

in such cases; and thus explained, so far as an empirical law of phenomena went, the curious and various forms of the colored curves. This law, when simplified by M. Biot,<sup>3</sup> made the tint proportional to the product of the distances of the point from the two poles. In the following year, Sir J. Herschel confirmed this law by showing, from actual measurement, that the curve of the isochromatic lines in these cases was the curve termed the *lemniscata*, which has, for each point, the product of the distances from two fixed poles equal to a constant quantity.<sup>4</sup> He also reduced to rule some other apparent anomalies in phenomena of the same class.

M. Biot, too, gave a rule for the directions of the planes of polarization of the two rays produced by double refraction in biaxal crystals, a circumstance which has a close bearing upon the phenomena of dipolarization. His rule was, that the one plane of polarization bisects the dihedral angle formed by the two planes which pass through the optic axes, and that the other is perpendicular to such a plane. When, however, Fresnel had discovered from the theory the true laws of double refraction, it appeared that the above rule is inaccurate, although in a degree which observation could hardly detect without the aid of theory.<sup>5</sup>

There were still other classes of optical phenomena which attracted notice; especially those which are exhibited by plates of quartz cut perpendicular to the axis. M. Arago had observed, in 1811, that this substance produced a *twist* of the plane of polarization to the right or left hand, the amount of this twist being different for different colors; a result which was afterwards traced to a modification of light different both from common and from polarized light, and subsequently known as *circular polarization*. Sir J. Herschel had the good fortune and sagacity to discover that this peculiar kind of polarization in quartz was connected with an equally peculiar modification of crystallization, the *plagihedral* faces which are seen, on some crystals, obliquely disposed, and, as it were, following each other round the crystal from left to right, or from right to left. Sir J. Herschel found that the *right-handed* or *left-handed* character of the circular polarization corresponded, in all cases, to that of the crystal.

In 1815, M. Biot, in his researches on the subject of circular polarization, was led to the unexpected and curious discovery, that this pro-

<sup>3</sup> *Mém. Inst.* 1818, p. 192.

<sup>4</sup> *Phil. Trans.* 1819.

<sup>5</sup> Fresnel, *Mém. Inst.* 1827, p. 162.