A detailed study of these regions with a large reflector would yield interesting results as to the development and magnitudes of the stars in these regions as they emerge from the amorphous nebulosity.

Counts made in the Hubble photograph of regions at the extremity of the ellipse yield an immense number of small star discs. The scale of the unenlarged photograph is about the same as the enlarged Yerkes image already dealt with, and similar squares give as many as 10 times the number, mostly of about the 20th magnitude. An interesting point is that the galactic non-nebular squares contain small star discs of this magnitude, which in all probability have no connection with the nebula.

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## *On Dense Matter.* By R. H. Fowler, F.R.S.

§ 1. *Introductory.*—The accepted density of matter in stars such as the companion of Sirius is of the order of $10^5$gm./c.c. This large density has already given rise to most interesting theoretical considerations, largely due to Eddington. We recognise now that matter can exist in such a dense state if it has sufficient *energy*, so that the electrons are not bound in their ordinary atomic orbits of atomic dimensions, but are in the main free—with sufficient energy to escape from any nucleus they may be near. The density of such " energetic " matter is then only limited *a priori* by the " sizes " of electrons and atomic nuclei. The " volumes " of these are perhaps $10^{-14}$ of the volume of the corresponding atoms, so that densities up to $10^{14}$ times that of terrestrial materials may not be impossible. Since the greatest stellar densities are of an altogether lower order of magnitude, the limitations imposed by the " sizes " of the nuclei and electrons can be ignored in discussions of stellar densities, and the structural particles of stellar matter can be treated as massive charged points.

Eddington has recently * pointed out a difficulty in the theory of such matter. Assuming it to behave more or less like a perfect gas, modified by its electrostatic forces and the sizes of such atomic structures as remain undissolved, there is a perfectly definite relation between the energy and the temperature, which depends on the density only to a minor degree. This assumption even here is not so unreasonable as appears at first sight. But even without it we naturally expect a perfectly definite relation between energy and temperature, in which there is a close correlation between large energies and large temperatures, small energies and small temperatures. The emission of energy by the star will proceed in the usual way at a rate depending on the surface temperature, and the internal temperatures must provide the gradient necessary to drive the radiation out. So long as the star contains matter at a high *temperature*, radiation of energy must presumably go on. But then, according to Eddington, there may come a time when a very curious state of affairs is set up. The stellar material will have

* Eddington, *The Internal Constitution of the Stars*, § 117, Cambridge Univ. Press (1926).