

indigo from the plant has been tackled, as Prof. Armstrong showed, with marked success. The research has a practical value far beyond the indigo question, since it connotes the systematic study of the physiology of a leguminous crop, thus helping to fill a lacuna in agricultural science widely recognised as one calling for early attention in view of the great economic importance of leguminous plants. In the discussion of the paper the chairman (Sir Thomas Holland), while recognising the financial difficulties of the Indian Government, deplored the decision to stop this promising research, and suggested that the funds required from the Government for its continuance would be essentially of the nature of a loan, since the special export cess levied in 1918 for assisting research on indigo could be made to support the cost of the investigation.

A SMALL brochure on "Safety First" in X-ray work, issued by Messrs. Watson and Sons, Kingsway, shows that the recommendations of the X-Ray and Radium Protection Committee have not been in vain. The two Memoranda which have been issued by this Committee are reproduced *in extenso*, and it is evident that Messrs. Watson are doing their best to induce their clients to accept the protective measures pre-

scribed. This is a welcome step in the right direction, for if radiological work throughout the country is to be free of risk to those engaged in it, it will be brought about only by those in charge of the installations insisting upon guarantees of safety. These guarantees can be provided at a small percentage cost of such installations, and we look confidently to the time when the National Physical Laboratory Certificate of Safety will become a *sine qua non* for practical work of this character.

SIR WILLIAM TILDEN and Prof. J. C. Philip are editing for Messrs. George Routledge and Sons, Ltd., a new series of volumes dealing with chemistry. Those for which arrangements have so far been made are:—"The Metastability of Matter," Prof. E. Cohen; "Oxidation and Reduction in Organic Chemistry," Dr. O. L. Brady; "Physical Aspects of Organic Chemistry," Prof. T. M. Lowry; "Atomic and Molecular Structure in Relation to Properties," Dr. I. Langmuir; "The Energy Factor in Chemical Change," Prof. J. R. Partington; "Space Formulæ in Carbon Compounds," Prof. J. F. Thorpe and Dr. C. K. Ingold; "Adsorption," Prof. J. W. M'Bain; and "The Theory of Quantitative Analysis and its Practical Application," Prof. H. Bassett.

Our Astronomical Column.

A VERY MASSIVE STAR.—A paper by Prof. Plaskett on a spectroscopic binary of very high mass was read by Prof. Newall at the meeting of the Royal Astronomical Society on June 9. The star is of the sixth magnitude, and shows two spectra with considerable difference of brightness, but both measurable. It is difficult to imagine any explanation of the double spectrum other than duplicity of the star, as the spectral type indicates a fair amount of condensation, and the distance between the stars is of the order of half an astronomical unit. As there is no evidence of light-variation, it is presumed that eclipses do not occur; it is therefore estimated that we see the orbit open to the extent of some 15° . The minimum values of the masses are given as about 70 times that of the sun for each component, the combined mass being about four times as great as that of any previously determined.

THE ROTATION PERIOD OF MARS.—Mars is the only planet of which the rotation period is exactly known. The periods of Jupiter and Saturn are often confidently stated to the fraction of a second, but it must be remembered that these values represent merely the rates of drifting and changeable spots in the vaporous envelopes of the two planets. We cannot perceive anything of the material features forming the real surface scenery of either Jupiter or Saturn, for they appear to be continuously veiled.

Mars, however, displays its actual surface markings to our view. We detect objects on its disc which are similar in shape and position to those which were discovered and delineated by Hooke, Cassini, and Huygens in the last half of the seventeenth century. There can be no doubt that the markings seen today are identical with those traced by the old observers about two and a half centuries ago.

The rotation period of Mars, according to the best determinations, is 24 hours 37 minutes 22.6 seconds, but there is a suspicion that this is too long, to the extent of about one-twentieth of a second.

RADIAL MOTIONS OF SPIRALS AND CLUSTERS.—C. Wirtz contributes an article on this subject to *Astronomische Nachrichten*, 5153. He quotes figures for 29 spirals of which only four show approach, and deduces a systematic recession of 840 km./sec., finding for the sun's velocity 712 km. towards R.A. 54° , N. Decl. 83° ; galactic Long. 95° , N. Lat. 23° . Omitting two doubtful figures the velocity, longitude, and latitude become 693 km., 90° and 29° , a shift of 7° from the first result. It appears that the nebulae in lower galactic latitudes tend to approach, those in high latitudes to recede, while the brighter ones (that is, either the nearer or the more massive ones) tend to approach and the fainter ones to recede.

The radial motions of ten globular clusters indicate a systematic approach of 55 km./sec., and give a solar velocity of 348 km. towards R.A. 11° , N. Decl. 77° , galactic Long. 90° , N. Lat. 15° ; or, omitting the systematic motion of approach, the velocity, longitude, and latitude become 373 km., 79° and 19° , only 12° from the first point. The number of clusters is too small for trustworthy analysis, but there is some evidence of greater velocity in low galactic latitudes, and of increasing velocity with increasing distances (using Shapley's parallaxes). There is an interesting resemblance between the apices derived from spirals and clusters, but the great difference in velocities leaves it doubtful whether it has any significance.

The author points out that trustworthy proper motions of the above spirals would enable a good estimate of their distances to be derived; a preliminary analysis of the few proper motions available (*Astronomische Nachrichten*, vol. 206, p. 114, 1918) gave for the solar apex R.A. 110° , N. Decl. 34° , annual motion $0.027''$. This point is 52° distant from the first point found from radial motions. This discordance is not too discouraging considering the meagreness of the material, and the large discordances that are found for the apex relatively to the stars belonging to the galactic system.