overview of current facts and speculations. We are led from the early beginnings of astronomy through a long chain of events (the author deftly handles how one chain of events leads to another) into the current world of cosmology. Here, the author attempts to explain not only how the universe functions but why it and we are here.

I was particularly intrigued with the subchapter, "Are We Alone?" Trefil is a pessimist in his outlook on the subject of extraterrestrial life and has written several publications on this topic. However, he presents a balanced view of this scientific but emotional topic, giving the optomistic view of Frank Drake, a more moderate opinion by Robert T. Rood, and the pessimistic view that he himself holds. My own opinion is that all such speculation about extraterrestrial intelligent life is meaningless because of our lack of information. All three individuals mentioned above believe that the seach for intelligent life should be carried on because it is a subject of deep philosophical meaning regardless of the outcome of the search.

I disagree with the argument that intelligent extraterrestrial life would inevitably colonize the galaxy. As the scientists cited above state, such a task would be far too expensive. Another problem that interstellar "empires" would face is the slowness of communication due to the finite speed of light.

Our current knowledge of cosmology is given excellent treatment, and we see a universe unfolding from 10^{-43} seconds after its creation to its possible end an almost incalculable time in the future. However, despite all our recent knowledge we are simply forced to admit that we do not know why the universe or ourselves are here. Perhaps we shall never know but the speculation is certainly interesting!

The quality of this book's pictorial content is excellent, and its more than 300 illustrations are an outstanding feature of this volume. The reproduction of the photographs and artwork is excellent. The author injects personal touches of humor from time to time, and these help to carry us along. A few typographical errors were noted, but these do not detract from the text. If you do not mind spending $29.95 for a book, this is an excellent choice for using one's nighttime cloudy hours.

Astronomy. A Step-by-Step Guide to the Night Sky. By Storm Dunlop. Collier Books, Macmillan Publishing Co., 866 Third Ave., New York, NY 10022. 1985. 192 pages, index. Price $ 8.95 paper (ISBN 0-02-079650-1).

Reviewed by Phillip W. Budine

In general, this book is excellent! A Macmillan Field Guide, it is slightly larger than pocket-size, which makes it handy to hold and use. The author is obviously an experienced observer and the book is primarily an "Observer's Bible." Most of the plates are in color and most of them are used for the first time in a book.

This work is divided into two principal Sections. Section One, "Beginning Astronomy," consists of the chapters: "How to Begin," "Starting to Observe," "Eyesight," "Where to Observe," "When to Observe," "Atmosphere and Seeing,' "Essential Equipment," "The Celestial Sphere," "Naked-Eye Observing," "Learning the Constellations,' "Finding One's Way Around the Sky," "The Northern Polar Constellations," "Equatorial Constellations," "The Southern Polar Constellations," "Objects Other Than Stars--What Might They Be?", "The Motion of the Moon and Planets," "Binoculars," "Telescopes," "Observatories," "Star Charts," "Co-ordinate Star Charts," "Finding Objects With Binoculars and Telescopes," "Time," "Making Detailed Observations," "How to Make Drawings, "How to Take Astronomical Photographs," and "Photography Through a Telescope."

Section Two, "Exploring the Sky," comprises "Zodiacal Light and the Gegenschein," "Aurorae," "Noctilucent Clouds," "Meteors," "Artifical Satellites," "The Moon," "Lunar Eclipses," "Lunar and Other Occultations," "The Sun," "Solar Eclipses," "Observing the Planets," "The Inferior Planets," "Mars," "Minor Planets," "Jupiter," "Saturn," "The Outer Planets," "Comets," "Stars," "Variable Stars," "Double and Multiple Stars," "Star Clusters," "Nebulae," "The Galaxy," and "Other Galaxies," followed by a Bibliography and a list of addresses of publications and organizations.

In the chapter about Jupiter there is an excellent nomenclature diagram on page 161 . I was very pleased to see that it notes System I and System II, used for rotation purposes. Most books do not illustrate or even mention these terms, which could also be applied to the Saturn diagram on page 164.

