the Spectrum

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

Editor: Ernst E. Both

MARCH 1971

MARCH MEETING: For our meeting on March 12, 1971 (8:00 PM) we are happy to welcome our own Dr. Fred Price who will present a lecture entitled: "Water and Life on the Moon?" Dr. Price is Associate Professor of Biology at the State University College at Buffalo, and as former President of the B.A.A. he certainly needs no introduction. As a second feature we present the Second Annual B.A.A. Astrophotography exhibit, which will be open after the meeting in the Print Room of the museum. We are very pleased to welcome back DR. PRICE!! * * *

* ERATOSTHENES AND THE SIZE OF THE EARTH * By Kurt Erland (conclusion)

Question: "How did you measure the actual distance between Syene and Alexandria?"
Answer: "I employed a bematistes, a surveyor who has been trained to literally pace off the distance between two points. This is not a very accurate way of doing things, but I was mainly interested in testing a method and not in extreme accuracy. Some of the bematistes are quite reliable and accurate, but others take their task lightly - they will stop frequently for refreshments and then they forget what their count was."
Question: "There is a story making the rounds to the effect that the way you measured the altitude of the Sun at Syene was by observing its reflection at the bottom of a deep well - this would indicate that the Sun was directly overhead. Did you really employ this method?"
Answer: "Oh - that is an interesting story, perhaps a little over-romanticized but completely false. What is now called "the well of Eratosthenes" is actually located at Elephantinos (Jazirat Aswan), an island in the Nile. In reality I used a sciotheron to measure the Sun's altitude."
Question: "What is a sciotheron?"
Answer: "Essentially it is a hollow hemisphere with a gnomon as a vertical radius at its center. The shadow of the gnomon on the inside of the bowl can be measured with accuracy by means of lines drawn on the inside of the bowl."
Question: "Is it not true that both Aristoteles and Archimedes measured the Earth's size before you?"
Answer: "No, they did not measure it, they merely estimated the size of the Earth. Aristoteles found a circumference of 400,000 stadia while Archimedes' figure was, I believe, about 300,000 stadia. Both of these values are much too high."
Question: "How would you evaluate your work on the Earth's size?"
Answer: "I believe my work to be the first reasonably accurate value for the size of the Earth. It is a complete vindication of the theory that the Earth is a sphere. The most important feauture of my work, however, lies in the method which I chose. It is the first correct method for the determination of the Earth's size, and with improved instrumentation it can be capable of great accuracy."

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* The B.A.A. Instrument Section Meeting, January 22, 1971. *

By Warren Steinberg.

On January 22, 1971, another informative meeting of the B.A.A. Instrument Section took place in the museum's Humboldt room. The move from the Roosevelt

room was necessitated by an increased attendance and the need for more stable tables needed for mirror testing. The highlight of the evening was Thad Czerhiejewski's fine 10-inch mirror which he had finished about 37 years ago. Thad has never had the chance to finish the rest of the telescope until now (a "mirror in the drawer" record that probably will never be broken). I might add that Thad is one of the original founders of our association.

Gil Gagne (another "old" but not forgotten member) came in with another 10-inch mirror which he hopes to make into a Newtonian/Cassegrainian telescope. He also displayed his glass-faceted metal tool for grinding the primary mirror. Gil plans to drill a hole in the center of the primary mirror only large enough for a ¼-inch bolt and to one end of it he would attach his diagonal (I hope he will also use an optical window for the Cassegrain secondary to make the system virtually diffraction-free). Ed Lindberg and Bob Burdick talked about Bob's new precision-machined caustic tester and methods of testing with it - Bob has started to grind the primary for his projected 12½-inch Cassegrain. Bill Parker mentioned the workings of Rudy Neuhauser's polishing machine where "one would control the machine with one hand, and the spiritus fermenti with the other hand" (doubtless a practice which would result in optics of rather dubious quality - eeb.). Rudy Neuhauser, Dave Zdrojewski and Wayne Johnson discussed precision optics, while photography with one's telescope was discussed among Bob Hofer, Jack Alba and Irv Goetz. Warren Steinberg described how, with only an outlay of 27¢ for a copper pipe and an old truck tire tube, one can make a button mold for making pitch laps.

Attendance: Jack Alba, Robert Burdick, Thad Czerniejewski, Gil Gagne, Irving Goetz, Bob Hofer, Wayne Johnson, Ed Lindberg, Rudy Neuhauser, Mr. and Mrs. Bill Parker, Ronald Poling, Warren Steinberg, Dave Zdrojewski.

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CLASSICS OF SMALL-TELESCOPE ASTRONOMY, PART I. Edited by Ernst E. Both

INTRODUCTION: In this day and age, when 25-inch to 36-inch telescopes are referred to as being "small" we tend to forget how much important work was carried out, mainly in the 19th century, with telescopes (mostly refractors) between 2.5 to 6 inches in aperture. Often the present-day owner of such truly "small" telescopes is dismayed because he feels there is very little for him to do. We have decided to publish, from time to time, some of the original papers dealing with results obtained from such instruments. These papers, if they appear in translation (as does our first selection) will be in the sense of a very free and edited version. We have selected a paper dealing with Mars because this year's opposition of Mars is a very favorable one, much like that of 1830, the topic of the paper to follow. In reading what follows the reader should remember that prior to 1830 very little was known about Mars. The authors, Beer and Mädler, produced the first map of this planet, and they determined its period of rotation with a precision greatly exceeding previous determinations. The rotation period closest to the modern value prior to Beer and Mädler was that determined by Kunowsky (1821-1822) = 24h 36m 40s. They came to surprisingly modern conclusions concerning the climate of Mars. And they are responsible for selecting the areographic prime meridian still in use today.

