The observations at Falmouth were placed in charge of Mr. Arthur Searle, assistant at the observatory of Harvard College. Those at Oakland were under the direction of Professor S. P. Langley, and those at Bardstown were conducted by Mr. Charles S. Peirce. For the details of what was done by them, reference is made to their own reports, which follow.

Very respectfully,

JOSEPH WINLOCK.

Professor BENJAMIN PEIRCE,
Superintendent United States Coast Survey.

CAMBRIDGE, *August* 20, 1869.

SIR: In accordance with your instructions I transmit to you the following account of the observations made by me on the solar eclipse of August 7. The station which you selected for me was Bardstown, Kentucky, a little southwest of the central line of the eclipse.

I was furnished with an elegant equatorial telescope of four inches clear aperture, and five feet focal length. Upon opposite sides of the tube of this telescope, and parallel to it, were attached two brass rods at the eye-end of the tube, and reaching about a foot beyond it. Upon these rods was fixed the spectroscope, and in such a manner that the slit was plainly visible. I found this arrangement of yours all that could be desired. With it I had little need of a finder. Pieces of white paper were pasted upon the brass-work of the slit to receive the image of the sun, which, during totality, could not well have been seen upon the polished brass. There was some danger of detaching this paper in opening and closing the slit, and I therefore wished to change the width of the slit as few times as possible during totality. The spectroscope attached to my telescope contained a single flint-glass prism and a three-prism direct-vision spectroscope screwed in in place of its telescope. There were no means of measuring the positions of the lines. In order to bring different parts of the spectrum into view it was necessary to unscrew a binding-screw, which then left the somewhat heavy arm which carried the direct-vision spectroscope entirely loose, and then to move this arm with the hand and tighten up the screw. When this was done the arm would fall a little, and it was only by looking at the spectrum, and estimating how much the arm would fall that it was possible to set upon any part of the spectrum. During totality there might be no light in the field if the observer were to move away from a protuberance, and, therefore, no means of knowing to what part of the spectrum, if any, the arm was set. If the slit was opened to give full light, the paper pasted on it might become detached and render it impossible to set the slit on a protuberance. There was no clock-work on the telescope, and the observers were in continual apprehension of some disturbance in the crowd of mostly ignorant spectators, and therefore an attempt to move this arm was a thing to be dreaded. On the other hand, it could be so set as to afford a view of the spectrum from its red extremity up to half-way between F and G. Under the circumstances I would not venture to move it. If I had been alone, and consequently at my ease, I should have done so.

My telescope was pointed for me by Mr. N. S. Shaler, the geologist, who generously relinquished his opportunity of witnessing the sublime phenomenon undisturbed, and offered his assistance in the astronomical observations. My telescope was, therefore, managed for me with perfect skill and coolness.

Upon the morning of the 6th I set up my instrument and searched for protuberances. I found only one, which was upon the following side of the sun, and was very yellow, that is to say, the yellow line near D was relatively very bright in it. Indeed, I could not see the F line at all. On the morning of the 7th I examined the sun with greater care, and noted several protuberances (which were afterward plainly seen at totality), but none of these were as brilliant as the one which had been seen the day before continued to be; and this was now less high, extended over a larger arc on the disk of the sun, and was still more yellow than it had previously appeared.

At the instant of totality my telescope was pointed on this protuberance and my slit was rather narrow. At that instant the continuous spectrum vanished, and five lines, brilliantly colored, became visible. These were F, *b*, another dimmer and broader line, say one-fourth of the distance from *b* to D, the well-known yellow line near D and C. After observing the spectrum of this protuberance at different positions, I looked at the sun, and was pleased to find my conceptions of the shape and color of this protuberance entirely confirmed.

The same glance showed me upon the southwestern limb of the sun (where my business chiefly lay) a well-marked rose-colored protuberance. I first observed the spectrum of another red protuberance on the southern edge, and then that of the one just mentioned. I found the spectra of the red protuberances to be alike; they differed from that of the yellow one only in the relative greater brilliancy of the red, yellow, and blue lines in the former, the fainter green being especially much fainter. I have no doubt, from my previous observations, that the yellow line was also less bright in the red protuberances, but it appeared so bright that I could not perceive that it was less bright than in the yellow protuberance.

Mr. Shaler then pointed for me on the corona, and I was just opening the slit to get more light when the sun burst forth and put an end to my observations. Two seconds more, or a little more privacy, would have enabled me to get it.

During the eclipse the following miscellaneous observations were made by Mr. Shaler and me:

The protuberances were of two distinct kinds: one sort was low, long, and yellow; the other high, short, and red.

Mr. Shaler saw the disk of the sun break into beads at the moment of totality. The appearance lasted only an instant, and seemed as if it were the effect of irregularities of the limb of the moon. About a month before, Mr. Shaler had observed on the limb of the moon a serrated appearance occasioned by a range of mountains.

Mr. Shaler observed that the corona formed a quadrangle, with concave sides vertical and horizontal, the latter being the longest. He estimated its mean breadth at one and a half the diameter of the sun. He found that it did not fade gradually away, but had a sharply defined edge.

I noticed the following points in reference to colors. While the eclipse was coming on there was no change in the colors of the landscape or of people's faces, but the light had a singular theatrical effect, owing to the sharpness of the shadows. During totality, the light on the landscape was like the gray of twilight. The moon, at this time, was not black, but of a deep, dull, and somewhat purplish blue, darker than the sky. Mr. Shaler confirmed this. The sky was of a dark purplish blue. It was not lighter near the corona. The corona was quite white and not bluish. The yellow protuberances were greenish like the aurora, and intensely brilliant. The red ones had much the color of the light from hydrogen in a Geissler tube. Upon the south, and also (as Mr. Shaler says) on the north, was a salmon-colored light upon the horizon, reaching up some five degrees or more. Venus and Mercury looked as white as Vega ever looks.

Mr. Shaler says: "Little effect was visible on animated nature until the last five minutes before totality, except that the cocks all began to crow, at several points, with the sleepy crow of early morning and not the exultation of full day. The birds began to make their nesting-cries as the light rapidly waned. Cattle were evidently much alarmed, and ran, with tails up and heads erect, across the fields almost in stampede. At the close of the eclipse a hen was found, with her chickens under her wings. Four months' old chickens were seen, within ten minutes of the total eclipse, quietly feeding. They then disappeared. The crowd was placed, at the request of the observer, beyond a fence, distant about thirty feet from the telescope. At the moment of totality a hollow sound, half of fear, half of admiration, called attention to their faces, with dropped jaws and look of horror, which were turned toward the wreck of the sun. There is no doubt that exceeding fear took possession of the whole people. The many who were present slipped away quietly; the few who staid after totality seemed singularly quiet, evidently recovering from a considerable nervous shock."

All of which is respectfully submitted, &c.

CHARLES S. PEIRCE.

Professor JOSEPH WINLOCK.