



the Spectrum

BUFFALO ASTRONOMICAL ASSOCIATION INC.
BUFFALO MUSEUM OF SCIENCE
HUMBOLDT PARKWAY
BUFFALO NEW YORK 14211

Editor: Ernst E. Both

MARCH - APRIL 1974

MARCH MEETING: Please note that there will be no B.A.A. meeting at the Museum on March 8. Instead, most of our members will attend the Buffalo Philharmonic Orchestra's Pops Concert (All-Gershwin Night) at Kleinhans Music Hall, March 8, 1974, 8:30 p.m. The concert is to benefit our projected observatory at Beaver Meadows and the Audubon Society's Environmental Education Center. SEE YOU AT KLEINHANS!!

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APRIL MEETING: April 12, 1974, 8:00 p.m., Club Room, Buffalo Museum of Science. For our April meeting we are happy to present Dr. David D. Meisel in an illustrated lecture on "Comets." Dr. Meisel is Associate Professor in the Department of Physics and Astronomy, State University College of New York at Geneseo, and a Research Associate of the Mees Observatory, University of Rochester. He received his PhD in Astronomy from Ohio State University (1967). He is a Fellow of the Royal Astronomical Society, and holds memberships in the American Astronomical Society and the International Astronomical Union. If you have wondered what happened to Comet Kohoutek and what comets are all about, come and hear this lecture. It should be quite exciting. HAPPY WELCOME, DR. MEISEL!!

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IN MEMORIAM: ROBERT KARTYAS, 7 May 1948 - 3 February 1974

It is with profound sadness that we record the death of our treasurer, Bob Kartyas. His death, coming unexpectedly at the very prime of life, has caused us all to more fully realize the dynamic role he played in our association. In turn it has made us the more aware of the loss we have suffered.

Perhaps not all members knew of Bob's many activities in connection with the B.A.A. His most conspicuous role was that of treasurer, since June 1972. Behind the scenes he was instrumental in forming the Publicity Committee which, among others, did an outstanding job of publicizing the Kohoutek Nights - this event, in itself, one of Bob's ideas. He was also to a large extent responsible for reviving the Observing Section which held its first meeting at Newstead Observatory, responsible also for organizing a Finance Committee to work on the Beaver Meadows project. Perhaps closest to his heart was the wish to preserve Newstead Observatory - to retain it side by side with our projected observatory at Beaver Meadows. Equally important to him was his devotion to popularizing astronomy and his interest especially in the young, budding devotees of astronomy.

One measure of a man lies in his ability to be interested in the world around him and the scope of this interest determines his uniqueness. Bob graduated from the University of Buffalo (SUNYAB) with a double major in anthropology and classics, and he planned to continue as a graduate student in classics next fall. Beyond that he had many interests and a capacity to become interested in many things. His second love (perhaps his first) was music. Besides tutoring students at the piano, he was taking a course in piano tuning and expected to support himself in graduate school as a piano tuner. He was dreaming of building, some day perhaps, his own harpsichord. Both in reading and in his music appreciation his tastes showed wide ranges. Among other interests one might mention his membership in the Tonawanda Historical Society; photographing historical landmarks in the Tonawanda area; rose gardening in his very small backyard garden; wine- and candle making;

Bob Kartyas was a strong and gentle man and our lives are richer for having known him and having been associated with him. May his memory spur us on to successfully complete the projects which captivated his interest - let us keep his memory alive.

We extend our deepest, heartfelt sympathy to his family and friends.

Warren Steinberg and Ernst Both for the B.A.A.

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* B.A.A. INSTRUMENT SECTION MEETING, January 1974 * By Warren Steinberg

First of all the Instrument Section wishes to extend its gratitude to the Tom Dessert family for its invitation to hold the January meeting at its home. The entire evening was filled with worthwhile activity. The early part of the evening was spent inside Tom's observatory viewing the comet (Comet Kohoutek, believe it or not) and taking photos of it and other wonders. Later we moved to the inside of Tom's house. While Bill Deazley and Rob Mayer (and others) were talking over Bill's astro-camera with its unique finder-attachement, Tom Dessert was in his darkroom, developing pictures and later even handing out samples of his work. Upstairs, in the family dining room, Ed Lindberg and other mirror making enthusiasts were testing a number of telescope mirrors. Naturally we had some trouble testing through the air currents produced by the temperature differences (seems that everybody was trying to talk at the same time) - but we did get some results.

