

tions of opinion were excited by the just admiration awarded, both at home and abroad, to the immortal labors of a German, William Herschel. The construction of numerous seven-feet and twenty-feet telescopes, to which powers of from 2200 to 6000 could be applied, was followed by that of his forty-feet reflector. By this instrument he discovered, in August and September, 1789, the two innermost satellites of Saturn—Enceladus, the second in order, and, soon afterward, Mimas, the first, or the one nearest to the ring. The discovery of the planet Uranus in 1781 was made with Herschel's seven-feet telescope, while the faint satellites of this planet were first observed by him in 1787, with a twenty-feet "*front view*" reflector.* The perfection, unattained till then, which this great man gave to his reflecting telescopes, in which light was only once reflected, led, by the uninterrupted labor of more than forty years, to the most important extension of all departments of physical astronomy in the planetary spheres, no less than in the world of nebulæ and double stars.

The long predominance of reflectors was followed, in the earlier part of the nineteenth century, by a successful emulation in the construction of achromatic *refractors*, and *heliometers*, paralactically moved by clock-work. A homogeneous, perfectly smooth flint glass, for the construction of object-glasses of extraordinary magnitude, was manufactured in the institutions of Utzschneider and Fraunhofer at Munich, and subsequently in those of Merz and Mahler; and in the establishments of Guinand and Bontems (conducted for MM. Lerebours and Cauchoix) in Switzerland and France. It will be sufficient in this historical sketch to mention, by way of example, the large refractors made under Fraunhofer's directions for the Observatories of Dorpat and Berlin, in which the clear aperture was 9·6 inches in diameter, with a focal length of 14·2 feet, and those executed by Merz and Mahler for the Observatories of Pulkowa and Cambridge, in the United States of America;† they are both adjusted with

* Consult Struve, *Etudes d'Astr. Stellaire*, 1847, note 59, p. 24. I have retained the designations of forty, twenty, and seven-feet Herschel reflecting telescopes, although in other parts of the work (the original German) I have used French measurements. I have adopted these designations not merely on account of their greater convenience, but also because they have acquired historical celebrity from the important labors both of the elder and younger Herschel in England, and of the latter at Feldhausen, at the Cape of Good Hope.

† See Schumacher's *Astr. Nachr.*, No. 371 and 611. Cauchoix and