ART. XXXIV.—*Observations on the Total Eclipse of the Sun of 1869*; by CLEVELAND ABBE, Director of the Cincinnati Observatory, Assistant in the Office of the Chief Signal Officer, Washington.

AMONG the parties organized to observe the total eclipse of 1869, Aug. 7th, that sent from the Cincinnati Observatory was probably favored above all others in the advantages of having a comparatively elevated station and exquisite atmosphere. The publication of the work done by this party has been delayed by the fact that, for a year subsequent to the eclipse, I was wholly absorbed in the labor attending the maintenance of the "Weather Bulletin of the Cincinnati Observatory," and my subsequent occupations in the present office have entirely prevented me thus far from even attempting the reduction of our observations; the original note books are at present packed away with the library of the observatory, awaiting the removal and rebuilding of that institution.

My own attention was expressly given to the structure of the corona and coronal streamers, for which I used the full aperture of an exquisite six-inch objective (one that had received a prize at the Paris Exposition Universelle), and which was loaned to the eclipse expedition by Mr. T. G. Taylor of Philadelphia. A short notice of the principal features noted by myself was sent at once to the editor of the *Astronomische Nachrichten*, but has not yet been published, and I therefore take the liberty of restating, through your Journal, the simple phenomena that I then saw.

Our station was at Sioux Falls City (formerly Ft. Dakota), in the southeastern corner of Dakota Territory, latitude 44° , longitude 97° , elevation about 1,500 feet above sea level, in the midst of an extended plateau.

Rain and cloud had continued up to a few hours previous to the critical moment, but the atmosphere during the eclipse was of surpassing steadiness and clearness. The altitude of the sun at the time of totality was about 40° , the local time $3\frac{1}{2}$ P. M., the duration of totality four minutes. No sooner had totality begun than after sketching in most of the prominences as points of reference, I viewed the corona without darkening glasses, and with a magnifying power of probably 120 diameters.

The whole interval of totality was unfortunately not at my disposal, owing partly to the very rough and faulty stand supporting the telescope (everything had to be transported an hundred miles by mules into a wilderness), and partly to an interruption by one of the members of the party; but there seemed to me to be no doubt of the facts as recorded, nor was I conscious of the least undue emotion that might have interfered with my reliability as a witness, although it was the first total eclipse I have ever had the pleasure of observing.

As seen through my inverting telescope, the structure of the largest protuberance on the right hand lower limb was well made out. The neighborhood of the sun was examined to a distance of its own diameter (a radius of possibly one degree from the sun's center), but no trace of the coronal rays as they were seen by others of my party. The evidence as to the existence, shape and positions of these streamers as given by my six assistants, was conclusive as to their actual appearance, with the usual variations as to details. That they were not detected by the six-inch glass was probably due to their diffused light and the small field of view. On the apparent upper and right hand limb of the sun, the six-inch glass showed the long series of red prominences depicted in the photographs published by the Naval Observatory; above the greater portion of the arc of the sun's limb thus covered, and extending somewhat

further to the right, appeared to rise up three, and possibly more, conical masses of pearly light. These were distinctly contrasted against the light diffused as the background of the field of view, and there was every evidence that they had an identical structure and cause. The outline of each of the pearly mountains was that of a rounded cone, as shown in the drawing, exactly resembling the kilns used in some branches of pottery, and other manufactures. The apices of the cones were blunted or truncated, and not well defined; the outlines of the sides of the cones were quite sharp down to within a few minutes of

the sun's limb, when all three appeared to begin to lose their distinctive characteristics.

The height of the apices above the limb varied between one half and two thirds of the solar radius: the diameters of the

bases of the cones was probably included between seven and three minutes. Each apex was of a slightly dusky shade compared with the body of the cone.

The most interesting feature was an unmistakable striation upon the surface of each cone, the striæ apparently twisting spirally around up to the apex opposite to the movement of the hands of a watch as represented on the accompanying drawing.

I noticed no colorations of these striæ other than their darker hue. The details of this striking and new phenomenon interested me so much that I naturally enough lost the observation of the third contact. The pearly cones were on that limb of the sun from which the moon was moving, and the details were every moment becoming more distinct, when the growing height of the bank of red protuberances was followed by the too speedy apparition of the glowing sun beneath.

Chagrin at the loss or imperfect observation of the third contact, caused me to forget to note whether the three cones continued in view for any number of seconds thereafter. From the time of first recognizing the pearly cones until their disappearance probably thirty seconds elapsed (I am writing without my note book or other aid to memory), and I did not note any change in the appearance of the striæ. The middle one of the cones caught my eye more particularly, and the impression was that the other two, especially that on the right, was some distance behind it, or possibly obscured by a cloud of haze in the solar atmosphere.

At the time it seemed to me that I saw in the central cone a column of smoke and hot gas ascending high above the area of red flame, then visible on the surface of the sun, and that the other two cones corresponded to other areas of red flame far behind. The difference in character and position between these cones and the coronal streamers, as observed by the others with the naked eye, and with opera glasses, seemed to argue that the latter were very probably individual and subjective phenomena or that they originated in the earth's atmosphere, while the pearly cones existed in the solar atmosphere and constituted a true solar corona.

My long delay in making this communication to the scientific world will be excused, I trust, in view of the imperative demands made upon my time during the two years that have elapsed since the eclipse of 1869. I shall be deeply interested to learn whether the phenomena seen by myself may not be repeated on some other occasion and be studied by more experienced observers.

I may add that I had hastily provided myself with a Nicol's prism, in hopes to make at least some trial of the nature of the

coronal light; but the rude apparatus did not work satisfactorily, and I confined myself to details of structure; indeed in my earnest gaze upon the novel phenomena I quite forgot the polarizing apparatus.

Washington, D. C., Feb. 6th, 1872.