Some discussion centered around cleaning aluminized mirrors. Yours truly stated that while there was some dirt on the surface of his mirror, he hadn't cleaned it since it was aluminized almost four years ago. Cleaning an aluminized mirror is a touchy job since the aluminum surface is soft and very thin (ca. 1/10 micron). If a mirror has to be cleaned, it should be soaked in soapy water for some time to dissolve or loosen the dirt on the surface (use ivory snow or other mild soaps), and the surface should be very lightly swabbed with cotton. Rinse the mirror with distilled water and let it drip dry with the mirror standing on edge.

We appreciate the continued interest shown in our section by members and friends. We try to keep the atmosphere informal and the interests geared to different topics. Anyone interested in this section and its work, please contact Ed Lindberg at 633-6725. Meetings are usually on the fourth Friday of every month, generally at the Museum.

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** SPACECRAFT LAUNCH WINDOWS ** By Dr. Frederick R. West (continued from Jan.-Feb. issue)

Average spacecraft time of travel T from the Earth to a planet along an ideal transfer orbit may be easily computed. Since the major axis of the transfer orbit (twice its semi-major axis or mean Sun-spacecraft distance a) is bounded at the orbit of the Earth and planet, if a_E and a_P are the mean Sun-Earth and Sun-planet distances respectively, then (see Figure 1, pg. 4 of Jan.-Feb. issue), $2a = a_E + a_P$

$$a = \frac{a_E + a_P}{2} \quad (1)$$

If a is in astronomical units, then Kepler's third law for orbital motion around the Sun gives the sidereal period P in sidereal of the spacecraft as

$$P^2 = a^3 \quad (2)$$

Since the spacecraft completes only half (180°) a revolution around the Sun in

in transit from the Earth to the planet, $T = \frac{1}{2}P$, and

$$T = \frac{1}{2} \left(\frac{a_E + a_P}{2} \right)^{2/3} \quad (3)$$

From equation (3), if one obtains values of a_P from any reference (such as the RASC's THE OBSERVER'S HANDBOOK 1974), values of T are easily calculated. These are listed below for all major planets and the asteroid Ceres:

Planet	Synodic Period	T	$V_{SI,SS}^*)$
Mercury	116 days	106 days	- 7 km/sec
Venus	584 "	146 "	- 2.5 "
Mars	780 "	260 "	+ 2.9 "
Ceres	467 "	1.3 years	+ 5.7 "
Jupiter	399 "	2.7 "	+ 8.8 "
Saturn	378 "	6.1 "	+10.4 "
Uranus	370 "	16.0 "	+11.0 "
Neptune	367 "	30.6 "	+11.5 "
Pluto	367 "	45.5 "	+11.8 "

*) The sense of the signs here is taken such that at infinity (far from Earth) the spacecraft velocity relative to Earth is negative if directed oppositely to the Earth's orbital velocity (V_E transfer orbits to inferior planets), positively if directed along the Earth's orbital velocity (orbits to superior planets).

Pioneer 11, launched in April 1973 toward Jupiter, and Mariner 10, launched toward Venus in November 1973, represent a new series of interplanetary probes, which use orbit changes produced by a close encounter with the planet to permit a close encounter with a second planet. Mariner 10, after encounter with Venus February 5, 1974, is now enroute to a close encounter with Mercury on March 29, 1974, while Pioneer 11 is planned for an encounter with Saturn after encounter with Jupiter in December of 1974. Such multiple planet probes to reach Mercury and planets beyond Saturn are useful for two reasons:

1. The large V_{SI} needed for a direct transfer orbit to Mercury (=6 to 10 km/sec), compared to 2.5 km/sec needed for an ideal transfer orbit to Venus, and
2. For spacecraft to Saturn and beyond, the extremely long T values, which can be drastically shortened by the proper close encounter of the spaceprobe with a nearer, massive Jovian planet, especially Jupiter.

