

*characteristic function* of the optical system to which the problem belongs. From this function is deduced the *surface of wave-slowness* of the medium; and by means of this surface, the direction of the rays refracted into the medium. From this construction also Sir W. Hamilton was led to the anticipation of *conical refraction*, mentioned above.

The investigations of MM. Cauchy and Lamé refer to the laws by which the particles of the ether act upon each other and upon the particles of other bodies;—a field of speculation which appears to me not yet ripe for the final operations of the analyst.

Among the mathematicians who have supplied defects in Fresnel's reasoning on this subject, I may mention Mr. Tovey, who treated it in several papers in the *Philosophical Magazine* (1837–40). Mr. Tovey's early death must be deemed a loss to mathematical science.

Besides investigating the motion of symmetrical systems of particles which may be supposed to correspond to biaxial crystals; Mr. Tovey considered the case of unsymmetrical systems, and found that the undulations propagated would, in the general case, be elliptical; and that in a particular case, circular undulations would take place, such as are propagated along the axis of quartz. It appears to me, however, that he has not given a definite meaning to those limitations of his general hypothesis which conduct him to this result. Perhaps if the hypothetical conditions of this result were traced into detail, they would be found to reside in a *screw-like* arrangement of the elementary particles, in some degree such as crystals of quartz themselves exhibit in their forms, when they have plagihedral faces at both ends.

Such crystals of quartz are, some like a right-handed and some like a left-handed screw; and, as Sir John Herschel discovered, the circular polarization is right-handed or left-handed according as the plagihedral form is so. In Mr. Tovey's hypothetical investigation it does not appear upon what part of the hypothesis this difference of right and left-handed depends. The definition of this part of the hypothesis is a very desirable step.

When crystals of Quartz are right-handed at one end, they are right-handed at the other end: but there is a different kind of plagihedral form, which occurs in some other crystals, for instance, in Apatite: in these the plagihedral faces are right-handed at the one extremity and left-handed at the other. For the sake of distinction, we may call the former *homologous* plagihedral faces, since, at both ends, they have the same name; and the latter *heterologous* plagihedral faces.