* Physical Observations of Mars at its Opposition in September 1830 *

By Wilhem Beer (1797-1850) and Johann Heinrich Mädler (1794-1874).

The past opposition of Mars was the most favorable one in recent years.

Another such favorable opposition will not occur until 15 years hence. This circumstance prompted us to observe the planet whenever our atmosphere permitted, in order to determine the position and shape of its spots, to follow possible physical changes, and to determine its period of rotation. We used a Fraunhofer refractor of 3.88 inches aperture with a focal length of 54 inches, equatorially mounted and equipped with a clock-drive.

Opposition occurred on September 19, but the planet was closest to the Earth five days earlier, on September 14, its distance then being 0.384 AU. Due to the fine optical quality of our instrument we usually could employ a magnification of 300, or at least one of 185 powers. Since the greatest apparent diameter was about 22", lower powers would have shown very little. Our observations covered the period from September 10 to October 20, and we were able to utilize 17 nights, covering all aspects of the planet. We obtained 35 drawings of Mars which were made directly at the telescope. Each of us checked the detail recorded and our drawings show only that detail which was confirmed by both of us.

On the first night of our observations we observed a spot, marked "a" (this is Sinus Meridiani, eeb.) which was close to the center of the disk and appeared so well-defined that we decided to use it to determine the planet's rotation period. On September 14 we followed its motion over three hours from the eastern hemisphere across the central meridian to the western hemisphere. The fact that it had not changed its appearance since September 10 coupled with its regular motion (indicating a motion due to rotation) convinced us of its identity and its constancy. On September 15 we were able (due to increasing clouds) to observe Mars only in the early evening hours and we did not see spot "a". But the following night we did observe it again and were able to make a preliminary determination of the rotation period. This indicated to us that spot "a" would henceforth be visible only in the morning- and daytime-hours and would reach the evening hours only during the middle of October - exactly as we later found. On the 13th of October spot "a" became visible again but was so close to the west limb that we could not be sure of its identity. Only during the following night did we identify it with certainty. Exact observations on October 19 and 20 allowed us then to calculate the period of rotation with greater accuracy; the result was: $24^h\ 37^M\ 9\overset{s}{.}9$, rotation from west to east (the modern value is only $12\overset{s}{.}8$ longer, eeb.).

From the beginning of our observations we had noticed a very obvious, white and sharply defined spot near the south pole, a spot which had been seen by earlier observers and which had been called the "snow zone" (i.e. the southern polar cap, eeb.). During the course of our observations its size decreased steadily until October 5. After this date its size very gradually began to increase again. On September 10 its size was estimated as 1/10 of the planet's diameter (extending to lat. -84°), on October 5 it was 1/20 (extending to lat. -87°), and on October 20 it was 1/15 (extending to lat. -85°). If Herschel's determination of the inclination and position of Mars' rotational axis is correct (we could not check his determination because our instrument lacks a micrometer), the southern hemisphere of Mars passed its vernal equinox on April 14, 1830, and its summer solstice on September 8. The pole spot then reached its smallest size 27 days after the greatest solar altitude (as seen from the southern hemisphere of Mars), a period which would be analogous to the last half of July in our northern hemisphere. Earlier observers have indicated that the polar spot reaches its greatest extent during the martian winter; nearly all observers indicate that its size varies. These facts speak, therefore, in favor of it being an actual snow cover.

Since we always found the planet's limb to be sharply defined (except for a very slight phase effect), and since the dark spots which we observed remained quite constant (apart from minor changes in color and a motion due to rotation), we reject the earlier hypothesis that these spots are merely cloud formations and that the atmosphere of Mars prevents us from seeing its surface (this theory was largely due to J. H. Schroeter in the latter part of the 18th and very early 19th century, eeb.).

Using the rotation period which we had derived, we next proceeded to determine the areocentric position of spot "a" and several other spots we had observed. We chose as the prime meridian that which passes from the poles through spot "a" (this table, together with the drawings, will appear in the next issue of the Spectrum, eeb.). Since one degree areocentric appears to us under an angle of 1/6 arc seconds, we cannot at present hope for a very great accuracy in these positions, and small deviations from these positions should not entitle us to consider them as real changes in the spots. The observed spots are, therefore, surface features, and not clouds.

Our observations show that there are bright, orange-reddish areas on Mars which are interspersed with darker areas, and further, that the bright areas are everywhere interconnected, much like the oceans on Earth. Only in the vicinity of the south pole does the continuum of bright areas begin to disappear. The regions near that pole are not as well-defined as elsewhere. * * (to be concluded in the April issue of the Spectrum. eeb.)

B.A.A. ASTROPHOTOGRAPHY EXHIBIT ON DISPLAY DURING MARCH. PLEASE TELL YOUR FRIENDS.

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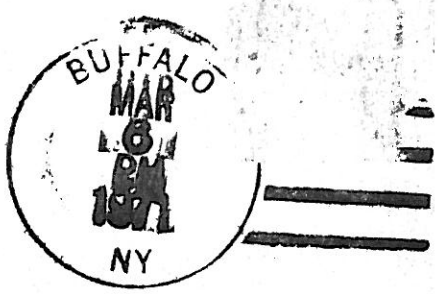

F I R S T C L A S S

Mr. Walter Wyman
193 Oak St.
Batavia, NY 14020