

ple. In our own time, the intersecting orbits of the small planets between Mars and Jupiter, the interior comets, which were first proved to be such by Encke, and the swarms of falling stars associated with definite days (since we can not regard these bodies in any other light than as such cosmical masses moving with planetary velocity), have enriched our views of the universe with a remarkable abundance of new objects.

During the age of Kepler and Galileo, our ideas were very considerably enlarged regarding the contents of the regions of space, or, in other words, the distribution of all created matter beyond the outermost circle of the planetary bodies, and beyond the orbit of any comet. In the same period in which (1572–1604) three new stars of the first magnitude suddenly appeared in Cassiopeia, Cygnus, and Ophiuchus, David Fabricius, pastor at Ostell, in East Friesland (the father of the discoverer of the sun's spots), in 1596, and Johann Bayer, at Augsburg, in 1603, observed in the neck of the constellation Cetus another star, which again disappeared, whose changing brightness was first recognized by Johann Phocylides Holwarda, professor at Franeker (in 1638 and 1639), as we learn from a treatise of Arago, which has thrown much light on the history of astronomical discoveries.\* The phenomenon was not singular in its occurrence, for, during the last half of the seventeenth century, variable stars were periodically observed in the head of Medusa, in Hydra, and in Cygnus. The manner in which accurate observations of the alternations of light in Algol are able to lead directly to a determination of the velocity of the light of this star, has been ably shown by the treatise to which I have alluded, and which was published in 1842.

The use of the telescope now excited astronomers to the

\* *Annuaire du Bureau des Longitudes pour l'an 1842*, p. 312–353 (*Etoiles Changeantes ou Périodiques*). In the seventeenth century there were recognized, as variable stars, besides Mira Ceti (Holwarda, 1638),  $\alpha$  Hydræ (Montanari, 1672),  $\beta$  Persei or Algol, and  $\chi$  Cygni (Kirch, 1686). On what Galileo calls *nebulæ*, see his *Opere*, t. ii., p. 15, and Nelli, *Vita*, vol. ii., p. 208. Huygens, in the *Systema Saturninum*, refers most distinctly to the nebula in the sword of Orion, in saying of *nebulæ* generally, "Cui certe simile aliud nusquam apud reliquas fixas potui animadvertere. Nam ceteræ nebulosæ olim existimatæ atque ipsa via lactea, perspicillis inspectæ, nullas nebulas habere comperiuntur, neque aliud esse quam plurium stellarum congeries et frequentia." It is seen from this passage that the nebula in Andromeda, which was first described by Marius, had not been attentively considered by Huygens any more than by Galileo.