

right ascension and declination. The frequently-repeated term *gradation* indicates a difference of brightness, which may be distinctly recognized even by the naked eye, or, in the case of those stars which are invisible to the unaided sight, by a Fraunhofer's comet-seeker of twenty-five and a half inches focal length. For the brighter stars above the sixth magnitude, a gradation indicates about the tenth part of the difference by which the successive orders of magnitude differ from one another; for the smaller stars the usual classifications of magnitude are considerably closer.

(1) α Ceti, R. A. $32^{\circ} 57'$, Decl. $-3^{\circ} 40'$; also called Mira, on account of the wonderful change of light which was first observed in this star. As early as the latter half of the seventeenth century, the periodicity of this star was recognized, and Bouillaud fixed the duration of its period at 333 days; it was found, however, at the same time, that this duration was sometimes longer and sometimes shorter, and that the star, at its greatest brilliancy, appeared sometimes brighter and sometimes fainter. This has been subsequently fully confirmed. Whether the star ever becomes perfectly invisible is as yet undecided; at one time, at the epoch of its minimum, it has been observed of the eleventh or twelfth magnitude; at another, it could not be seen even with the aid of a three or a four-foot telescope. This much is certain, that for a long period it is fainter than stars of the tenth magnitude. But few observations of the star at this stage have as yet been taken, most having commenced when it had begun to be visible to the naked eye as a star of the sixth magnitude. From this period the star increases in brightness at first with great rapidity, afterward more slowly, and at last with a scarcely perceptible augmentation; then, again, it diminishes at first slowly, afterward rapidly. On a mean, the period of augmentation of light from the sixth magnitude extends to fifty days; that of its decrease down to the same degree of brightness takes sixty-nine days; so that the star is visible to the naked eye for about four months. However, this is only the mean duration of its visibility; occasionally it has lasted as long as five months, whereas at other times it has not been visible for more than three. In the same way, also, the duration both of the augmentation and of the diminution of its light is subject to great fluctuations, and the former is at all times slower than the latter; as, for instance, in the year 1840, when the star took sixty-two days to arrive at its greatest brightness, and then in forty-nine days became visible to the naked eye. The shortest period of increase that has as yet been observed took place in 1679, and lasted only thirty days; the longest (of sixty-seven days) occurred in 1709. The decrease of light lasted the longest in 1839, being then ninety-one days; the shortest in the year 1660, when it was completed in nearly fifty-two days. Occasionally, the star, at the period of its greatest brightness, exhibits for a whole month together scarcely any perceptible variation; at others, a difference may be observed within a very few days. On some occasions, after the star had decreased in brightness for several weeks, there was a period of perfect cessation, or, at least, a scarcely perceptible diminution of light during several days; this was the case in 1678 and in 1847.

The maximum brightness, as already remarked, is by no means always the same. If we indicate the brightness of the faintest star that is visible to the naked eye by 0, and that of Aldebaran (α Tauri), a star of the first magnitude, by fifty, then the maximum of light of Mira fluctuates between 20 and 47, *i. e.*, between the brightness of a star of the fourth, and of the first or second magnitude: the mean brightness is 28