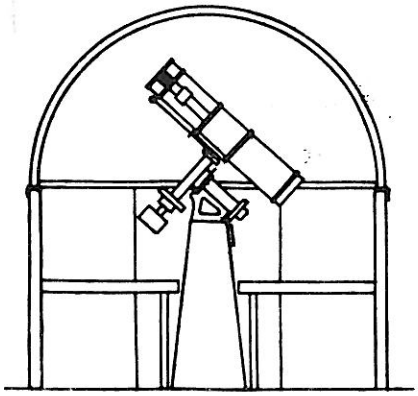


The Spectrum

DECEMBER 1969

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

GREENWICH OBSERVATORIES - OLD v NEW

DECEMBER MEETING: Our final meeting of 1969 (December 12, 1969, 8:00 PM) will feature a very full and varied program: Ed and Olga Lindberg will present an illustrated talk entitled ~~"Royal Observatories"~~ - they have travelled extensively in Europe and have brought back many slides of astronomical facilities. The second feature of the evening is the annual round-up of summer star nights. Edith Geiger will once again provide her witty comments on past events. To conclude this evening, members and guests will have an opportunity to preview the long-awaited exhibit on "Astrophotography" sponsored by the Buffalo Astronomical Association in cooperation with the Museum. Needless to say, this promises to be an exciting evening - one which you simply cannot afford to miss!

* * *

* SATURN'S SATELLITE SYSTEM * By Dr. Frederick R. West

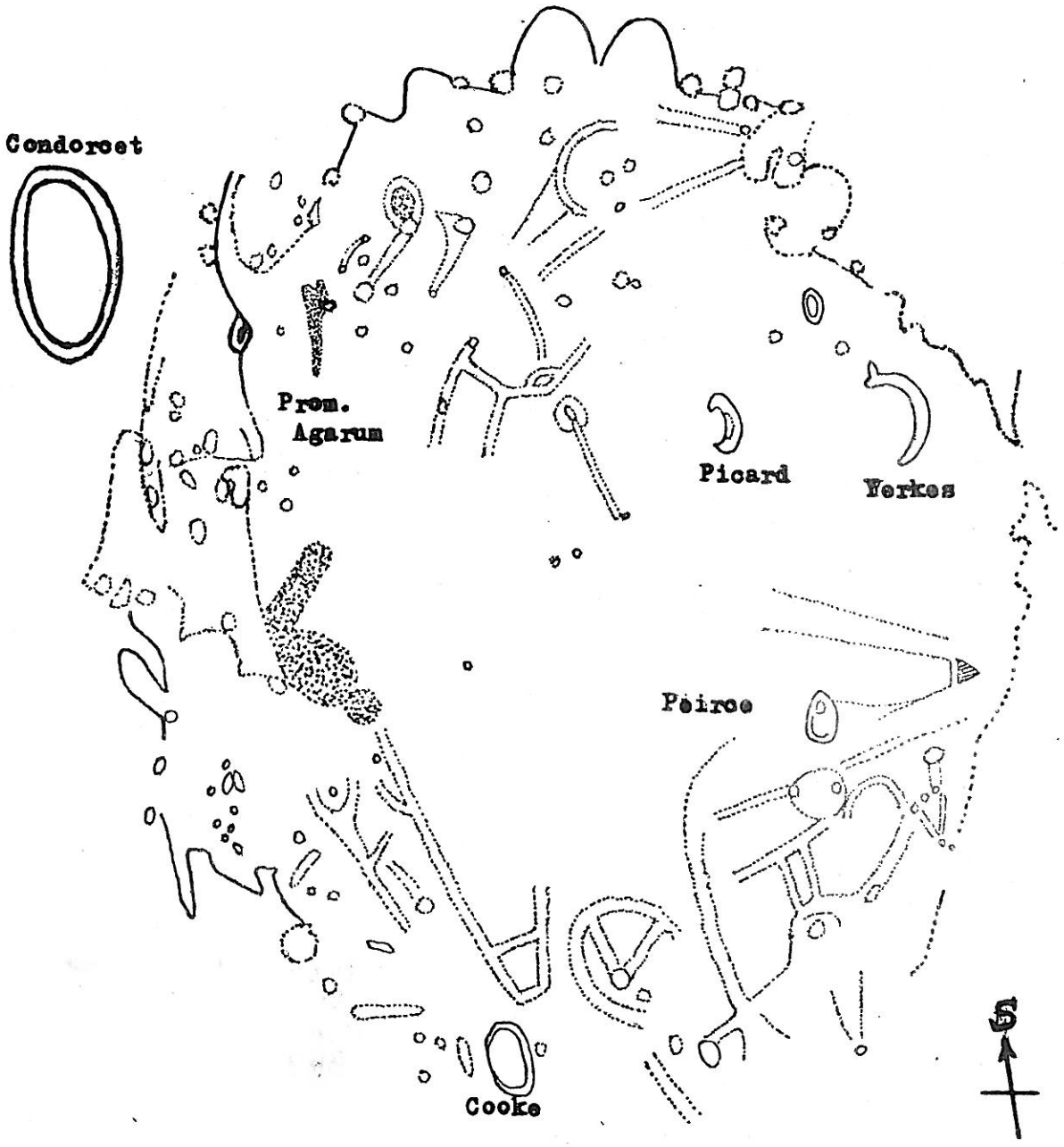
During the next few months, Saturn will be prominent in the evening sky in the constellation of Aries, since this planet was in opposition to the Sun on October 29. Of course Saturn is famous for its ring system, made up of many millions of small particles that orbit the planet in the plane of its equator at distances from 47,000 to 85,000 miles from Saturn's center. The ring is quite thin; every 13 to 15 years we see the ring edge-on, at which times the ring is difficult or impossible to see. The ring must therefore be less than 15 miles thick and may have a thickness of as little as 8 inches. The ring system makes Saturn one of the most beautiful objects known in the sky. Outside the ring system, Saturn has 9 or 10 known satellites, which make this satellite system a true miniature solar system. Kepler's third law holds for the ratios of the revolution periods squared of any two satellites equalling the ratio of the cubes of their mean distances from Saturn's center. In addition, some interesting ratios exist between the periods of revolution of some of some of the satellites. The satellites have been discovered over a 300-year interval, from Huyghens' discovery of Titan in 1655 to the discovery of a possible tenth satellite (Janus) just beyond the outer edge of the ring, by Dollfus in 1966, when we saw the ring edge-on. This discovery cannot be considered final, since the Italian astronomer L. Rosino (personal communication) was unable to sight or photograph Janus with comparable telescopes and weather conditions in which A. Dollfus, J. Texereau, and R. L. Walker photographed this satellite (see note by eeb at end). Some basic information on what is probably known about these satellites is presented in the following table.

