taken with eight or ten telescopes, mostly in Europe.

Assistant-astronomer C. D. Perrine, assisted by Mr. Palmer, is employing the Crossley Reflector every clear night to obtain photographs of Eros and its surrounding stars, to furnish the planet's accurate position in the evening, in the morning, and on the meridian. The measurement of these plates will be a heavy task. Fortunately, Professor Rees, Director of the Columbia University Observatory, has volunteered to measure them. Columbia University is the only institution in this country which has had experience in measuring such plates, though many foreign observatories have long been doing similar work.

The planet Eros is now of about the 9.3 magnitude. It is easily visible in a three-inch telescope.

W. W. CAMPBELL,
Director of the Lick Observatory.

ON THE NATURE OF THE SOLAR CORONA, WITH SOME SUGGESTIONS FOR WORK AT THE NEXT TOTAL ECLIPSE.

IN an article on the corona, published in the November number of the *Astrophysical Journal*, I suggested a method by which the existence of the Fraunhofer lines in the spectrum of the corona might be detected. The method was based on the supposition that the light emitted by the particles in virtue of their incandescence, so overpowers the reflected sunlight that the lines are invisible. That the coronal light is strongly polarized is well known, and there is scarcely any doubt but that the polarized light is reflected sunlight. If now a Nicol prism be placed before the slit of the spectroscope in such a position as to transmit the polarized radiations, these will be allowed to pass with almost undiminished intensity, while the emitted or unpolarized light will be reduced in intensity by one-half. The great change in the ratio resulting might easily be sufficient to bring out the dark lines distinctly. I feel firmly convinced that this experiment should be tried at the Sumatra eclipse of next May, for I have successfully accomplished it in the laboratory with an artificial corona. It was found that a gas flame in a strong beam of sunlight shone with a pure bluish-white light, due to the reflection or rather scattering of the sunlight by the minute carbon particles.* The flame thus illuminated showed the Fraunhofer lines distinctly, but by reducing the intensity of the sunlight a point was reached at which they disappeared, and the spectrum appeared continuous. The light scattered by the flame was found to be *completely* plane-polarized in certain directions, giving us just the required conditions, namely particles emitting a continuous spectrum, and scattering a polarized solar spectrum. In front of the slit of the spectroscope a Nicol was arranged in such a manner that it could be drawn into and out of position by a cord. The Fraunhofer lines could be made to appear by sliding the Nicol in front of the slit, and disappear by drawing it away. While it does not by any means follow that the use of a Nicol on the actual corona will bring out the lines, the experiment seems to be well worth trying, as it would furnish further information regarding the relative intensity of the emitted and reflected light. Another interesting point is that the minute particles in the flame do not scatter the longer waves, the flame reflecting practically no red or orange light. Thus the Fraunhofer lines can only be traced up to about the D lines. By gradually reducing the intensity of the sunlight they disappear first in the yellow, then in the green, blue, and violet in succession.

* A photograph of the flame with a spot illuminated by powerful convergent beams of sunlight furnishes a beautiful proof of the existence of solid particles in the flame.

This indicates that our chances of detecting the lines in the spectrum of the corona will be greatest in the photographic part of the spectrum. Moreover, it appears to explain the absence of radiant heat in the light emitted from the corona, the particles being too small to scatter these longer waves to any appreciable extent. Abbott, of the Smithsonian party at Wadesboro, found the corona cold in comparison with his bolometer, and infers from this that the corona neither reflects sunlight nor emits light in virtue of incandescence, expressing the opinion that the luminosity is analogous to that of vacuum tubes transmitting electric discharges. It seems to me that the polarization of the coronal light makes this theory untenable, and that the absence of heat rays can be explained fully by the small size of the particles. I am aware that the absence of radiant heat in the *emitted* light has yet to be accounted for. My own notion, based on experiments which are now in progress, is that the reflected or scattered light is vastly in excess of the emitted, and that the absence of the Fraunhofer lines is more probably due to line-of-sight motion of the particles, than to simple drowning out by emitted light.

My experiments on the ratio of emitted to reflected light of a body brought to incandescence by powerful solar radiation are not yet completed, consequently I do not yet feel prepared to make any very positive statement in regard to this matter. A full account of this work will appear shortly in the *Astrophysical Journal.*

Any observers planning to use a Nicol prism in connection with a spectroscope in the manner described will find a gas or candle flame illuminated with a beam of sunlight concentrated by means of a large mirror or lens, extremely useful in making preliminary experiments.

For work on the polarization of the corona I believe that the artificial corona described elsewhere will be found most useful for preparatory work. Not only is it polarized, and polarized in the same way as the real corona, but it resembles it in a most striking manner, and can be easily made of the same brilliancy. It would be well to work with particles of different size, giving different percentages of polarization, and the picturesque refinements for producing the polar streamers could of course be omitted. For work of this sort it would be well to use a lamp with a ground glass bulb, as the conditions of illumination would then more nearly approach those in the real corona.

Data regarding the plane of polarization in the streamers would be useful in formulating a theory of the streamers. These, it seems to me, can be conceived as formed in two ways: they may be streams of coronal particles moving in curved paths, in which case the plane of polarization should be everywhere strictly radial, or what is extremely improbable, they may be caused by divergent beams of light coming from the polar regions of the sun and moving in curved paths, owing to the rapid decrease in the refractive index of the sun's atmosphere in an outward direction. If this were the case, the plane of polarization would turn with the streamer.

This latter hypothesis is extremely visionary, and I do not present it seriously, for it is almost impossible to conceive of any way in which the isolated beams of light could be formed, unless perhaps by vortex funnels more highly luminous than the surrounding surface of the sun. Such fanciful speculations are hardly worth indulging in, though they have interested me for the moment in connection with the matter of the possible curvature of light rays in the sun's atmosphere alluded to in a recent paper by Julius in the *Astrophysical Journal.*

R. W. Wood.

University of Wisconsin.