Since the successful launch of Venera 1 toward Venus out of parking orbit by the USSR on February 12, 1961, spacecraft have been launched from the Earth to Venus, Mars, and Jupiter during launch windows for those planets. An enumeration of launch windows since 1961 follows, together with spacecraft successfully launched from the Earth. Some future launch windows with a few planned NASA craft are also included. Notice that often spacecraft times of travel from Earth to the planets are considerably shorter than T in the table above. This is because the actual transfer orbits differ somewhat from the ideal transfer orbits described above. The sequence of listing is as follows: Launch Window Date, Name of Spacecraft, Launch Date, Arrival Date, Type of Mission. A) Launch Windows to VENUS:

Jan-Feb 1961: Venera 1, 2/12/1961-5/20/1961, planetary flyby, transmission failed 2/27/61.

Jul-Aug 1962: Mariner 2, 8/27/1962-12/14/1962, infrared, radio obs., magnetometer.

Mar-Apr 1964: Zond 1, 4/2/1964-8/ /1964, atmosphere probe, communication fails.

Oct-Nov 1966: Venera 2, 11/12/1965-2/27/1966, planetary flyby, ultraviolet obs.

Venera 3, 11/16/1965-3/1/1966, reached planet, but atmosphere signals fail.

May-Jun 1967: Venera 4, 6/12/1967-10/18/1967, atmospheric probe, temp., pressure, composition.

Mariner 5, 6/14/1967-10/19/1967, flyby, ultraviolet, radio observations.

Jan 1969: Venera 5, 1/4/1969-5/16/1969, atmospheric probe, day side.

Venera 6, 1/10/1969-5/17/1969, atmospheric probe, night side.

Jul-Aug 1970: Venera 7, 8/17/1970-12/15/1970, atmosphere probe, reached surface, temp., press.
 Mar-Apr 1972: Venera 8, 3/26/1972-7/22/1972, surface lander, temp., pressure, surface comp.
 Oct-Nov 1973: Mariner 10, 11/3/1973-2/5/1974, flyby, UV photos, first Mercury flyby.
 Future windows are: May-Jun 1975, Jan 1977 (NASA probe planned), Jul-Aug 1978.

B) Launch Windows to MARS:

Oct-Nov 1962; Mars 1, 11/1/1962-6/ /1963, flyby, radio signals lost 3/19/1963.
 Nov-Dec 1964; Mariner 4, 11/28/1964-7/14/1965, flyby, first close-up photos, magnetometer, etc.
 Zond 2, 11/30/1964-8/6/1965, flyby, radio signals lost Feb 1965.
 Jan-Feb 1967: No Spacecraft Launched
 Feb-Mar 1969: Mariner 6, 2/24/1969-7/29/1969, flyby, close-up photos, infrared, UV scans.
 Mariner 7, 3/27/1969-8/5/1969, same.
 May-Jun 1971: Mars 2, 5/19/1971-11/27/1971, Mars orbiter, close-up photos, soft lander fails.
 Mars 3, 5/28/1971-12/2/1971, same + lands, but short-lived. Surface pressure.
 Mariner 9, 5/30/1971-11/13/1971, Mars orbiter, 4000 close-ups, infrared, etc.
 Jul-Aug 1973: Mars 4-7, launched in succession 7/21, 7/25, 8/5, 8/9, to arrive Feb-Mar 1974,
 mission unknown, presumably orbiter-lander.
 Future windows are: Sep-Oct 1975 (NASA plans Viking 1+2, as orbiter-landers), Nov-Dec 1977,
 Dec 1979.

