

ness, and, considered in this manner, they furnish a simple explanation of many of the remarkable optical phenomena already spoken of.

Comets are not only characteristically different in form, some being entirely without a visible tail, while others have a tail of immense length (as in the instance of the comet of 1618, whose tail measured 104°), but we also see the same comets undergoing successive and rapidly-changing processes of configuration. These variations of form have been most accurately and admirably described in the comet of 1744, by Hensius, at St. Petersburg, and in Halley's comet, on its last reappearance in 1835, by Bessel, at Königsberg. A more or less well-defined tuft of rays emanated from that part of the nucleus which was turned toward the Sun; and the rays being bent backward, formed a part of the tail. The nucleus of Halley's comet, with its emanations, presented the appearance of a burning rocket, the end of which was turned sideways by the force of the wind. The rays issuing from the head were seen by Arago and myself, at the Observatory at Paris, to assume very different forms on successive nights.* The great Königsberg astronomer concluded from many measurements, and from theoretical considerations, "that the cone of light issuing from the comet deviated considerably both to the right and the left of the true direction of the Sun, but that it always returned to that direction, and passed over to the opposite side, so that both the cone of light and the body of the comet from whence it emanated experienced a rotatory, or, rather, a vibratory motion in the plane of the orbit." He finds that "the attractive force exercised by the Sun on heavy bodies is inadequate to explain such vibrations, and is of opinion that they indicate a polar force, which turns one semi-diameter of the comet toward the Sun, and strives to turn the opposite side away from that luminary. The magnetic polarity possessed by the Earth may present some analogy to this, and, should the Sun have an opposite polarity, an influence might be manifested, resulting in the precession of the equinoxes." This is not the place to enter more fully upon the grounds on which explanations of this subject have been based; but observations so remarkable,† and views of so exalted

* Arago, *Des Changements physiques de la Comète de Halley du 15-23 Oct., 1835. Annuaire, 1836, p. 218, 221.* The ordinary direction of the emanations was noticed even in Nero's time. "*Comæ radios solis effugiunt.*"—Seneca, *Nat. Quæst.*, vii., 20.

† Bessel, in Schumacher, *Astr. Nachr.*, 1836, No. 300-302, s. 188, 192,