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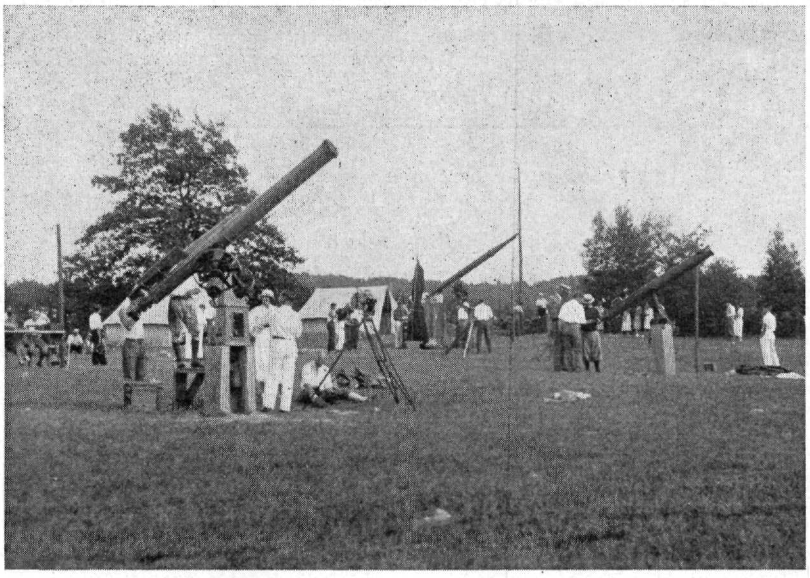
The Chemist Goes Eclipse Hunting

By WALLACE R. BRODE, *Assistant Prof., Dept. of Chemistry*

LIKE the "big game" hunters in the realm of animals there are "big game" hunters in the realm of astronomy. The animal hunter does not have to be a zoologist to enjoy some of the thrill or pleasure of the camera or gun hunt, and neither does the "eclipse hunter" have to be an astronomer to enjoy the thrill of nature's most gorgeous and magnificent spectacle. The total eclipse of the sun on August 31, 1932, was the writer's 5th eclipse, having been under the moon's shadow on four previous occasions, once in Europe and three times in this country. Having had more than his share of clouds and poor weather on these ocasions, he felt that the laws of probability would favor the one of this year. It is of course possible to enjoy the show as a spectator and that has been his usual capacity on other occasions, this time however, a serious effort was made to make some practical scientific measurements through a study of the sun's flash spectrum.



ON LOCATION

Our knowledge of the composition of the sun and stars is based entirely on spectroscopic observations. While we know some 90 elements on the earth we have as yet been able to identify only 58 in the sun. Peculiarly enough it is often the abundant element on the earth, which we have not detected in the sun. For example, P, Hg, Cl, Br and I, have not been positively identified in the sun, while other very rare elements such as Erbium, Harnium. and Indium are very prominent in the sun's spectrum, in fact the rare element Helium, was first identified in the sun and later found on the earth.

The sun may be considered to consist of a central body, known as the "photosphere," which is at a very high temperature and emits light in the form of a continuous spectrum such as would be obtained in the radiation from a black body at the sun's temperature. Surrounding this incandescent body is an atmosphere of gaseous material which is known as the "chromosphere." The chromosphere, while at a very high temperature (about 6000 degrees), is quite cold in comparison with the photosphere and acts as an absorbing screen between the earth and the photosphere. It is from a study of the absorption spectra of the chromosphere that we have learned most of what we know about the composition of the sun.

At the last instant before totality the moon will have covered all of the sun's photosphere and there will remain for a brief moment the chromosphere or sun's atmosphere on the apparent side of the sun, behind which there is no incandescent photosphere. Because of the relative intense brightness of the photosphere, it is impossible to see this atmosphere surrounding the sun unless some distant object such as the moon can eclipse the photosphere and leave only the surrounding atmosphere. At a temperature of 6000 degrees (about that of a carbon arc) the elements surrounding the sun will emit light and produce a spectrum of their own which can be photographed. As the moon continues to cover the sun the portion of the chromosphere near the sun's surface is hidden from view and we obtain the spectrum of the gases higher up in the sun's atmosphere. Therefore a measurement of the length of the spectrum lines on a moving plate will enable us to determine not only the elements in the atmosphere of the sun but also the relative heights that these elements extend above the surface of the sun.

At the relatively lower temperatures in the chromosphere it should be possible to observe the band spectra of such substances as the Calcium sub-halides (CaF, CaCl, CaBr or Car) and thereby identify the presence in the sun of the halogens whose normal spectra are so far out in the ultra violet as to be absorbed by the earth's atmosphere. To effect the recording of the indicated band spectra it is necessary to photograph the far red portions of the visible spectrum and out into the infra red beyond the visible to about 10,000 Å. Five different kinds of specially sensitized film were to be used, one of which was so sensitive to heat rays that it had to be kept packed in dry ice until it was used.

Early in February of this year Dr. Stetson, Director of the Perkins Observatory of the Ohio Wesleyan Uni-

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versity, Delaware, invited the writer to join his party at Douglass Hill, Maine. The designs for the flash spectrograph were finished early in June and by the first week in August the instrument had been assembled and test plates had shown that the instrument was in good operating condition. The instrument was then shipped to Maine and active work started at the Douglass Hill Camp on the fifteenth of August. At this time many of the other observing scientists had their adjustment work well under way, some having come as early as the first of August. After the necessary concrete bases had been constructed the instrument was carefully adjusted by taking several hundred photographs with an artificial slit system. This slit system was removed for the final eclipse photographs and in its place the thin crescent formed by the last visible portion of the sun as the moon passes in front of it was to be used as the slit or line source of light. This line is of course curved in a crescent form but for our study only a small segment at the center of the crescent was used, the remainder being cut off by a shield in front of the film.

The operating crew of the flash spectrograph included in addition to Dr. Brode, Prof. F. C. Caldwell of the Department of Electrical Engineering, Prof. E. S. Manson of the Department of Astronomy, Mrs. Wallace R. Brode (M. S. (Physics) '31) and Dr. Edward F. Wesp of the Department of Chemistry.

It would have been much better in certain respects if it had rained all day. As it was the eclipse day started clear and towards noon a few clouds appeared. The sun continued to be fully visible until not more than 10 minutes before the time of totality when the wind shifted and brought a neighboring cloud directly over the sun. So near were we to the edge of the cloud that at the time of totality the eclipse was clearly visible a mile to the east of us. The cloud was so dense, however that no photographs of any type were obtained and our only knowledge of the occurrence of the eclipse came through the wierd light, the almost complete darkness at the total period, and watching the turkeys go to roost. There will be another eclipse in Borneo in a year or so and then one in Russia in 1936 for which we have plenty of time to get ready.

Ivor Armistead can't figure out what all this talk of hunting in the EE lab is about. He says that since squirrel season has closed and there are no rabbits on the campus (not that we know of any), the only thing he can think of is that there is to be an open season on profs who call extra class sessions for their courses.

Jim Hart to Pete Clymer: "Say, Pete, are cranberries good to eat?"

Pete: "Sure, they make better apple sauce than prunes."