C) Launch Windows to JUPITER:

No Spacecraft Launched in windows: Dec 1969, Jan 1970, Jan-Feb 1971.
 Feb-Mar 1972, Pioneer 10, 3/3/1972-12/3/1973, flyby, close-up photos, magnetosphere, satellite.
 Mar-Apr 1973, Pioneer 11, 4/5/1973-12/ /1974, same but Saturn flyby 1979
 Future windows are: Apr-May 1974, May-Jun 1975, Jun-Jul 1976, Jul-Aug 1977 (NASA plans 2
 Jupiter-Saturn probes), Aug-Sep 1978, Sep-Oct 1979. Note: Mariner, Viking, Pioneer are
 USA probes, Venera, Zond, Mars are USSR probes. For more details on these spacecraft see
 SKY AND TELESCOPE from April 1961 on; also AVIATION WEEK contains much information on
 both successful and unsuccessful interplanetary missions. ERROR IN FIRST PART OF ARTICLE:
 Jan-Feb issue of Spectrum 1974, pg. 5, third line below Fig. 2: "Earth's escape velocity
 V_E " should read "Earth's orbital velocity V_E ". (our typing is often mind-less, eeb.)

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* COMET BRADFIELD 1974 b * By Ernst E. Both

No sooner has the "fizzle of the century" (Comet Kohoutek, the quoted appellation has been used by some irreverent members of the human race - actually, in astronomical terms, Kohoutek was a "smashing success") passed into near unobservability, when another comet arrives to grace (?) our evening skies. Comet 1974 b was discovered on February 12, 1974 by William A. Bradfield of Dernancourt (near Adelaide), Australia. It is scheduled to pass perihelion on March 19, 1974 at a distance from the Sun of about 47 million miles. It will be closest to Earth around April 3 (ca. 64 million miles) and will become circumpolar in our sky around April 7 (i.e. from that day on it will be visible all night). Expected to reach apparent magnitude around 4.5 by March 24 (at which time it will set nearly 2½ hours after the Sun), Comet Bradfield may make up for some of the disappointment Comet Kohoutek produced. After all, it doesn't happen too often to see two comets in close succession. Herewith an ephemeris (from IAU Circular No. 2636, 20 Feb 1974):

1974 ET	RA 1950	decl. 1950	distance from Earth (a.u.) from Sun app. mag.		
Mar 9	1h 12.19	-19° 54.9			
14	1 33.36	-13 16.6	0.909	0.522	5.0
19	1 52.64	- 4 12.4			
24	2 08.59	+ 7 21.4	0.728	0.520	4.5
29	2 20.64	+20 32.2			
Apr 3	2 29.23	+33 42.2	0.688	0.617	5.1
8	2 35.39	+45 27.7			
13	2 40.26	+55 16.7	0.770	0.766	6.3

Potential comet photographers should note that since the motion in declination is very rapid (nearly 6 arcminutes/hour) careful guiding in declination on the comet becomes very critical.

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Pioneer 10 and 11 Status Report From NASA News Release No: 74-43

NASA's two Jupiter Pioneer spacecraft are continuing to push outward the limits of explored space. Pioneer 10 now is 37 million miles beyond Jupiter, and Pioneer 11 is completing its trip through the Asteroid Belt.

Pioneer 10 flew by Jupiter last December 3, and returned pictures and much information on the giant planet. It is now 567 million miles from Earth, the farthest distance yet attained by a man-made object. The craft is traveling about 50,000 miles per hour on its flight path out of the solar system, and is expected to reach the orbit of Saturn in March 1976. Communications time from Earth to Pioneer 10 and back has now increased to an hour and 42 minutes. The Pioneer 10 meteoroid detector has experienced two hits since leaving Jupiter. This suggests about the same concentration of the tiny, high-velocity dust particles beyond Jupiter as Pioneer found between the outer edge of the Asteroid Belt and Jupiter. The craft is continuing to function well. Minor changes in spacecraft systems caused by passage through Jupiter's intense radiation belts now have either disappeared, or are having no effect on performance. One of the cosmic ray instruments suffered some loss of functions when it went through the radiation belt, and experimenters are now assessing the seriousness of this.

