

OUR ASTRONOMICAL COLUMN.

RELATIVITY AND GRAVITATION.—A pamphlet has just reached us entitled "La spostamento del perielio di mercurio, e la deviazione dei raggi luminosi, secondo la teoria di Einstein," by Attilio Palatini (from *Nuovo Cimento*, July, 1917; Pisa: Stabilimento Tipografico Toscano). The pamphlet, like the article by Prof. Eddington in *NATURE* of December 28, 1916 (vol. xcvi., p. 328), aims at making the outlines of Einstein's relativity theory clear to those who have not access to his original works. The points in which the new theory differs from our earlier conceptions of Euclidean space and Newtonian dynamics are clearly brought out. As the title indicates, particular stress is laid upon the manner in which it completely accounts for the excess of $43''$ per century in the motion of the perihelion of Mercury's orbit, which had been recognised as a difficulty in the Newtonian theory. It is especially noteworthy that the Einstein theory was laid down quite independently of this result, which is therefore in the nature of an undesigned coincidence. It differs in this respect from some other relativity theories, which have assumed arbitrary values for certain coefficients, in order to satisfy the observed facts. Einstein's result involves no arbitrary constant, but simply depends on the ratio of Mercury's velocity to that of light. The pamphlet employs two different methods of development, each leading to the result that the perihelion advances $0.1''$ in one revolution of Mercury.

The other test proposed by Einstein for his theory is that a ray of light from a star just grazing the sun's surface and passing on to the earth would be deflected through an angle of $1.75''$. It is shown in the pamphlet how this result is deducible from Einstein's principles, and allusion is made to total solar eclipses as affording opportunities for a practical test. The Astronomer Royal has already urged that advantage be taken of the very favourable total eclipse of May, 1919, for experiments of this kind. Prof. Eddington has pointed out that the doctrine that light has inertia would lead us to expect a deflection of $0.88''$ at the sun's limb in any case; so the Einstein test depends on the difference between this value and $1.75''$.

THE SYSTEM OF κ PEGASI.—The star κ Pegasi is a visual binary having the unusually short period of 11.35 years, and one of the components, as found by Campbell in 1900, is a spectroscopic binary. An investigation of this interesting triple system has been made by Dr. F. Henroteau, utilising spectrograms previously taken at the Lick Observatory, and numerous others recently obtained by himself (Lick Observatory Bulletin, No. 304). Elements of the orbit of the spectroscopic pair, computed for the epochs 1900, 1912, and 1917, clearly show the changes to be expected from the revolution round the centre of mass of the visual system, and they also indicate a revolution of the line of apsides, probably due to perturbations occurring in the spectroscopic binary orbit under the influence of the third body. Combining the data obtained by telescopic and spectroscopic observations, it is shown that the semi-major axis of the orbit of the spectroscopic binary is 511,100,000 km., while that of the visual pair is 1,826,000,000 km. Since the apparent semi-major axis is $0.29''$, it follows that the parallax is $0.025''$. The total mass of the spectroscopic pair is 10.33 times, and the mass of the other visual component 4.00 times, that of the sun. There are curious variations in the appearance of the spectrum, which seem to be satisfactorily explained by the superposition of an F class spectrum, oscillating in a period of 5.9715 days, upon a spectrum of possibly the same class oscillating by a smaller amount in a period of 11.35 years.

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FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE AND HORTICULTURE.

Baillière, Tindall, and Cox.—A new edition of *Cows, Cowhouses, and Milk*, G. Mayall.

ANTHROPOLOGY AND ARCHÆOLOGY.

Macmillan and Co., Ltd.—*Folk-Lore in the Old Testament*, Sir J. G. Frazer, three vols.

BIOLOGY.

Constable and Co., Ltd.—*Coniferous Trees*, A. D. Webster, illustrated. *C. H. Kelly.*—*Spiders and Beetles, and How to Identify Them*, S. N. Sedgwick. *John Murray.*—*The Life and Letters of Sir Joseph Dalton Hooker, O.M., G.C.S.I., L. Huxley*, based on material collected and arranged by Lady Hooker, two vols., illustrated. *L. Reeve and Co., Ltd.*—*Flora of Tropical Africa*, edited by Sir D. Prain, vol. vi., section 2, part 2, dealing with the orders *Ulmaceæ* to *Cycadaceæ*; vol. ix. (*Gramineæ*), part 2. *The University Tutorial Press, Ltd.*—*Text-Book of Botany*, J. M. Lowson, Indian edition, revised by Birbal Sahni.