One item is sadly neglected in the chapter on Comets. On page 168, the author states, "Never miss the opportunity to observe a bright comet." Although several comets are usually visible each year to amateurs with moderate-sized telescopes, most of those that are regular visitors to the inner Solar System are quite faint. The only exception is Halley's Comet, but it is not mentioned under "Observing Comets" (page 169) that this comet returned in 1985-86, much less where to look for it!

As for planetary observing, there is an excellent diagram on page 150 that illustrates a central meridian timing. It is obvious that the planet shown is Jupiter, although the caption does not mention this. On page 148, under the heading "Intensity Estimates," the scale referred to uses 0 for the brightest objects (and I presume that it uses 10 for the darkest, although this is not stated). This is the scale used by the British Astronomical Association and is the opposite of that used by the A.L.P.O. (which runs from 0 for black to 10 for brilliant white). Also, an excellent diagram on page 145 depicts the maximum and minimum apparent sizes of the naked-eye planets.

Under the list of addresses the Journal, A.L.P.O. is not listed under Journals, although the A.L.P.O. itself is listed under Organizations. Many other groups are listed too, although not the well-known Oriental Astronomical Association (OAA) in Japan.

To sum up, this book is a "must" for a beginner and will serve as a excellent primer for the more serious amateur. The price is very reasonable in today's market, and it is a colorful and delightful guide to use! I strongly suggest that you add this book to your shelf. It will give you plenty of incentive, if you need it, to get out and observe the sky.

Astronomy With Your Personal Computer. By Peter Duffett-Smith. Cambridge University Press, 32 East 57th St., New York, NY 10022. 1985. 256 pages, illustrations, index. Price $ 44.50 cloth (ISBN 0-521-26620-3), $ 14.95 paper (ISBN 0-521-31976-5). IBM PC, Apple (C/PM), or BBC(B) program disks available separately for $ 19.50.

Reviewed by J. D. Beish

Those of us who think back to the times of Galileo or Newton marvel at their perseverance in handling the difficult task of calculating with the mathematical equations used in their discoveries. Or, more recently, consider the early 1900's when Lowell and Pickering toiled over their calculations to find Planet X. Consider what they could have discovered had they had modern calculators, much less modern personal computers!

Today, amateur astronomers have at their disposal not only a vast array of electronic and mechanical gadgetry, but they also have advanced digital computers that they can carry with them. Amateur astronomy is undergoing a small revolution, especially in the areas of Solar System ephemerides, astronomical time calculations such as the rising and setting of celestial bodies, or finding the parabolic elements of a newly discovered comet.

This book lists 26 BASIC-language programs, each with accompanying equations, explanations, and sample runs. Actually, if one started at the beginning and worked through to the end, one could construct a complete astronomical program that covered many items of interest to the planetary observer. Subroutines and handling programs with helpful suggestions are included for each subject.

This reviewer has checked some of the more complicated programs using Microsoft BASIC on an Osborne-1 computer; and they were found to be error-free, providing accurate results and also being very easy to use. In the introduction the author states that he has tested all routines using Microsoft BASIC-80, the public domain BASIC compiler BASIC-E, and C-BASIC. With very little modification, the routines are easily adaptable to most other forms of BASIC. The book has been arranged with a minimum amount of fuss, keeping the novice, as well as the expert programmer, in mind.

In my opinion, this is one of the best publications of its type on the market today. The book is very well written and illustrated. It is constructive and educational and is highly recommended. The only disappointment that I have with the book is the lack of routines and calculations for the physical ephemerides of the Moon and planets. Of course, these additions would necessitate a second volume, which may be a good idea.

A Brief View of Astronomy. By Jay M. Pasachoff. CBS College Publishing, 383 Madison Ave., New York, NY 10017. 1986. 286 pages, Appendix and Glossary. Price $ 19.95 paper (ISBN 0-03-058422-1).

