

Sailors and Soldiers on the Land, together with some Considerations by a Free Trader in Favour of the Policy therein Advocated."

THE following volumes are in preparation for appearance in the "University of Michigan Studies" (New York: The Macmillan Company):—Contributions to the History of Science, part ii., "The Prodromus of Nicholas Steno's Latin Dissertation on a Solid Body Enclosed by Natural Process within a Solid," translated into English by Prof. J. G. Winter, with a foreword by Prof. W. H. Hobbs, illustrated; part iii., "Vesuvius in Antiquity," passages of ancient authors, with a translation and elucidations, by F. W. Kelsey, illustrated; Scientific Series, vol. ii., "Studies on Divergent Series and Summability," by Prof. W. B. Ford.

OUR ASTRONOMICAL COLUMN.

TWO LARGE FIREBALLS.—On October 20 at 8h. 14m. and 10h. 34m. p.m. large fireballs were observed. The first was seen by Mr. J. E. Clark, of Purley, Surrey, and it was estimated as twice as bright as Venus. The path was $82^{\circ}+62^{\circ}$ to $79^{\circ}+35^{\circ}$, and its duration four to five seconds. The second was seen by Mrs. Fiammetta Wilson at Totteridge, Herts, and by Mr. Denning at Bristol. It appeared as a ball of fire streaming slowly along in a level course about 8° above the northern horizon. This fireball was at a great distance from the observers, and probably over the southern region of Scotland. It probably emanated, like Mr. Clark's fireball, seen earlier on the same night, from a radiant near Zeta Herculis low in the N.W. sky.

ENCKE'S COMET.—Further particulars of Dr. Max Wolf's recent observation of Encke's comet are given in *Astronomische Nachrichten*, No. 4861. The search for the comet was undertaken at the instigation of Dr. Kritzinger, and eight plates were taken at different times during August and September, with exposures amounting altogether to about thirteen hours. The last two exposures were made on September 22, in a very clear sky, and though the plates were on the point of being regarded as failures, the use of lower magnifying power easily revealed the comet, at a point about $20'$ from the position given by the ephemeris. The comet appeared on both plates as a faint nebulous patch, with an extremely small condensation, and the displacement of the images in the interval between the exposures corresponded precisely with the ephemeris. The photographs were taken with the 71-cm. reflector, which was guided to follow the probable motion of the comet. The observation is of special interest from the fact that the comet was not far from the aphelion point of its orbit.

INTERNAL MOTION IN SPIRAL NEBULÆ.—An investigation of internal motions in the spiral nebula Messier 101 has been undertaken by A. van Maanen (*Proc. Nat. Acad. Sci.*, vol ii., p. 386). In the first instance measures were made with the stereocomparator on two photographs taken by Ritchey in 1910 and 1915, and strong evidence of motion, even in this short interval, was obtained. Other plates, taken with the Crossley reflector of the Lick Observatory in 1899, 1908, and 1914, were afterwards included in the discussion. The resulting data depend upon measures of eighty-seven nebulous points and thirty-two comparison stars. Relatively to the mean of the comparison stars, the annual motion of translation of the nebula was found to be $+0.005''$ in R.A. and $-0.013''$ in declination. The mean rotational motion is $0.022''$ left-handed, and the mean radial motion $0.007''$ outward. The measures further indicate a small, but scarcely trustworthy, decrease of rotational

motion with increasing distance from the centre. At the mean distance of $5'$ from the centre, the rotational motion of $0.022''$ corresponds to a period of about 85,000 years. If the parallax were known, and if it could be assumed that the movements were in elliptical orbits, the central mass could be calculated. A comparison with the average translation of spiral nebulae determined by Curtis suggests a parallax of $0.005''$, while a comparison of the cross-motions with the known radial velocities of some of the spiral nebulae leads to $0.0003''$. The corresponding central masses are 30,000 and 140,000,000 times that of the sun, and the corresponding orbital motions 21 and 345 km./sec. Evidence of rotation has also been found in Messier 81.

THE ASSOCIATION OF TECHNICAL INSTITUTIONS.

A LARGELY attended general meeting of the members of the Association of Technical Institutions was held on October 20-21 at the Imperial College of Technology and Science, under the presidency of Sir Alfred Keogh, K.C.B., the president of the association, with the view of discussing educational questions bearing upon the work of technical schools and colleges. The Right Hon. A. H. Dyke-Acland, the chairman of the executive of the governors of the Imperial College, extended a welcome to the members and referred to the splendid service which Sir Alfred Keogh, the rector of the college, in his capacity of director of the Army Medical Service, was rendering to the nation.

The conference was addressed in the first instance by Lord Haldane, Chancellor of the University of Bristol, who took for his subject "Education after the War, with special reference to Technical Instruction." He made clear in his address that unless technical education was based upon large ideas and was penetrated by sound knowledge it must surely fail. He deprecated most strongly the current controversies which sought to place the teaching of the humanities and natural science in unfriendly relation. Knowledge was one and indivisible. The study of fine literature and of the thought it embodies was just as needful to the complete training of the human being as the study of mathematics or of the phenomena of Nature, since the object of all true education was a wider, a more penetrating and stimulating vision. The teaching of the higher mathematics could, if taught in the right way, be made as stimulating as the classics. There was a great awakening in the nation, induced by the events of the war, to the paramount necessity for knowledge. Education and business were not really in two compartments. Rightly considered, the successful pursuit of manufacture and commerce depended for its permanence and value upon sound methods of education and the acquisition of accurate knowledge. Many apt and clear illustrations in support of this contention were adduced from the sphere of chemical, physical, and electrical science and practice. In the domain of applied science attention was directed to the fact that London was the great centre of the world's trade in furs, but that in order to make the furs marketable to the consumer we exported them to foreign countries, notably to Saxony, where alone they could be dyed and treated with suitable effect. The aloofness between the man of business and the man of science must cease, and all classes from the workers upwards, amongst whom there was splendid raw material, must receive the benefits of scientific training. We must have a higher standard of knowledge not only for managers, but for workmen also, if the position of