CHEMISTRY.

G. Allen and Unwin, Ltd.—*The Treasures of Coal Tar*, Prof. A. Findlay. *Baillière, Tindall, and Cox.*—*Plant Products and Chemical Fertilisers*, S. H. Collins, and a new edition of *Aids to Analysis of Foods and Drugs*, C. G. Moor and W. Partridge. *Blackie and Son, Ltd.*—*A Complete Course of Volumetric Analysis for Middle and Higher Forms of Schools*, William T. Boone. *J. and A. Churchill.*—*Applied Analytical Chemistry*, edited by Prof. V. Villavecchia, translated by T. H. Pope, vol. ii.; *Chemical Combination among Metals*, Drs. M. Guia and C. Guia-Lollini, translated by G. W. Robinson. *Constable and Co.*—*What Industry Owes to Chemical Science*, R. B. Pilcher and F. Butler-Jones, with an introduction by Sir G. Beilby ("The Engineer" Series), and a new edition of *Laboratory Guide of Industrial Chemistry*, A. Rogers, illustrated. *Crosby Lockwood and Son.*—*High Explosives: their History, Manufacture, Properties, and Uses*, Lieut. E. de W. S. Colver, illustrated. *Longmans and Co.*—*Lecithin and Allied Substances: The Lepins*, Dr. H. Maclean (*Monographs on Biochemistry*). *Macmillan and Co., Ltd.*—*Sir William Ramsay, K.C.B., F.R.S.: Memorials of His Life and Work*, Sir W. A. Tilden, with portraits; *The Manufacture of Intermediate Products for Dyes*, Dr. J. C. Cain, illustrated. *Scott, Greenwood, and Son.*—*New editions of The Chemistry of Essential Oils*, E. J. Parry, two vols., and *Iron Corrosion, Anti-Fouling and Anti-Corrosive Paints*, L. E. Andes. *The University Tutorial Press, Ltd.*—*Senior Practical Chemistry*, H. W. Bausor.

ENGINEERING.

Benn Bros., Ltd.—*Electrical Measuring Instruments: their Design, Construction, and Application*, Dr. C. V. Drysdale and A. C. Jolley; *The Handling of Materials: A Manual on the Design, Construction, and Application of Cranes, Conveyors, Hoists, and Elevators* (being the second and enlarged edition of "Electric Cranes and Hoists"), H. H. Broughton, two vols., illustrated; *The Induction Coil*, Prof. E. Taylor Jones; *Manual of the Telephone*, W. Aitken, two vols.; and a new edition of *Electric Mains and Distributing Systems*, J. R. Dick and F. Fernie. *Blackie and Son, Ltd.*—*Tidal Lands: A Study of Shore Problems*, A. E. Carey and Prof. F. W. Oliver, illustrated. *Constable and Co., Ltd.*—*The Pro-*