Reviewed by Jose Olivarez

Every amateur astronomer's library should include a good college textbook on astronomy. Such a text helps the amateur put the entire field of astronomy in perspective by offering more of an overview than the specialized volumes on the planets or deep-sky objects that are usually acquired first. Many college-level astronomy textbooks have been written recently, but only a few of them are truly outstanding. Among the very best are those by Jay M. Pasachoff of Williams College, Massachusetts, who has authored Contemporary Astronomy, Astronomy: From the Earth to the Universe, and the present volume.

A Brief View of Astronomy retains the clarity and attractiveness of Dr. Pasachoff's other fuller texts but is a shorter version consisting of a mix that covers both basic astronomy and many of the exciting topics now at the forefront. Massive black holes in the centers of galaxies and quasars, observations of our galaxy from the Infrared Astronomical Satellite, spacecraft views of Jupiter and Saturn, and new theoretical ideas about the first fraction of a second of the universe's existence are among the topics covered. Also, the book is almost entirely lacking in mathematics, but those seeking to understand astronomy more deeply may want to look at Dr. Pasachoff's Contemporary Astronomy, which includes some basic equations.

This book is replete with hundreds of black-and-white illustrations and with 18 pages of beautiful color plates that show observatories, planets, and nebulae. The seasonal constellation charts in the back of the book are by the celestial cartographer Will Tirion. There are also 12 pages of appendices and a Glossary.

A Brief View of Astronomy is a "best choice" among brief astronomy texts for the student or for the amateur astronomer's library. It is one of those rare textbooks that is actually easy to read, and Dr. Pasachoff's view that we are living in a golden age of astronomy is evident throughout the book. This is one college text that is a joy to read and to own!

The Cosmic Inquirers: Modern Telescopes and Their Makers. By Wallace Tucker and Karen Tucker. Harvard University Press, 79 Garden St., Cambridge, MA 02138. 1986. 221 pages, index and bibliography. Price $ 20.00 (ISBN 0-674-17435-6).

Reviewed by Walter Scott Houston

This is a book about the new telescopes that operate far from the Earth's surface and about the scientists who invented them, harvesting such incredible new data that they are properly called the "New Galileos." It is also the story of the VLA radio telescope in New Mexico and the orbiting X-Ray Einstein Observatory. Add to this the surprising gamma-ray satellite, the creation of a man who had a C- average in high school, and the infrared astronomical satellite, IRAS, the first satellite to discover a comet. There is a final chapter, more tears than hope, for the now-stranded space telescope, which so far has specialized heavily in collecting terrestrial dust.

The book considers the men and the blood, sweat, and tears these men had to immerse themselves in to get their instruments, including the problems both technical and human that they encountered. Enough is explained, especially about design problems, so that the reader gets a basic understanding of how the equipment works, why it works, and how it obtained such dazzling results in space. It talks even more of the doctoral dissertations of young men that, 20 years later, flew the rockets and gave science new tools to take space apart. The book also sounds warnings that the "golden age" may be temporary as governmental decision makers go more and more for "safe" experiments that lead science only in well-understood paths. Of course, this behavior is not new to university circles where non-controversial papers (and by definition unimaginative papers) are often the primrose path to tenure.

Harlow Shapley, in 1932 in Milwaukee, told me that he spoke to our tiny amateur astronomical society without a fee because the days of the private donor were gone, and that astronomy would live or die in the remainder of the century on the basis of governmental grants which would not be available unless the general public heavily approved. In blunt terms, Shapley was ringing doorbells among the young to obtain votes a decade or more in the future.

One of the authors, Wallace Tucker, a scientist himself, tries to show what happens when statesmen assume control over scientific projects. The VLA and the X-ray experiments were scientist designed and operated and were successful. When NASA couldn't resist the temptation to get aboard the glory train, troubles began, at least he so insists; and he produces documentation. He punches out with remarks scattered through the book:

> "NASA'S mission is not science, as you know."
> "NASA's mission . . . is primarily to keep NASA employees employed."

and one that strikes close to us although written before the shuttle disaster,

> "NASA administrators try to keep as many groups as possible happy by diffusing responsibilities, with little regard for future management problems. The result, inevitably, is poor communication."

