ART. XLIII.—*A Proposed Arrangement for Observing the Corona, and Searching for intra-Mercurial Planets during a Total Eclipse of the Sun*; by SIMON NEWCOMB.

IT is a fact of universal observation that, during a total eclipse of the sun, the dark body of the moon is surrounded by a brilliant crown of light, commonly likened to the "glory" represented by painters as surrounding the heads of saints. But, of the form and extent of this "corona," nothing definite seems to be certainly known. It is commonly represented as being not uniformly luminous at equal distances from the center, but as radially striated, and extending out into rays in various directions. At least, one observer has gone so far as

to connect the dark and bright rays with the elevations and depressions on the limb of the moon. If these dark rays have any existence, it is difficult to account for them by any known cause. It is easy to see that they cannot be shadows of opaque masses situated anywhere in space, because the shadow of no object situated so near the line joining the observer and the sun could look long and narrow to the observer.

Do these rays and striations really exist? We know that such appearances are one of the most common optical illusions when we view a bright object on a dark ground. And, in the various descriptions of them which have come to my knowledge, I have not found a single statement that any observer took the precaution to turn his head in order to see whether these rays of millions of miles in length turned with it. Their existence cannot, therefore, be regarded as proven.

The following method is proposed as one that will immediately decide the question of the existence of these rays, and give, at least, a rough approximation to the height of the corona. Erect between the eye of the observer and the sun a series of circular screens subtending angles varying between $32'$ and the greatest probable limit of the corona, say $38'$. As soon as the total phase commences the observer will stand behind the larger screen and see whether he can make it hide the entire luminosity surrounding the sun, and, if not, will note very carefully the position of any object or luminosity not hidden. He will then make similar observations with the other screens in succession until one is found which shows the corona on all sides at once.

The law of diminution of light from the inside to the outside of the annulus can, perhaps, be most accurately determined by exposing a number of equally sensitive photographic plates during widely different intervals, and noting the positions of the circles of equal effect on the different plates.

It may be remarked that the height commonly attributed to the corona does not seem compatible with that of an atmosphere surrounding the sun in a state of equilibrium. Though such an atmosphere were of hydrogen, and at a temperature of $100,000^{\circ}$ Fahrenheit, its density would be reduced one-half in every 350 miles of height. At a height of $1'$ in arc, or 26,000 miles, it would be so rare as to be altogether invisible, unless we suppose the temperature to be many times $100,000^{\circ}$. It seems, then, that the general atmosphere of the sun, if there is one, would be altogether hidden by the moon in most total eclipses of the sun, and that its greater brilliancy on the side over which the moon least projected would be very strongly marked.

The search for intra-Mercurial planets will be facilitated by the use of similar screens of a larger size. The following proposition is laid down as one hardly admitting of doubt. If the great motion of the perihelion of Mercury deduced by Le Verrier from the observations of transits of that planet is caused by the attraction of matter in the solid or liquid state, that matter can be seen during a total eclipse if the direct light of the corona and protuberances is shut off from the eye. This is founded on the following propositions :

The masses of matter in question cannot be more than half of Mercury's distance from the sun.

Hence, taking equal surfaces of them and of Mercury, they will shine with more than four times the brilliancy of that planet.

If they are not smaller than the second magnitude they will be visible to the naked eye, properly prepared by being kept in previous darkness and shaded by the screen.

If they are smaller than the second magnitude, they must be a hundred or more in number. Some of them will then be easily detected with a telescope of large field of view unless they are below the fifth magnitude.

If they are below the fifth magnitude, they must number thousands, and they will then be visible to the naked eye as a continuous diffused light.

The screen for this search should be large enough to protect the telescope from the sun during the entire period of the total phase.

It is hoped that these arrangements and observations will be found to merit the attention of a share of the observers during the total eclipse of August next.