duction and Treatment of Vegetable Oils, T. W. Chalmers, illustrated; Locomotive Valves and Valve Gears, J. H. Yoder and G. B. Wharen, illustrated; Physical Laboratory Experiments for Engineering Students, S. Sheldon and E. Hausmann, illustrated; and a new edition of Industrial Electrical Measuring Instruments, K. Edgcombe, illustrated. *Crosby Lockwood and Son.*—The Aviation Pocket-Book for 1918: A Compendium of Modern Practice and a Collection of Useful Notes, Formulæ, Rules, and Tables relating to Aeronautics, R. B. Matthews, illustrated; The Mechanical Engineer's Pocket-Book for 1918, comprising Tables, Formulæ, Rules, and Data: A Handy Book of Reference for Daily Use in Engineering Practice, by the late D. Kinnear Clark, tenth edition, thoroughly revised and enlarged, by H. H. P. Powles, with a new Electrical Section by Dr. F. T. Chapman; The Engineer's Year-Book for 1918, H. R. Kempe, with collaboration, illustrated; Aviation Engines: their Design, Construction, Operation, and Repair, a book for the Student, Engineer, and all interested in Aviation, by a recognised authority, illustrated; Glossary of Aviation Terms in English-French and French-English, Lieut. V. W. Pagé and Lieut. P. Montariol, illustrated; An Aviation Chart: The Location of Aviation Power Plant Troubles Made Easy. A large wall chart, showing a typical aeroplane power plant in part section, with all important components shown. *Macmillan and Co., Ltd.*—Alternating-current Electrical Engineering, P. Kemp, illustrated. *Sir Isaac Pitman and Sons, Ltd.*—Electric Motors and Control Systems, A. Dover, illustrated; A Small Book on Electric Motors for Continuous and Alternating Currents, W. P. Maycock; Rudiments of Telephony, T. E. Herbert; The Stability and Control of Aeroplanes, A. W. Judge (vol. iii. of the Manuals of Aeronautics); Aeronautical Materials and Methods of Construction, A. W. Judge (vol. iv. of the Manuals of Aeronautics); and new editions of Magneto and Electric Ignition, W. Hibbert, illustrated; Alternating-current Work, W. P. Maycock, illustrated; The Practical Telephone Handbook and Guide, J. Poole, illustrated; The Slide Rule, C. N. Pickworth, illustrated; Gums and Resins, J. Parry, illustrated (Common Commodities and Industries Series); Glass and Glass Manufacture, P. Marson, illustrated. *Scott, Greenwood, and Son.*—The Strength of Ships, J. B. Thomas, illustrated; Elastic Stresses in Structures, translated from the French by E. S. Andrews, illustrated; Machine and Fitting Shop Practice, G. W. Burley, two vols; Modern Steam Boilers, E. Pull; Moving Loads by Influence Lines and Other Methods, E. H. Sprague.

GEOGRAPHY.

Cambridge University Press.—The North Riding of Yorkshire, Capt. W. J. Weston (Cambridge County Geographies).

GEOLOGY.

Cambridge University Press.—Lecture on John Michell, delivered before the Yorkshire Philosophical Society, Sir Archibald Geikie.

MATHEMATICAL AND PHYSICAL SCIENCES.

Cambridge University Press.—The Theory of Electricity, G. H. Livens; Theory of Functions of a Complex Variable, Prof. A. R. Forsyth; Lecture Notes on Light, J. R. Eccles. *C. H. Kelly.*—Stars and How to Identify Them, E. W. Maunder. *Longmans and Co.*—Infinitesimal Calculus, Prof. F. S. Carey, in two sections, Section II.; Differential Equations, Dr. H. Bate-man (Longmans' Modern Mathematical Series). *Macmillan and Co., Ltd.*—A Text-Book of Physics for the

Use of Students of Science and Engineering, J. Duncan and S. G. Starling, illustrated, in five parts: Dynamics; Heat, Light, and Sound; Magnetism and Electricity; Heat; Light and Sound. *The University Tutorial Press, Ltd.*—Intermediate Text-Book of Magnetism and Electricity, R. W. Hutchinson.

MEDICAL SCIENCE.