Some of you will remember that S.I. Hayakawa in his essay, "The Language of Hollywood," inspected the clash of bureaucracy and talent in the movie industry and did accurately forecast its collapse. The mechanisms that he described are the same as those Tucker finds in NASA today. Those of us who have dealt with Federalism in social programs know the pattern all too well.

I did talk to some of my friends in the space program and got identical replies, "Don't use my name, but read the book." Thus, this volume properly can be considered as perhaps a swan song for unbridled talent and as a tardy attempt to rebel against the mountain. After the events of Spring 1986, the text makes sense, at least today. The authors offer no solutions; but individual opinions aside, the book is a striking salute to the brief time period of perhaps four decades when inspiration and insight ran gloriously through the space pioneers and gave them the chance to be "New Galileos." Amateur astronomers, especially, ought to read this book carefully.

/Pioneering Space./ By James E. Oberg and Alcestis R. Oberg. McGraw-Hill Book Co., 1221 Avenue of the Americas, New York, NY 10020. 1986. 298 pages, illustrations, index. Price $ 16.95 cloth (ISBN 0-07-048034-6).

Reviewed by Harold Anderson

This book is nontechnical, fast reading, and most interesting. It deals with the humorous as well as the serious problems of space travel. Newspapers rarely write about the specifics of space travel such as interpersonal problems. Pioneering Space covers such issues in an incredibly interesting manner.

Humor is not left behind on Earth. On one Soviet space mission with two cosmonauts, one decided to take a nap in the Soyuz capsule away from the other. His partner, discovering the hatch closed, politely knocked. The other asked, "Who's there?"

All astronauts and cosmonauts agree that no camera can replace the human eye. Photographs that were stunning to ground crews were disappointing to those who saw the actual views from space. Astronauts used 10X50 binoculars to view the Earth; with them they could see ships at sea.

This book gives details of more personal problems of space flight, such as personal hygiene, gas, poor air, and the like. On an early Gemini mission a frogman, upon opening the hatch, reached in to shake hands, but got a whiff of air and threw up on the capsule commander. The Soviets are experimenting with a fragrance called "pine forest" but haven't commented on the outcome.

When permanent space stations come into use, astronauts will need a local source of food and oxygen, rather than having them brought in. Already both the American and the Societ missions are growing gardens on their longer space flights. Seeds are given normal nutrients along with filtered air. In 1982, cosmonauts grew wheat, oats, peas, and carrots. On longer missions, these gardens supplied some of the food. Some plants give off a large amount of oxygen. Drinking water comes from recovered water vapor and from carbon dioxide reactors.

The Soviets have found that democracy works far better than other forms of government in space. For example, if the commander is required to share in the unpleasant work, such as cleaning up, everyone is happier.

The first part of Chapter Twelve deals with the modern space toilet, how it was developed and how it works. It makes quite interesting reading. Ever wonder if male and female astronauts sleep in the same room? On American missions they sleep wherever they like. However, the Soviets felt that the female cosmonauts should have their privacy, designing a private room for them. After one night alone, each female astronaut decided to sleep near the men.

This book is quite interesting. It is humorous at times and answers many questions you may have had about space travel. Read it.

Armchair Astronomy. By Patrick Moore. W.W. Norton and Co., 500 Fifth Ave., New York, NY 10010. 1986. 185 pages, Glossary and index. Price $ 16.95 cloth (ISBN 0-393-02253-6).

Reviewed by Rodger W. Gordon

What do astronomers do on cloudy nights? "Read astronomy books" is a good answer and, if that means Patrick Moore's Armchair Astronomy, all the better.

Set along the same general lines as the late Joseph Ashbrook's "Astronomical Scrapbook" series published for many years in Sky & Telescope magazine*,

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* And also available in book form; see our outside back cover. [Ed.]

