On the Polarization of Light by oblique transmission through all Bodies, whether crystallized or uncrystallized. *By* David Brewster, *LL.D. F.R.S. Edin. and F.S.A. Edin.* *In a Letter addressed to* Taylor Combe, *Esq. Sec. R.S.* Read January 27, 1814. [*Phil. Trans.* 1814, *p.* 219.]

In examining what changes were produced upon light transmitted through mica in the direction of that line which Dr. Brewster calls its oblique depolarizing axis, he observed some appearances indicating a partial polarization: but upon turning the mica round, so as to preserve the same obliquity of incidence, this effect was found not to depend on the position of the axis, but to be greater or less, in proportion to the obliquity of incidence alone, and to be produced even by a plate of glass substituted for the mica, though not in so great a degree. By transmitting the same pencil of light successively through fifteen plates of glass, at an angle of about 70°, the whole of that which is transmitted is polarized; so that its transmission through agate, its reflection from polished surfaces at a specific angle, or the kind of refraction it undergoes in its transmission through Iceland spar, depend upon the relative position of the planes of refraction. If a second series of similar plates be presented to light thus polarized, it will also be totally transmitted if the plates be parallel to the former, but totally reflected if, with the same inclination, the planes of refraction be at right angles to each other.

By experiments made on the number of plates requisite for causing complete polarization at different angles of incidence, the number varied as the co-tangent of incidence.

The author next endeavoured to ascertain the difference that would be occasioned by using plates of greater refractive density; and he found that a less angle of incidence was then sufficient for effecting complete polarization by the same number of plates: but the subjects of his experiments were not sufficiently different in refractive power for him to determine with precision their proportional effects.

Dr. Brewster observes, that the polarization effected by such a series of plates may be employed with advantage in examining those coloured rings produced by topaz, described in his former communication.

In consequence of the reflections that take place at each of the surfaces, the principal image seen through a number of such plates is always surrounded with a great number of faint images; and when the inclination is very considerable, a nebulous image appears that is oppositely polarized, and has the same relation to the bright image as the author had before observed in agate.

When the coloured rings produced by topaz are viewed through a number of plates so inclined, the two halves of the rings appear completely different; the colours of one set being complementary to those of the other.

When the angle of incidence is 54° 35′ (the angle at which Malus observed *reflected* light to be completely polarized), then the number

of plates requisite for complete polarization of the *transmitted* beam is 30: and since, under these circumstances, the whole of the light that is not reflected at the first surface is transmitted through the whole series, the author observes, that transmission is not in this case a maximum at a perpendicular incidence, and that the law employed by Bouguer fails by reason of these newly-discovered properties of light, of which that distinguished philosopher was not aware.

The celebrated discovery of Malus, of the polarization of light by oblique reflection, and its connexion with the properties of doubly-refracting crystals, is perhaps the most important discovery that has been made in optics since that of the principle of the achromatic telescope; but the author observes, that it does not furnish us with any information of the manner in which these crystals effect polarization, and that the present discovery of polarization by oblique refraction supplies the connecting link between these two classes of facts, and holds out a prospect of a direct explanation of the leading phenomena of double refraction.

Should the present paper meet with the approbation of the Society, Dr. Brewster promises a further communication of experiments on the polarization of light by reflection, in which he designs to show that the law observed by Malus is not general, and that the principle has been completely overlooked by him; as it depends on the proportion which the quantity of light reflected bears to that which is transmitted when incident at the polarizing angle. When light is incident upon water at the polarizing angle, he remarks that only $\frac{31}{1000}$ is reflected; that even from glass only $\frac{75}{1000}$ is reflected; but when realgar, diamond, or chromate of lead are employed, then at the polarizing angle these bodies reflect as much as one half of the light, and consequently have not power to polarize all that they reflect.

Further Experiments on the Light of the Cassegrainian Telescope compared with that of the Gregorian. By Captain Henry Kater, *Brigade-Major. In a Letter addressed to the Right Hon. Sir* Joseph Banks, *Bart. K.B. P.R.S.* Read November 18, 1813. [*Phil. Trans.* 1814, *p.* 231.]

The experiments detailed in the present letter were conducted exactly in the same manner as those detailed by Capt. Kater in his former communication, for the purpose of comparing a new Cassegrainian telescope, made by Mr. Crickmore of Ipswich, with the Gregorian used in the former experiments. The diameter of the large speculum in this instrument is 4·9 inches, but was reduced by a ring of pasteboard to 3·6, in order to render the illumination equal to that of the Gregorian, in which the large speculum measured 3·95 inches.

The areas exposed to the light being estimated at 7·152 and 10·593, and the magnifying powers at the same time being 157 and