Baillière, Tindall, and Cox.—Meat inspection Problems, Dr. W. J. Howarth; Aids to Rational Therapeutics, Dr. R. W. Leftwich; and new editions of Papers on Psycho-Analysis, Dr. E. Jones, and Errors of Accommodation and Refraction of the Eye, Dr. E. Clarke. *A. and C. Black, Ltd.*—A new edition of Radiography and Radio-Therapeutics, Dr. R. Knox. *J. and A. Churchill.*—The History and Present Position of Massage and Medical Gymnastics, Dr. Kleen, translated by Dr. Mina Dobbie; and a new edition of A Manual of Bacteriology, Prof. R. T. Hewlett. *H. K. Lewis and Co., Ltd.*—Regional Surgery, edited by Dr. J. F. Binnie, three vols, vol. i.; The Influence of Sunlight in the Production of Cancer of the Skin, Dr. N. Paul, illustrated; The Action of Muscles and Muscle Rest, Dr. C. Mackenzie, illustrated; Anti-Malarial Work in Macedonia among British Troops, Maj. W. G. Willoughby and Capt. L. Cassidy, illustrated; Gould's Pocket Medical Dictionary; Stitt's Tropical Diseases; Stitt's Practical Bacteriology; and new editions of Dr. H. Lewis Jones's Medical Electricity, revised and edited by Dr. L. W. Bathurst, and Landmarks and Surface Markings of the Human Body, L. B. Rawling. *Longmans and Co.*—X-Ray Atlas of the Skull, Capt. A. A. Russell Green, illustrated; Tube Teeth and Porcelain Rods, Dr. J. Girdwood, illustrated. *Macmillan and Co., Ltd.*—The Life of Sophia Jex-Blake, Dr. Margaret Todd ("Graham Travers"), with portraits; An Enquiry into the Analytical Mechanism of the Internal Ear, Sir T. Wrightson, Bart, with an Appendix on the Anatomy of the Parts Concerned by Prof. A. Keith; Fibroids and Allied Tumours: their Pathology, Clinical Features, and Surgical Treatment, Dr. C. Lockyer, illustrated; Hysterical Disorders of Warfare, Dr. L. R. Yealland; Alcohol and Life: A Manual of Scientific Temperance Teaching for Schools, J. A. Hunter, illustrated. *Masson et Cie (Paris).*—Emotions et Commotions de guerre, Prof. A. Léri; Traitement des Psychonévroses de guerre, G. Roussy, J. Boisseau, and M. d'Élsnitz; Prothèse fonctionnelle en chirurgie de guerre, Ducroquet; Blessures de la Moelle et de la Queue de cheval; Formes cliniques et anatomiques, Traitement, Prof. G. Roussy and J. Lhermitte; La suspension dans le Traitement des Fractures (Appareils Anglo-Américains), C. Robert et P. Desfosses; and new editions of Traitement opératoire des plaies du Crâne, T. de Martel, and Les Blessures du Cerveau, C. Chatelin.

PHILOSOPHY.

Cambridge University Press.—The Neo-Platonists, T. Whittaker, new edition. *Macmillan and Co., Ltd.*—A Commentary to Kant's Critique of Pure Reason, Prof. N. Kemp Smith; Some Suggestions in Ethics, Dr. B. Bosanquet.

TECHNOLOGY.

Baillière, Tindall, and Cox.—The Alkali Industry, Dr. J. R. Partington. *Benn Bros., Ltd.*—Notes on Design of Electromagnetic Machines, part ii., Design of a Slow-speed Alternating-current Generator ("The Electrician" Monographs). *Constable and Co., Ltd.*—Wool, F. Ormerod, illustrated; Cotton, G. Bigwood, illustrated (Staple Trades and Industries Series).

Crosby Lockwood and Son.—Lockwood's Builder's Price Book for 1918, edited by R. S. Ayling, illustrated. *Scott, Greenwood, and Son.*—A new edition of Grammar of Textile Design, H. Nisbet.

MISCELLANEOUS.

G. Allen and Unwin, Ltd.—Scientific Synthesis, Dr. E. Rignano, translated by W. J. Greenstreet. *Cambridge University Press.*—The Collected Papers of Sir Benjamin Browne, containing, among others, the following contributions:—Education from the Employers' Point of View, Labour Problems, Co-partnership, Insurance, and the Scientific Training of Young Workmen. *Constable and Co., Ltd.*—Man's Redemption of Man, Sir W. Osler, Bart.; Science and Immortality, Sir W. Osler, Bart.; A Way of Life, Sir W. Osler, Bart. *John Murray.*—The Herring: its Effect on the History of Britain, A. M. Samuel, illustrated.

PRIMITIVE CULTS.

MISS M. A. MURRAY contributes to *Folk-Lore* (vol. xxviii., No. 3) a paper on the "Organisations of Witches in Great Britain." The author brings forward certain facts which appear to show a connection between witches and fairies—not the little beings which the fancies of poets have evolved; the fairies of the witch trials are the fairies of Scotch and Irish legend. The ritual of the witches is like the ritual of the fairies: both sacrificed children to their god, whom Christians stigmatised as the devil; both stole up-baptised children for the sacrifice; both sacrificed their god or devil every year, apparently on May Day; both had ritual dances of the same type. "If, as many authorities contend, the fairies are really the aboriginal inhabitants of these islands, there is nothing surprising in their ritual and beliefs being adopted by the invading race. And in that case I am right in my conjecture that the rites of the witches are the remains of the ancient and primitive cult of Great Britain."