Mr. Moore gives us some fascinating looks into the lesser-known sidelights of astronomy and at the men and women who follow the stars. The human side of astronomy is brought out in articles dealing with such interesting characters as T.J.J. See, Basil Ringrose (a pirate no less!), or Sir William Lower. If you have ever wondered who "Leo Brenner" was and why he is seldom referred to today, you will find out here.

Many of us are familiar with the main avenues of astronomy, but Patrick Moore takes us "off the beaten path" for a glimpse at dead-end trails, discarded theories, and mostly forgotten characters whose names are occasionally found in other works. However, Mr. Moore balances his book with features about well-known amateurs such as the late W.H. Steavenson or J.P.M. Prentice. For example, how many persons know that Steavenson had only one good eye? Mr. Moore errs though, when he states that Steavenson wrote only one small book. Steavenson's name is found on one of the all-time great works in astronomy, Splendour of the Heavens . He was a contributor to as well as a co-editor with T.E.R. Phillips of this "magnum opus" of the astronomical knowledge of the 1920's and 1930's.

How will the sky look in a million years? Mr. Moore tells us that our familiar Sirius will be a below 2nd-magnitude star then, but Gamma Draconis will shine at -2.2, although now it is at 2nd magnitude. Also, one million years ago, Kappa Orionis shone at -4.3 magnitude, or as bright as Venus.

But I don't want to give too much away. If you are interested in a book that goes beyond "mere facts," this is a good volume to own. Nobody has come out with an astronomical equivalent of the "Trivial Pursuit" game yet; but if you want to throw a few interesting astronomical trivia at your amateur friends some evening, Patrick Moore's book will provide some interesting diversion.

Webb Society Deep-Sky Observer's Handbook. Volume 1. Double Stars. Second Edition. Edited by Kenneth Glyn Jones. Enslow Publishers, Bloy St. and Ramsey Ave., Box 777, Hillside, NJ 07205. 1986. 192 pages, illustrated. Price $ 13.95 paper (ISBN 0-89490-122-2).

Reviewed by John D. Sabia

The Second Edition of Double Stars has been improved upon since the printing of the British-American edition of 1979. The quality of paper in the newer edition allows for a better reproduction of illustrations and is much easier on the eye. The seven original chapters have had some rewriting. Notably, additions have been made to Chapter 2, "Types of Double Stars," Chapter 3, "Observing Methods," Chapter 5, "Micrometers for Double Star Measurements," and Chapter 7, "Brief Biographies of Double Star Observers." A new chapter has been added; Chapter 8, "Color of Double Stars," with five pages of observations, indexed by constellation.

Part Two of this book contains two new appendices: "Appendix 1: Pairs of Known Separations for Calibration of Micrometers," and "Appendix 2: List of Useful Addresses." Fully 143 stars and over 1110 measurements have been added to the catalog of double stars.

NEW BOOKS RECEIVED

Notes by J. Russell Smith

The Anthropic Cosmological Principle. By John D. Barrow and Frank J. Tipler. Oxford University Press, 200 Madison Ave., New York, NY 10016. 1986. 706 pages, index. 9.5 X 6.25 in. Price $ 29.95 cloth (ISBN 0-19-851949-4).

This book contains considerable mathematics. Its chapters are titled: "Introduction," "Design Arguments," "Modern Theology and the Anthropic Principles," "The Rediscovery of Anthropic Principles," "The Weak Anthropic Principle in Physics and Astrophysics," "The Anthropic Principles in Classical Cosmology," "Quantum Mechanics and the Anthropic Principle," "The Anthropic Principle and Biochemistry," "The Space-Travel Argument Against the Existence of Extraterrestrial Intelligent Life," and "The Future of the Universe."

Galaxies. By Paul W. Hodge. Harvard University Press, 79 Garden St., Cambridge, MA 02138. 1986. 174 pages, illustrations, index. 8 X 10.25 in. Price $ 22.50 cloth (ISBN 0-674-34065-5).