On Pioneer 11 all systems continue to run well. The spacecraft will reach Jupiter next December 5, and may then go on to Saturn. So far this craft has experienced eight hits on its meteoroid detector by high-velocity meteoroids in the Asteroid Belt. Taking into account design differences between the meteoroid detectors aboard Pioneers 10 and 11, the Pioneer 11 instrument has experienced about the same rate of hits in the Asteroid Belt as Pioneer 10. Pioneer 11 now is 410 million miles from Earth and is traveling along its flight path at about 36,000 miles per hour.

Radar Distinguishes Hills, Valleys on Mercury From NASA News Release No: 74-12

The report on the discovery of surface features on Mercury by Radar was made in the January issue of the Astronomical Journal by Drs. Richard M. Goldstein and Shalhav Zohar of JPL's Communications Research Station. Goldstein heads JPL's radar astronomy team that probes the planets at the Goldstone, Calif., Deep Space Station. Directing high-powered beams at Mercury some 55 million miles away, the JPL team took a series of radar "snapshots" of the planet. These snapshots - 14 radar probes during the last half of 1972 - produced the following panorama of the equatorial regions of Mercury:

Five or more areas probed appear to be circular features likely to be craters averaging 30 miles in diameter.

Two experiments indicated several craters might be 300 miles across, although the evidence is not conclusive.

While most of the hills seem to be gradual or gently sloped, one experiment indicated a promontory rising about 4,200 feet from a 75-mile wide base.

These findings may be verified March 29 when Mariner 10 is scheduled to fly by and take the first close-up photographs of Mercury. The 14 JPL radar scanings of Mercury were made with the Goldstone station's 210-foot transmitter to send the 2.388 GHz signal and, alternately, to receive the returned signal. Transmitting power is 400 kilowatts on a 12.5 cm wavelength. The echo returns in about 10 minutes with a power of a very tiny fraction of a watt. Bouncing radar beams off features on Mercury, Goldstein says, is "like trying to hit a dime at 10,000 miles."

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FOR SALE: Webcor slide-tape synchronizer; binoculars 7X35=one Yamatar German type, one Bushnell one-piece body; 8mm Movie Reviewer; Telephoto and wide angle lens sets for twinlens reflex camera; delux elevator tripod for cameras/binoculars; camera tripod; sylvania light gun; Paillard-Bollex 8mm Movie Camera with telephoto; exposure meters; Revere 16mm magazine camera with turret f/2.5; prices on request, call Warren Steinberg or Mr. Bloomfield at 834-2400. *****

* BAA ASTROPHOTOGRAPHY EXHIBIT will take place during April, in the Print Room of the Museum. All B.A.A. members are eligible. Photographs (black & white, or color, preferably 8X10 prints) should be submitted to Ernst Both no later than March 20, 1974. Photos may be either glossy or dull finish, unmounted. Include name, date, equipment used, exposure, time, and address. Let's make this the biggest and best exhibit yet. *****

APRIL METEORS: On the evening of the 21st and morning of the 22nd, remnants of Comet Thatcher (1861) provide us with the Lyrid meteors whose radiant lies about 10° south and west of Vega (RA 18h08m, decl. $+ 32^{\circ}$) At maximum only 12 meteors per hour are seen on the average. The Moon at last quarter may interfere somewhat. By the morning of April 23 the average has dropped to 3-4/hour. No showers of any consequence occur in March. Darwin Christy.

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** SPY AND TELL ** Warren Steinberg has been appointed treasurer until June of this year, at which time new elections will be held. Congratulations, Warren! Members who have not as yet paid their dues, please see Warren soon. *** John Riggs - we should have told you this long ago - will be celebrating his anniversary this March. He began one year ago to host a radio program on WBFO (88.7 FM) featuring classical music, every Sunday morning from 9-11 a.m. This is a very excellent program and we hope members and friends will tune in Sundays to hear our own John Riggs! Happy Anniversary!! *** We hear that Tom Dessert is planning to build the largest telescope in WNY. *** SALVE ET VALE *****

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** FIRST CLASS **

John Riggs
255 Grimsby Rd.
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