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**Title:** "Solar Eclipse of August 7, 1869," by Charles F. Himes

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# SOLAR ECLIPSE OF AUGUST 7, 1869.

REPORT OF PROF. CHARLES F. HIMES, PH.D.

*Prof. Morton:*—

Dear Sir,—According to request, I make the following report of the section of the Photographic Corps organized by you and stationed at Ottumwa, Iowa, consisting of J. Zentmayer, J. C. Browne, E. Moelling, W. J. Baker, and myself.

The point of observation was finely located on a hill about a mile north-east of the city, in latitude 41° 2′, longitude 92° 23′ West of Greenwich, according to determinations of Professor Alexander, who happened to be located at the same place for astronomical observations.

On our arrival on Wednesday evening preceding the 7th, we found a very convenient shelter shed, with sliding roof and photographic room, erected under instructions from Professor Coffin.

The telescope was set next day upon a cross of timber firmly let in the earth. The clock work, not of very superior construction, was found to have become deranged by carriage, but fortunately the skill and experience of Mr. Zentmayer were available, and it was put in as good running order by him as it was susceptible of, otherwise we would have lost the opportunity for taking the totality negatives with a length of exposure sufficient to give the amount of detail and corona we obtained. It was deemed advisable, however, that Mr. Moelling should pay exclusive attention to the clock during the progress of the eclipse, in order to detect and correct any irregularity that might occur.

In the absence of any assistance from an astronomical party, the adjustment of the instrument and of the reticule for determining angles of position was mainly accomplished by Mr. Zentmayer, in a very satisfactory manner, in spite of the unfavorable weather preceding the evening of the 6th.

The morning of the 7th found the sky overcast, but gradually with a dry wind from the east, the clouds gave way, until at noon, not a trace of cloud or haze was to be seen. These few hours were improved by determining the actinic focus with great accuracy.

I placed the chronograph, a make-circuit one with two pens, in position, having connected one pen with the camera to register the exposure of the plates, and the other with a key upon which the seconds were to be tapped from a chronometer; but whilst it was found to act satisfactorily, having cause to fear that, by reason of the

fact that for want of sufficient force it had to be entrusted to volunteer parties, it might become deranged at a critical moment, I did not deem it advisable to trust our record to it alone, and immediately before the beginning of the eclipse, determined to make a record of the times from a chronometer kindly placed at my disposal by Professor Alexander, the correction for which, as given by him, will be found with the annexed schedule of negatives. I found it very easy to note the fraction of a second by the click of the exposure slide, warning having been given me before touching the trigger. I send this record because that made by the chronograph is not complete, and, perhaps, not reliable, as far as it goes, as the instrument became deranged during the progress of the eclipse. I did not find leisure, at the time, to examine and compare it, and, as I regarded the schedule of negatives complete without it, took the liberty to place it in the hands of Prof. Alexander, subject to your request, as he desired to examine it for the record of some of his astronomical observations which he had made upon it by means of the key of the seconds-tapper.

The photographic preparation was exclusively managed by Messrs. Browne and Baker, and the negatives obtained were photographically perfect. A statement by them of formulæ of Collodion, solutions, &c., will doubtless be made to you.

It was found necessary to increase the length of exposure by detaching two of the springs attached to the exposure-slide as the total phase was approached. The exposure during the partial phase I would estimate at from $\frac{1}{30}$th to $\frac{1}{50}$th of a second, with the aperture of the telescope reduced to two inches by a diaphragm placed over the objective. During totality, the full aperture was used, and exposures of six, twelve and sixteen seconds given, producing negatives of exquisite sharpness and detail, including a portion of the corona. The general plan of exposure was to obtain five negatives, if possible, near the contacts, and three near the beginning and end of totality, and at intervals of five and ten minutes during the other phases, and we have reason to be satisfied with the results. The one immediately preceding totality displays the limb of the sun beautifully cut up into Bailey's beads, and the one taken at the instant of the close of the total phase, received the first rays of the emerging sun, but is of interest as showing in this connection the red prominences. On this plan thirty-four excellent, accurately timed negatives were obtained, as given in annexed schedule, in

which D indicates diaphragm of two inches, F, full aperture; under *Length of Exposure*, under *Drop*, 1 indicates exposure slide with slit $\frac{1}{40}$th of inch wide; 2, with slit $\frac{1}{30}$th; 3, with slit $\frac{1}{20}$th, and 4, with circular aperture size of eye-piece. Under *Spring*, 1, 2, 3, denote that one, two or three springs were used upon the exposure slide.

The distribution by you of the prints from negatives of last year at Aden, aided much in regulating developments and exposure.

Whilst we all feel fully satisfied with the results of our efforts, the success of which has been so largely due to the thoroughness of preparation in all details, and the use made of the experience of previous parties by you, we confess with observers of this phenomenon, generally, that we feel that our present experience would have been of great value.

We were necessarily excluded from extended observations beyond our special work, bnt there are several notes made that may be of interest in this connection.

I had watched the approach of totality, anxious if possible to obtain a negative with Bailey's beads, and was surprised with the sudden transition to comparative darkness at the instant of totality, and the peculiar brilliancy with which the stars seemed to spring out without the long struggle through twilight.