Satellite	Discovery	Mean Distance (miles)	Period	Diameter (miles)	Eccentr.	Inclinat.	App. Mag.
Janus	Dollfus 1966	95,000	17h58m	(100)	(0.00)	(0°00)	(15)
Mimas	Herschel 1789	115,000	22 39	200?	0.02	1°31'	12
Enceladus	Herschel 1789	148,000	1d08 53	300?	0.0044	0 01	11
Tethys	Cassini 1684	183,000	1 21 18	400?	0.000	1 05	11
Dione	Cassini 1684	235,000	2 17 46	500?	0.002	0 01	11
Rhea	Cassini 1672	327,000	4 12 25	1100	0.001	0 21	10
Titan	Huyghens 1655	759,000	15 22 41	3200	0.029	0 20	8
Hyperion	Bond 1848	920,000	21 06 38	150?	0.104	1 00	14
Iapetus	Cassini 1671	2,210,000	79 07 56	1000	0.028	14 43	var10
Phoebe	Pickering1898	8,034,000	550	150?	0.163	150 03	15

One can divide the Saturn satellite system into three main groups. The first group contains the inner 5 (or 6, if we count Janus) satellites. Their orbits are nearly circular (eccentricity zero) and in the plane of Saturn's equator. Except for Rhea, the outermost satellite of this group, their diameters are 500 miles or less, and are poorly determined. Their smallness and proximity to the usually bright ring make them difficult to detect. If Janus exists, it is now unobservable, and final confirmation of its discovery must wait until 1980, when we shall next see the rings edge-on. The orbital periods of the four satellites Mimas, Enceladus, Tethys, and Dione are nearly in the ratio 2:3:4:6; the orbital periods oscillate about these values and the orbit planes vary slightly in their orientations. The cause of these variations is the gravity pulls that the satellites exert on each other, and these variations are the only means we have to find the masses of the satellites. This method allows only a rough estimate of the masses, since the variations are small and hard to observe. Diameters of the four satellites mentioned above are estimated from their apparent magnitudes by assuming an albedo (reflectivity) similar to Saturn's. Rhea, the outer satellite of this group, has a diameter of 1100 miles, fairly accurately determined by observation of an eclipse of it by Titan's shadow in 1921.