Mr. T. J. Westropp, who is doing excellent work in investigating on scientific lines the early remains in Ireland, has republished from the Proceedings of the Royal Irish Academy (vol. xxxiv., Section C, No. 3) a paper entitled "The Ancient Sanctuaries of Knockainey and Clogher, Co. Limerick." Here a cairn commemorates the cult of the goddess Aine, of the god-race of the Tuatha de Danann. She was a water spirit, and has been seen, half-raised out of the water, combing her hair. "She was a beautiful and gracious divinity, 'the best-natured of women.'" and is crowned with meadowsweet (*Spiræa*), to which she gave its perfume. She is a powerful tutelary spirit; protector of the sick, and connected with the moon, her hill being sickle-shaped, and men, before performing the rites at her shrine, used to look for the moon—whether risen or not—lest they should be unable to find their way back. They used to visit her shrine on St. John's Eve, carrying wisps of lighted straw, in order to bring good luck to crops and herds. One day some girls saw her, and she showed them through a ring that her hill was crowded with fairies. Her son, the magic Earl of Desmond, is still seen riding over the ripples of Loch Gur until his horse's golden shoes are worn out. This is a valuable instance of the survival in an attenuated form of the primitive figures of Irish mythology.

The beginnings of religion are discussed in an interesting paper by Dr. E. S. Hartland in the *R.P.A. Annual*, published by the Rationalist Press Association, on religion among the Indian tribes of Guiana, based on the researches of Mr. Walter E. Roth, Protector of Indians in the Pomeroon district, British Guiana. "This attitude towards their external and material en-

vironment is reflected in their religion—if we may call it religion, which is merely distrust and dislike of the spirits that are believed to surround them, for the spiritual environment can be less steadily and distinctly contemplated than the material, and therefore is even more the subject of surmise and distrust. The unknown is magnified; the strange, the unusual, the unfamiliar, is regarded with uneasiness, with anxiety, evolving into hostility, with wonder and awe, leading not to inquiry and deliberate scrutiny, but to aversion and terror. Such is the mood, and such are the experiences, to which modern psychology is inclined to trace the beginnings of religion."

SULPHUR IN THE UNITED STATES.

THE Smithsonian Institution issues for publication in the Press interesting descriptive articles upon subjects dealt with in many of the bulletins distributed by it. These articles keep the people of the United States in close touch with the activities of the National Museum and other scientific departments and enable them to appreciate the interest and value of the work being carried on. We print below, in a slightly abridged form, an article upon the subject of Bulletin 102, part 3, of the U.S. National Museum, as it deals with a subject of particular importance at the present time, and refers to the ingenious method by which two sulphur deposits near the Gulf Coast in Louisiana and Texas are worked. The success of the process is such that the Gulf deposits are supplying practically all the crude sulphur in the United States, and its development has shifted the world's largest sulphur industry from Sicily to that country.

Few people realise the extent to which sulphur enters into the manufacture of the materials of everyday life that surround them. Yet it is not primarily because sulphur is necessary to convert the sap of a tropical plant into resilient and versatile rubber or wood-pulp into miles of news-print paper that this substance claims our attention at this time; rather because it is numbered among those substances of prime importance, absolutely essential to the carrying on of war, as entering into the very fabrication of explosives themselves. Hence it is not only a matter of curiosity, but also one of urgent interest, to inquire into the sources of this war mineral.

In this connection the appearance is timely of a publication of the U.S. National Museum under the title "Sulphur: An Example of Industrial Independence." This is by Mr. Joseph E. Pogue, of the Division of Mineral Technology, and presents in a few pages, in a simple and non-technical manner, the striking aspects of one of the most interesting mineral industries in the United States to-day. At the outbreak of the war in 1914 the United States was producing each year about 350,000 tons of sulphur, valued at a little more than 6,000,000 dollars. This quantity not only was sufficient to supply the needs of the country, but also contributed about 100,000 tons to European markets. With the development of war activities, however, the production has increased to meet the growing needs of munition-makers, while the exports have decreased as a result of disturbed trade conditions and the need for building up reserves of this essential material at home.

It is a singular fact that the chief raw materials of explosive manufacture are localised in a remarkable manner, and sulphur is no exception to this rule. In the United States practically the entire supply comes from a number of deposits in Louisiana and Texas, near the Gulf Coast. These deposits are similar in