This well-illustrated book has the following chapters: "Galaxies and the Universe," "Galactic Structure," "The Formation and Evolution of Galaxies," "Stars and Clusters," "Gas and Dust," "The Missing Mass," "The Magellanic Clouds," "The Local Group," "The Nearest Spirals," "Clusters and Superclusters of Galaxies," "The Distance Scale," "Disturbed Galaxies," and "Quasars."

The New Astronomy. By Nigel Henbest and Michael Marten. Cambridge University Press, 32 East 57th St., New York, NY 10022. 1986. 140 pages, illustrations (including many colored photographs), index. 10.9 X 8.6 in. Price $ 14.95 paper (ISBN 0-521-31057-1).

This is an excellent book, covering the topics of "The New Astronomy," "Solar System," "Optical Astronomy," "Starbirth," "Infrared Astronomy," "Stardeath," "Radio Astronomy," "Milky Way System," "Ultraviolet Astronomy," "Normal Galaxies," "X-Ray and Gamma-Ray Astronomy," and "Active Galaxies."

Invitation to Astronomy. By Simon Mitton and Jacqueline Mitton. Basil Blackwell, Inc., 432 Park Ave. S., Suite 1505, New York, NY 10016. 1986. 210 pages, Glossary and index. 7.75 X 4.75 in. Price $ 24.95 cloth (ISBN 0-631-14699-7), $ 8.95 paper (ISBN 0-631-14695-4).

The authors cover their subject in the following chapters: "The Cosmic Perspective," "Staring Into Space," "The Inheritance," "Treasure at the End of the Rainbow," "Reach for the Stars," "Bigger and Better Observatories," "Seeing With Other Eyes," "Voyaging to the Planets," "Getting It All Organized," "Spiralling Outward," "Pushing the Limits," "The Nature of the Universe," and "A Bright Future for the Stars?" These are followed by "Further Reading" and a Glossary. I am sure that you would like to have this book on your shelf.

A Career in Astronomy. By Harry Shipman, Education Officer, American Astronomical Society, Sharp Laboratory, University of Delaware, Newark, DE 19711. No date. 20-page booklet. Price $ 0.25 in coin for postage and handling.

This booklet is quite useful for high school students and their advisors or counselors. After an "Open Letter," the topics are: "A Career in Astronomy," "The Nature of Astronomy," "Observation in Astronomy," "What Does an Astronomer Do?", "Opportunities in Astronomy," "Becoming an Astronomer," "Books on Astronomy," and "Astronomy Programs," the last of which are listed for the States of the United States, Canada, and Mexico.

OBSERVER'S LOG

A.L.P.O. Founder Walter Haas has forwarded an interesting series of observations, writing:

"On October 31, 1986 I observed three eclipse reappearances of Galilean satellites of Jupiter. The "first speck" of light of the reappearing satellite was detected at these Universal Times: J.II at 2:33:43, J.IV at 2:39:46, and J.I at 3:48:57. The observations were made with a 20-cm. Newtonian reflector at 406X with rather poor seeing and a moderately clear sky. A fourth eclipse event occurred earlier on October 31 against a bright twilight sky at my location and was not timed for that reason, namely an eclipse disappearance of J.IV predicted for 0:20 U.T. in the Astronomical Almanac.

"It must be unusual to observe three eclipse events in less than an hour and one-half. It may be interesting to try to specify the maximum possible number of such events during a single night's observing session of, say, six or eight hours. A simplistic answer would be seven: after opposition we could have eclipse reappearances of J.I and both disappearances and reappearances of J.II, J.III, and J.IV. (Before opposition we would have disappearances of J.I.) However, it is very unusual for both disappearances and reappearances of J.II to be observable; it is necessary for this result to have Jupiter rather close to quadrature and also not too far from perihelion. Refined orbital theory, however, might place restrictions on the time interval during which the seven events cited can occur.

"Persons interested in timing these satellite eclipses are invited to correspond with the ALPO Director. Both visual timings of first or last visibility and refined photometric observations are of value to the Association of Lunar and Planetary Observers (ALPO)."

