

WILLET'S POINT, NEW YORK HARBOR,

March 9, 1871.

SIR: I have the honor to submit the following report of my operations with the expedition sent to Spain under your orders by the United States Government to observe the solar eclipse of December 22, 1870.

Having reached Jerez December 11, I was occupied previously to the 22d in making a topographical sketch, which I inclose, of the farm occupied as an observatory, and, when the weather permitted, in observing stars with the sextant for latitude.

The topographical sketch was made by the method of "foot reconnaissance" used in the engineer department of the Army, the instruments employed being a common box-compass, protractor and scale; the distances were measured by pacing. The variation of the needle was measured as carefully as the instruments at hand would permit from the meridian line established by Mr. Dean, and was found to be about $19\frac{3}{4}^{\circ}$ west. No contours are shown, the ground being so flat that those obtained with the hand-level would lend no additional value to the sketch. A plan of the buildings used for the protection of the instruments is given on a larger scale. In making this plan a small Casella theodolite and a tape-line were used. The house from the top of which observations of the eclipse were taken with the lighter instruments was situated about three-eighths of a mile north-northwest from the barn. Its occupation was determined upon too late for the ground upon which it stood to be introduced into the sketch. Plate No. 28.

In observing with the sextant I was aided by Professor Langley and Mr. Gannett, who kept the record. The weather was not favorable, and I was unable to make as many observations on south stars as I desired. Sufficient were obtained, however, to show that the eccentricity of the instrument, if any, was very slight. The site of the observations was a few feet south of the transit observatory. The chronometers were unpacked on the 13th. The evenings of the 13th, 14th, and 15th were cloudy. On the 16th I was able to observe Polaris. Clouds again on the 17th and 18th. On the 19th Polaris was observed, and on the 20th Polaris and β Orionis. The error of the chronometer was furnished each evening by Mr. Dean, who obtained it from observations with the transit instrument. The refraction correction was obtained from observations with a pocket aneroid barometer, and pocket thermometers. The results are shown in the following table:

Date.	Star.	No. of observations.	Resulting mean latitude.	Probable error.
December 16.	Polaris.	30	$36^{\circ} 41' 49.3''$	$\pm 1.68''$
December 19.	Polaris.	40	$36^{\circ} 41' 52.1''$	$\pm 0.24''$
December 20.	Polaris.	10	$36^{\circ} 41' 45.5''$	$\pm 2.04''$
December 20.	β Orionis.	23	$36^{\circ} 41' 45.4''$	

Combining these results by weights I have for the adopted latitude of the transit observatory

$$36^{\circ} 41' 49.''3$$

with a probable error of $\pm 0.''66$.

During the eclipse my duty was to observe the general phenomena and structure of the corona. For this purpose I was provided with the comet-seeker from the Harvard Observatory, having an aperture of 4.5 inches and magnifying power of 30, mounted on a solid wooden tripod. I was stationed upon the top of the house above referred to.

From the time of first contact the sun was frequently obscured by passing clouds until about a minute before totality, when they broke away and left a clear view of the eclipse. This clear view lasted about two-thirds of totality. Just before the final disappearance of the sun the thin crescent of light was broken into fragments, in no manner resembling what have been described

and sketched as "Baily's Beads." Near the extremities of the crescent these fragments were so short as to appear almost like points, while at the center a considerable arc had but one break in it when it vanished.

A halo appeared about the moon a few seconds before totality, and as the sun disappeared the corona shot out in all its glory. Surrounding the moon's disk and immediately adjacent to it there was a bright light of varied height and of regular but blurred outline. Where the sun was last seen this light arose to a height of about 4'. At the opposite side it was barely visible, while halfway between it rose to about 2'. These heights are merely approximate, the light fading off so gradually that it was exceedingly difficult to fix its limit. As the eclipse progressed it became lower on the first side, increased in height on the opposite side until the sun appeared and then vanished with the rest of the corona. For want of a better name I shall call it the *glow*. It resembled the brief trail of bright light left by the setting sun on a clear day. It undoubtedly appertained to the sun. Its gradual unveiling on the one side and obscuration on the other settle that point.

Outside of the *glow* streamed forth the radial portion of the corona. To keep a distinction I shall call this portion the streamers, and when using the word corona shall refer to the glow and streamers, collectively. The streamers extended generally about 15' in height, though they were considerably shorter, say 12' high, in the direction of the sun's axis. The intervening dark lines radiated from the moon's center and extended from the outer edge of the corona to the *glow*, where they were lost in the brighter light. These dark lines were well marked, clearly visible to the naked eye and straight, except in those portions where the photograph shows openings. Even here I saw no curves, but an amateur observer stationed near me saw them. I had unfortunately selected the opposite side of the corona for my special scrutiny. The streamers did not alter their relative positions but frequently flashed out at greater length and with brighter light, not unlike the flashing of the aurora borealis. For a moment I thought this might be due to passing clouds, but the waves flashed constantly from the center and this fact caused me to change my opinion. The general boundary of the corona was an irregular, jagged line, though it was impossible to give it a definite outline on account of the flashing and the gradual fading off of the light at the exterior. This vagueness and changing of outline will account for the failure of the attempt made by an amateur observer to trace an image of the corona thrown upon ground-glass by Professor Young's comet-seeker.

The color of the corona was a silver white, with a rosy tint near the moon's disk tinging the *glow* and the inner portion of the streamers.

The protuberances were numerous, but I was unable to detect any relation between them, and the structure, shape, or dimensions of the corona.

The effects of the phenomenon upon animate nature were what have often been described, and have no bearing upon the scientific objects of the expedition.

Very respectfully, your obedient servant,

O. H. ERNST,

Captain of Engineers, United States Army.

Professor JOSEPH WINLOCK,
Cambridge, Massachusetts.

Notes to accompany sketch.

At the commencement of totality the corona appeared to consist of straight rays tolerably evenly distributed; after an interval of about 10 seconds, however, two bundles of curved rays appeared distinguishable from the other parts by a rather greater length, and without any definite limits. The remaining portions seemed to extend about half the diameter of the disk, all round. The tint of the corona was a light grayish-blue, and was darker over the prominences.

Between the curved portions a bright prominence was seen of branched shape and distinct form. On the right upper surface a brilliant corruscation formed the distinguishing feature, in