The corona approached much more nearly in regularity the four-rayed form generally given, and which had always seemed idealized or conventional. The S. W. ray was, however, unequally subdivided with the smaller part toward the north. The whole seemed of a fibrous, slightly curled or twisted character, somewhat like a cirrus cloud, and of silvery whiteness. The prominences, especially the large one a little to the left of south, seemed at the first instant of a dazzling white, but after my attention had been diverted for a few moments, it appeared of a brilliant decided rose color, bordering on crimson, and remained of this color to the close. To Mr. Zentmayer, who was engaged at the camera and had used neither telescope nor screen, it appeared white, with a slightly roseate hue. To Mr. Moelling, under similar conditions, it appeared white throughout. Messrs. Brown and Baker who had a short glimpse of it from the door of the dark room, rather incline to the opinion that they were white.

During the progress of the eclipse, Mr. Zentmayer, who examined the ground glass of the camera from time to time to notice the posi-

## PHILADELPHIA PHOTOGRAPHIC CORPS.

*Record of the Times and Lengths of Exposures of the Photographic Plates exposed during Total Eclipse of the Sun, at Ottumwa, Iowa, August 7th, 1869, as noted by C. F. Himes. Greenwich Time. To accompany report to Prof. Henry Morton.*

| No. | Time of Exposure. | Length of Expo. | | Aperture. | |
|---|---|---|---|---|---|
| | | Drop. | Spring. | | |
| 1 | 9 h. 59 m. 30 s | 1 | 3 | D | Lost. |
| 2 | 10 h | 1 | 3 | D | |
| 3 | 10 h. 1 m. 5 s | 1 | 3 | D | |
| 4 | 10 h. 2 m, 5 s. (within a second.) | 1 | 3 | D | |
| 5 | 10 h. 3s | 1 | 3 | D | |
| 6 | 10 h. 4 m. 42 s | 1 | 3 | D | |
| 7 | 10 h. 9 m. 55 s | 1 | 3 | D | |
| 8 | 10 h. 14 m. 57 s. } Glass marked XI. Second quality. } | 1 | 3 | D | |
| 9 | 10 h. 19 m. 57 s | 1 | 3 | D | Lost. |
| 10 | 10 h. 28 m. 55 s | 1 | 3 | D | Lost. |
| 11 | 10 h. 32 m. 50 s | 1 | 3 | D | |
| 12 | 10 h. 37 m. 28 s | 1 | 3 | D | Lost. |
| 13 | 10 h. 41 m. 41 s | 1 | 3 | D | |
| 14 | 10 h. 49 m. 22½ s.—glass 2d quality | 1 | 3 | D | |
| 15 | 10 h. 55 m 56 s | 1 | 1 | D | |
| 16 | 10 h. 56 m. 33½ s | 1 | 1 | D | |
| 17 | 10 h. 57 m. 36½ s | 1 | 1 | F | Baily's Beads. |
| 18 | about 6 seconds | 4 | | F | |
| 19 | Totality " 12 " Exposure | 4 | | F | |
| 20 | " 16 " | 4 | | F | |
| 21 | 11 h. 4 m. 15 s. close of tot. and after tot. | 4 | | F | Fogged a little. |
| 22 | 11 h. 6 m. 12 s. | 1 | 1 | D | |
| 23 | 11 h. 6 m. 52 s. | 1 | 3 | D | |
| 24 | 11 h. 7 m. 57½ s | 1 | 3 | D | |
| 25 | 11 h. 10 m. 6½ s | 1 | 3 | D | |
| 26 | 11 h. 16 m. 16½ s | 1 | 3 | D | |
| 27 | 11 h. 22 m, 45½ s | 1 | 3 | D | |
| 28 | 11 h. 29 m. 27 s | 1 | 3 | D | |
| 29 | 11 h. 37 m. 57½ s | 1 | 3 | D | |
| 30 | 11 h. 47 m. 58 s | 1 | 3 | D | |
| 31 | 11 h. 53 m. 7½ s | 1 | 3 | D | |
| 32 | 11 h. 53 m. 45 s | 1 | 3 | D | |
| 33 | 11 h. 54 m. 12½ s | 1 | 3 | D | |
| 34 | 11 h. 55 m. 12 s | 1 | 3 | D | |
| 35 | 11 h. 55 m. 40 s | 1 | 3 | D | |
| 36 | 11 h. 56 m. 10 s | 1 | 3 | D | |
| 37 | 11 h. 57 m. 58 s | 1 | 3 | D | |
| 38 | 11 h. 59 m. 55 s | 1 | 3 | D | |
| 39 | 11 h. 59 m. 7⅕ s. by chronometer of different rate used by Prof. Alexander, and exposure made at signal from him at this time. | 1 | 3 | D | |

D denotes aperture of two inches in diaphragm on objective.
F denotes full aperture.
Drop 1 indicates drop with slit in slide one-fortieth of an inch wide.
Drop 4 indicates drop with circular aperture size of eye-piece.
Spring 1, 2, 3, indicates number of springs used on drop.

tion of the image of the sun, called my attention to an appearance of small luminous bodies like meteors crossing the dark image of the moon from cusp to cusp. Subsequently, they were seen to pass over the ground glass from outside of the field on to the image of the sun, where of course they were lost, always coming from the same side. We were led by this circumstance to regard them as most likely to be optical illusions, perhaps insects with transparent wings or bodies, but the fact that other observers report a shower of meteors between the moon and the earth, which seemed to be as far as I can gather from a hasty description, identical in appearance with the objects noticed by us, our observation may be of considerable value, especially as Mr. Zentmayer, who saw most of them, is disposed not to regard them as optical illusions, since they must have been caused by objects not less than 2,000 feet distant.

I cannot omit to mention the friendly manner in which we were treated by the authorities and citizens of Ottumwa.

Favored as we were with a sky free from cloud or haze, and a beautiful point of view, this phenomenon left an ineraseable impression upon our minds and hearts.

Dickinson College, August 1st, 1869.