ANNOUNCEMENTS

Sustaining Members and Sponsors. --The persons and groups listed below have supported the work of the A.L.P.O. by voluntarily paying higher dues; $40 per volume for Sponsors and $20 per volume for Sustaining Members. We are very thankful for their generosity.

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(Please inform the Editor if you find any errors in the above lists.)

New Lunar Recorder. --James Phillips, M.D., has been appointed as Recorder, Lunar Dome Survey. Readers will remember the announcement of his revival of the Lunar Dome Survey in our November, 1986 issue [JALPO , 31 , Nos. 11-12, p. 269] and, of course, will have noted his historical article on lunar domes in this issue [pp. 67-73]. This project already has over 80 participating observers and appears more than worthy of being "officialized." Dr. Phillips' address is now listed on our inside back cover, and members interested in lunar observation are invited to write to him.

Amateur Achievement Award. --The Astronomical Society of the Pacific's "Amateur Achievement Award" for 1987 has been given to Clinton B. Ford of the American Association of Variable Star Observers (AAVSO). Mr. Ford joined the AAVSO in 1928, and has served as its Secretary since 1948 and as its President in 1961. The AAVSO itself celebrated its 75th anniversary this year.

Capen Estate Sale. --Many astronomical items from the estate of our late Mars Recorder, Charles F. Capen, are now for sale at quite reasonable prices. Items include small telescopes, eyepieces and other telescopic accessories, filters, and Mars books. For more information, write Mars Recorder Jeff D. Beish at the address on the inside back cover.

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STAFF

DIRECTOR //EDITOR
John E. Westfall
P.O. Box 16131
San Francisco, California 94116

FOUNDER/DIRECTOR EMERITUS
Walter H. Haas
2225 Thomas Drive
Las Cruces, New Mexico 88001

SECRETARY AND BOOK REVIEW EDITOR
J. Russell Smith
8930 Raven Drive
Waco, Texas 76710

MERCURY SECTION
Richard M. Baum (Recorder)
25 Whitchurch Road
Chester CH3 5QA, England

VENUS SECTION
Julius L. Benton, Jr., (Recorder)
See address of Saturn Recorder

MARS SECTION
Donald C. Parker (Recorder, photography)
12911 Lerida St.
Coral Gables, Florida 33156
Jeff D. Beish (Recorder, statistics)
9460 Toni Drive
Miami, Florida 33157

JUPITER SECTION
Phillip W. Budine (Recorder)
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Oxford, New York 13830
Jose Olivarez (Recorder)
See address of Lunar and Planetary Training Program Recorder
Jean Dragesco (Assistant Recorder, Photography)
B.P. 117
Butare, Rwanda
Paul K. Mackal (Assistant Recorder)
7014 W. Mequon Road
112 North
Mequon, Wisconsin 53092
John E. Westfall (Assistant Recorder, Eclipse Timings)
See address of Director/Editor

SATURN SECTION
Julius L. Benton, Jr. (Recorder)
Associates in Astronomy
305 Surrey Road
Savannah, Georgia 31410

REMOTE PLANETS SECTION
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Francis G. Graham (Recorder, Eclipses)
P.O. Box 209
East Pittsburgh, Pennsylvania 15112

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Jim Phillips, M.D. (Recorder, Lunar Dome Survey)
65 Gibbes Street
Charleston, South Carolina 29401

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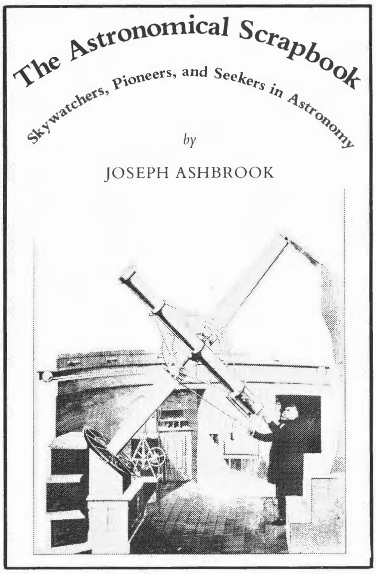

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