A Unique Long-period Variable Star.

By MAJOR W. J. S. LOCKYER.

SINCE the year 1811 the star designated R. Aquarii (position for 1900 Right Ascension $23^h\ 38{\cdot}6^m$, Declination $-15°\ 50'$) has been known as a variable star. It goes through a complete cycle of variability in 385·5 days, attaining a maximum brightness of 6·2 and a minimum of 11·0.

This star, like about 85 per cent. of all long-period variables, has a spectrum of the class Md, *i.e.* a

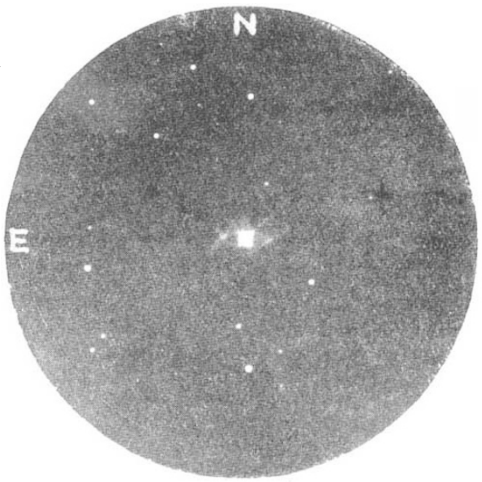

FIG. 1.—Nebulosity around R. Aquarii.

Photographed by C. O. Lampland, Lowell Observatory.

spectrum showing bright hydrogen lines and numerous absorption flutings of titanium-oxide on a continuous spectrum, and indicative of comparatively low temperature.

On October 16, 1919, Mr. Paul W. Merrill, using the 100-inch reflecting telescope of the Mount Wilson Observatory, discovered that several other bright lines, characteristic of gaseous nebulæ, were present. This made the spectrum unique, because while there is considerable evidence to connect hot stars, such as Class O or Wolf-Rayet Stars, with gaseous nebulæ, there was no instance, prior to this, in which a comparatively cool star is associated with the nebulæ.

A further interesting observation that has been made is that while the nebular lines remain almost constant in intensity throughout the light changes of the star, the other lines representing the Md spectrum vary through a large range. This suggests that the star and nebula are independent of one another: other observations on the other hand tend to show a close connection between the two.

The most recent discovery relating to this star is of extreme importance, for it is now known that the star is in the centre of a mass of nebulous matter.

The photograph showing this was taken by Mr. C. O. Lampland with the 40-inch reflecting telescope of the Lowell Observatory. This nebular image he describes as an oval-shaped, elongated configuration composed of arcs of well-defined nebular filaments and the star is centrally and symmetrically placed. The position-angle of the longer axis of the formation is about 90° and the greatest extent of the faint structure in this direction is a little more than two minutes of arc. Mr. Lampland has forwarded a positive photograph on film from which the accompanying illustration (enlarged twice) has been made. On his photograph 1 mm. represented 24·5 seconds of arc (approx.).

The general form of the nebulosity here displayed is very similar to that of the nebula N.G.C. 5921. This latter is reproduced on Plate I. in vol. xiii. of the "Publications of the Lick Observatory," and is given there as an example of what Mr. H. D. Curtis calls a ϕ-Type Spiral Nebula.

The actual presence of this nebulosity is of great value in accounting for the unique character of the star's spectrum. Attention must also be directed to the importance of long-exposed photographs with powerful reflectors for the purpose of searching for nebulosities whenever nebular lines appear in a spectrum. It will be remembered how such lines, appearing in the spectra of novæ in the later stages of their career, led to the discovery of the presence of nebular matter surrounding the star.

Marine Invertebrates.

FURTHER reports on material collected by the British and Australian Antarctic Expeditions have been received. The Chætognatha of the Australian Expedition have been described by Prof. T. H. Johnston and Mr. B. B. Taylor, systematic accounts of the Crustacea of the British (*Terra Nova*) Expedition are given by Mr. R. W. Barney on the Ostracoda, and on the Tanaidacea and Isopoda by Dr. W. M. Tattersall. Dr. H. M. Woodcock and Miss Olive Lodge describe the collection of parasitic protozoa, which consists of only three species—a new species of the flagellate genus Cryptobia, a new species of Gregarine (Selenidium), and a ciliate. This ciliate, for which a new genus (Hæmatophagus) is created in the family Stentoridæ, is parasitic on the baleen plates of the humpback whale, and feeds exclusively on the whale's red-blood corpuscles. It reaches a length of 1-1·5 mm., and secretes a delicate transparent tube, up and down which it moves; when feeding the oral end of the ciliate may project from the tube. The red-blood corpuscles are directed into the mouth by the adoral zone of strong cilia fused into membranellæ, pass into the protoplasm, and become enclosed in food-vacuoles. The larger vacuoles may contain numerous corpuscles which become compressed, and, owing to the dissolution of the envelope of the corpuscles, the hæmoglobin-containing substance of all the red cells in the vacuole merges into one homogeneous mass. As digestion proceeds the vacuoles pass gradually backwards, and pigment—agreeing in appearance with melanin—is formed on the outside of the vacuole. Hæmatophagus is unique among ciliates in producing melanin as a result of the digestion of hæmoglobin. This pigment tends to accumulate in the hinder half of the body, and the authors find evidence that when the organism is full-grown the pigment is got rid of by casting off that portion of the body prior to the commencement of the resting, multiplicative phase. How the blood of the whale becomes available to the ciliate has not been established.

Mr. C. H. Edmondson gives (Occasional Papers, Museum of Polynesian Ethnology and Natural History, Honolulu, 1920) a short account of the edible mollusca of the Oregon coast. These are all bivalves; some, belonging to the genera Siliqua and Mya, are