rocks at Bardal were under the sea before *Allée Couverte* times. There may have been a cultural survival from the Maglemose civilisation, even if they are Late Neolithic in age. Is it possible that the new and interesting find of an engraved animal on a piece of crust at Grime's Graves is to be correlated with this group?

Group 5. Bronze-age rock carvings of South Scandinavia, with an outlier in North Russia. This group, which is especially concentrated in Bohuslän (north of Göteborg), is too well known to be discussed here further. It is dated from a consideration of the form of daggers figured, as well as from the carved ornamentation. Runes

are never found in association with these rock carvings.

The North Russian outlier is of some interest, and will be partly described this year. The carvings are found here on extremely hard, glacier-worn surfaces of rock, forming the eastern shore of Lake Onëga, south of Pudosh, and north of the Black River. There are ships, swans, a devil 10 ft. long, animals, a phallic scene, fish, signs, etc. (Figs. 3 and 4).

Group 6. Maritime Alps. This group is also too well known to require further discussion. The occurrence of a ploughing scene, very similar to one found in the Bronze-age group of South Scandinavia, may be noted.

Dark Nebulæ.

By DR. A. C. D. CROMMELIN.

SEVERAL years ago photographs taken by Profs. E. E. Barnard and Max Wolf rendered the hypothesis highly probable that many of the dark lanes and spaces met with in the Galaxy and in regions of diffused nebulosity were due to the intervention of occulting matter rather than to actual diversity of star distribution. One of the most notable examples occurs in a long strip of nebulosity that runs southward from

here reproduced, and is quite startling from the hard, clear-cut outlines of the marking, which is blacker than the neighbouring sky background. It would seem that this sharp outline must indicate a stratum of dust rather than one of gas; it can be traced for some distance outside the long nebula, and is probably connected with an isolated bright nebula some 15 minutes of arc distant to the north-east. It will be remembered that a great part of Orion is covered with faint nebulosity, first revealed as a large spiral by Prof. Barnard's photo-

FIG. 1.—Nebulosity south of ζ Orionis. From a photograph taken by Mr. Duncan with the 100-in. telescope of the Mount Wilson Observatory.

ζ Orionis. Dr. Isaac Roberts noted that there was "an embayment, free from nebulosity, dividing it into halves." Prof. Barnard afterwards remarked that this space appeared to be "a dark body, projected against, and breaking the continuity of, the brighter nebulosity." More recently still the object has been photographed at the Lick and Mount Wilson observatories. The Mount Wilson photograph, taken with the 100-in. Hooker telescope, is

NO. 2693, VOL. 107]

FIG. 2.—Enlargement of dark nebulosity in Fig. 1.

graphs with a lantern lens. There is a striking falling off of star-density to the east of the long ζ Orionis nebula as compared with that to the west, which presumably indicates a general absorption of light.

The Proceedings of the Amsterdam Academy of Science, vol. xxiii., No. 5, contains two papers by Dr. A. Pannekoek on a region of dark nebulosity in Taurus. Dr. Pannekoek refers to a paper by Sir F. W. Dyson and P. J. Melotte (M.N.R.A.S., vol. lxxx., p. 3). He uses their figures of star-density in these regions to make an estimate of

the distance of the occulting screen, and obtains the distance 140 parsecs, which is about four times that estimated for the Hyades. Since the angular extent is 30° , this implies a real length of 70 parsecs, and gives a vivid idea of its gigantic dimensions.

Dr. Pannekoek next proceeds to make an estimate of the mass of the nebula; he first works on the assumption that it is composed of hydrogen. The star-counts indicate an absorption of two magnitudes. Using Dr. Abbot's absorption coefficient for atmospheric air, and taking the thickness of the stratum as 10 parsecs, he finds 10^{-15} for the density of the gas-cloud. The mass is independent of the thickness assumed, and comes out twenty thousand million times that of the sun. This is greater than many estimates of the combined mass of the whole sidereal system, and at once suggests the probability that the larger portion of that mass is not condensed into stars, but distributed in cosmic clouds. Some striking consequences of the presence of such a great mass at a comparatively moderate distance are drawn by

Dr. Pannekoek. The sun would travel round it in a very eccentric ellipse in a period of some two million years, being now near apocentron.

While so large a mass of the universe as a whole would render it easier to account for the numerous cases of high velocity among the stars, it would make the moderate velocities of the bulk of the stars difficult to explain. The author notes a suggestion by Prof. De Sitter that the necessary mass of the occulting clouds may be greatly reduced if we postulate that they consist of dust instead of gas. It has already been pointed out that the aspect of the dark marking near ζ Orionis accords with the hypothesis of solid matter. However, even in this case the necessary mass is enormous, since it is *a priori* improbable that the thickness of the stratum should in all cases be a very small fraction of its visible dimensions.

The demonstration of the existence of these immensely massive cosmic clouds seems to make it desirable to rediscuss the dynamics of the stellar system.

Obituary.

PROF. E. B. ROSA.

THE death, on May 17, of Prof. Edward Bennett Rosa, of the Bureau of Standards at Washington, at the age of sixty years, is a serious blow to electrical science. Born in 1861, Prof. Rosa gained distinction as a student in the Johns Hopkins University under Rowland, and after some experience in professorial work in the Wesleyan university where his early undergraduate days had been passed was in 1901 appointed to the staff of the Bureau of Standards as a physicist. There his main work was done. In 1910 he became chief physicist, and as head of the electrical department was responsible for many of the valuable researches which have been carried out at the bureau.

Among the earliest of these was his determination, in collaboration with Dr. Dorey, of " v ," the ratio of the electrical units, and most of them turn on questions relating to the measurement of the fundamental units, the ohm, the ampere, and the volt. He combined in a marked degree the insight required to design and carry through to a successful result a difficult experiment and the mathematical skill needed to develop to a high degree of accuracy the theory on which the experiment is based.

Prof. Rosa's papers on the calculation of coefficients of self- and mutual induction, and on the theory of the instruments employed in absolute measurements, will always be standard; while his own experimental determinations of some of the fundamental quantities are among the best which have been made. He realised the need for accuracy and exactness in the processes of measurement, whether applied to scientific work or to industry, and he organised the electrical section

of the bureau in a manner which fitted it to respond to the requirements both of scientific and industrial research. The list of his papers covers a wide range, and in all of them he added to our knowledge in a substantial manner.

Prof. Rosa visited England in 1908, acting, along with Dr. Stratton and Prof. Carhart, as one of the American representatives to the International Electrical Conference, held in London under the presidency of the late Lord Rayleigh. At that conference a formal distinction was drawn between the absolute and the international units of measurement: between the ohm (10^7 absolute C.G.S. units) and the international ohm—the resistance at 0° C. of a uniform column of mercury weighing 14521 grams, and 106.300 centimetres in length; or the ampere (10^{-1} absolute C.G.S. units) and the international ampere—the current which under certain carefully defined conditions deposits from a solution of nitrate of silver a mass of 1.11800 milligrams of silver per second.

Prof. Rosa would probably have preferred to retain as standards for legal purposes the absolute magnitudes 10^7 C.G.S. units for resistance and 10^{-1} C.G.S. units for current, but he accepted the views of the majority of the conference, and at a later date lent his valuable assistance in defining accurately the conditions necessary for the realisation of the international ohm, ampere, and volt. As the outcome of the work of the conference, a committee, known as Lord Rayleigh's Committee, was appointed to define these conditions, and representatives of England, France, and Germany met at Washington and carried out a series of experiments, the results of which have determined the practice of all National Standardising Laboratories. Of the