The second group consits of the next two satellites out. They are Titan, Saturn's largest satellite, and Hyperion. Titan's diameter is probably larger than that of the planet Mercury and it is likely to be more massive than our Moon. Titan has a definite atmosphere that shows the spectrum of methane. The other satellite Hyperion, which is more distant from Saturn, is small, certainly less than 200 miles in diameter. These satellites revolve around Saturn nearly in its equatorial plane, but have somewhat elliptical orbits. The revolution periods of Titan and Hyperion are nearly in the ratio of 3:4.

The third group consits of the outer satellites Iapetus and Phoebe. Their orbits are markedly elliptical and are inclined at large angles to Saturn's equator plane; their orbit planes are closer to Saturn's orbital plane around the Sun. Phoebe revolves around Saturn in a retrograde sense (clockwise as seen from Saturn's north pole, whereas the other satellites would appear to revolve counterclockwise). Iapetus is about the size of Rhea and shows up to 1.5 magnitude variation in different parts of its orbit; it seems to keep the same face toward Saturn much as the Moon does toward the Earth. Phoebe is very small and faint, and at its great distance from Saturn the Sun at times exerts a considerable tidal pull on it, which causes the orbital elements of Phoebe to vary considerably with time. (to be concluded in the next issue. See also the note on page 4 of this issue.) * * *



* MARE CRISIUM - SPOTS AND STREAKS, 1964. * By Dr. Fred W. Price

The accompanying chart of the Mare Crisium is based on observations made on the evenings of February 20th, 22nd, and 24th, 1964, with the 8-inch refractor of the Kellogg Observatory, Buffalo Museum of Science. The Mare was under a high angle of illumination and special attention was paid to the light spots and streaks which are only visible under these conditions of illumination, or at least are difficult to see under low lighting. The observation of these diffuse markings is extremely trying and demands excellent seeing. Many of them are visible on the best photographs. Note the configuration of the well known "Trapezium" in the S. part of the Mare. I hope that members of the BAA will attempt to confirm my observation. I have blank outlines available if anyone would like to have them on which to record their observations.

* * * *

TO ALL OF OUR READERS WE WISH A JOYOUS HOLIDAY SEASON AND A HAPPY NEW YEAR * 1 9 7 0 *

NOTE on the discovery of JANUS: All published photographs of Janus were taken within two days of ring-passage. This may indicate that there is a very critical time factor involved in the successful observation of this satellite. For published photographs of Janus, see Sky and Telescope 33:93, Feb. 1967; 33:226, Apr. 1967; and 34:136, Sept. 1967. eeb. * * * * *

FOR SALE: One 8-inch f/8 Cave mirror, freshly Beryllium-coated; also three Kellner eyepieces (4 mm, 1/2 inch, and 3/4 inch) and one 2X-Barlow. Prices to be arranged - call 884-3850 after 5 PM.

* * * * *

WANTED: July 1963 issue of Sky and Telescope - please contact E. Both, Museum of Science.

\- * -

FEBRUARY MEETING: For our meeting on February 13, 1970, we have planned an ASK THE EXPERTS night. Questions must be submitted in writing - if you have any questions pertaining to astronomy or instrument making, etc., please write them down and bring them to the December or January meeting. This is your chance to solve some of your problems (astronomical, we hope). Panel members will include Dr. Chapman, Orrin Christy, Ron Clippinger, Ed Lindberg, Dr, Price, Walter Semerau, Walter Whyman, and yours truly. eeb.

* * *

Buffalo Astronomical Association, Inc.
c/o Buffalo Museum of Science
Humboldt Park
Buffalo, N.Y. 14211

Mr. & Mrs. Duane Lundell
4495 East Overlook Dr.
Williamsville, N.Y.
14221

FIRST CLASS