OUR ASTRONOMICAL COLUMN.

REFRACTION AND THE APPARENT DIURNAL MOVEMENTS OF STARS.—The question of the apparent change of positions of stars due to refraction as the hour angle varies, becomes of importance when long intervals of time are taken into account. In photographing the stars, it is generally usual to "stand by" and make all the necessary small adjustments, due to atmospheric refraction, with the hand. A method has, however, been recently suggested and worked out by Dr. A. A. Rambaut, by which the rate of the driving clock may be so adjusted as to take into account these minor discrepancies when a high state of accuracy is desired for stars at large hour angles (*Monthly Notices*, vol. lvii. No. 2). This method does not, of course, take into consideration local or temporary changes in the refraction, but the perfectly regular and systematic change as the star increases or decreases its altitude. For a telescope to follow a star with absolute precision, a clockwork must be constructed which would drive the instrument at an ever-varying rate according to the formula given by Dr. Rambaut. This, however, cannot be practically achieved, and would, further, be unnecessary, as a close approximation is all that is needed in practice. By a system of curves obtained from the above-mentioned formula, and treated graphically, it has been found that a uniform rate, *if suitably chosen*, will not in ten minutes introduce an error amounting to one-twentieth of a second, which is within the limits of the accidental errors of a good equatorial clock. By prolonging the exposure beyond the period for which a uniform rate is admissible, the rate must be altered to one now more suitable. A series of weights, skilfully employed in controlling the action of a pendulum in connection with the driving clock, will allow the different rates to be easily produced. Dr. Rambaut describes a graphical method for obtaining the length of exposure during which a uniform rate may be used. This he finds most convenient in practice for short exposures, and he relates that he can turn his telescope, with the greatest confidence, from a star at its upper culmination, to follow which a star must lose at the rate of from 18 to 100 seconds or more a day, and one at its lower culmination, gaining at the rate of 70 or 80 seconds a day, and he finds "the telescope will follow both with equal accuracy." It may be remarked that this method is practically intended to be utilised when photographs for the detection of stellar parallax are in question, as it is only then that they must be obtained when the stars have a considerable hour angle.

"BULLETIN ASTRONOMIQUE DE FRANCE."—The April number of this monthly contains, among other things, an interesting article, by Camille Flammarion, on the planet Venus, more special attention being paid to the observations which have indicated the presence of an atmosphere. There is also an account of Mr. Percival Lowell's recent observations on the surface markings, and the subsequent determination of the period of rotation, mentioned previously in this column. *A propos* of our note last week, on the question of the adoption of France of Greenwich time, we find that the following resolution was voted by the assembly at the meeting of the French Astronomical Society, on March 3 last, the proceedings of which are here recorded:—"La Société astronomique de France, considérant qu'au Congrès de Washington la proposition du méridien de Behring, qui avait un caractère eminemment géographique, impersonnel et d'ordre universel, n'a pas été adoptée, ne juge pas à propos d'en adopter un autre, qui n'a à aucun degré le caractère auquel la France est toujours restée fidèle dans les réformes dont elle a pris l'initiative." This number of the *Bulletin* contains also several communications relating to the moon, and another beautiful reproduction from one of Lœwy and Puiseux's lunar negatives is given, which, for amount of detail and fine contrast, is strikingly beautiful.

PROF. EDUARD HAERDTL.—The Professor of Astronomy at Innsbruck, Prof. Eduard Freiherr von Haerdtl, whose death (*Astr. Nach.*, No. 3416) we regret to record, was born in the year 1861 at Penzing, near Vienna. After finishing his Gymnasium studies in 1880, he selected mathematics and astronomy as his chief pursuits at the Vienna University. He was one of the most apt pupils of Th. von Oppolzer, whose work he vigorously took up, and afterwards so ably continued. In 1892 Haerdtl was promoted to the Professorship of the Innsbruck University. Endowed with a great capacity for carrying out astronomical computations, his dissertation "Beiträge zur Assyrischen Chronologie" was followed by other publications, chief of which was the investigation of the movement of Winnecke's comet. The prize of the Copenhagen Academy of Sciences he won with an interesting essay, entitled "Skizzen zu einem speciellen Fall des Problems der drei Körper," after which he busied himself with the terms of long period in the movement of the moon, and shortly before his death with Winnecke's comet again. Full of such promise, and cut off at the early age of thirty-six, not only has astronomical science lost a man who seemed destined to enrich her with many valuable contributions, but his circle of friends mourn the loss of a kind and true "Kamerad."

ON ELECTRICAL PROPERTIES OF FUMES PROCEEDING FROM FLAMES AND BURNING CHARCOAL.[1]

§ 1. MANY experimenters have investigated the electrical properties of flames and incandescent solids. The methods usually employed have been (1) to examine the electric conductivity of different parts of the flame;[2] (2) to measure the difference of potential between platinum wires in different positions in the same flame;[3] (3) to find the leakage of a charged conductor when placed near, or in view of, a flame or an incandescent solid;[4] (4) to observe the leakage of a conductor, raised to a red or white heat, by an electric current, and electrically charged while it is surrounded by different gases;[5] and (5) to observe the production of electrification or diselectrification by a glowing wire, through which a current is passing, in neighbouring insulated conductors separated from it by different gases.[6]

§ 2. This short communication divides itself into three separate inquiries: (1) to test by one of our electric filters[7] the electric quality of the fumes from different flames and burnings (this method has not, we believe, been tried before); (2) to observe the difference of potential between a copper plate and a zinc plate when the fumes from different flames and burnings at different distances from the plates passed between them and round them; and (3) to observe the leakage between two parallel metal plates with any difference of electric potential when the fumes from flames and burnings were allowed to pass between them.

§ 3. To test the electrification of fumes from different flames and burnings, the arrangement shown diagrammatically in Fig. 1 was used. The flame is kept burning at the mouth of a large vertical iron funnel A, closed at its upper end; and the heated air, along with the products of combustion, is drawn off by an air-pump through a small aperture, B, near the upper end. Before reaching the pump the air has to pass through three circular pieces of brass wire gauze, D, one centimetre apart, which are fixed across the funnel about 5 centimetres below the exit tube B; and through a worm of block-tin pipe, 90 centimetres long, which is kept surrounded by cold water in a vessel C. The electrification was tested by a quadrant electrometer (sensitiveness of the electrometer 111 scale divisions per volt), and an electric filter F. The filter F was of block-tin tube, 5 centimetres long and 1 centimetre bore, and full of fine brass filings kept in position by a plug of cotton-wool and a piece of brass wire gauze at each end. Between the filter and the air-pump is a T-shaped piece of glass tubing with lower end of the vertical tube dipping into a basin of mercury. This served as a pressure gauge to indicate the difference of air pressures on the two sides of the filter when the air-pump was worked. The flame, the iron funnel, the worm, and the case of the electrometer are all metallically connected.

[1] By the Right Hon. Lord Kelvin, G.C.V.O., F.R.S., and Dr. Magnus Maclean. Paper read at a meeting of the Royal Society, Edinburgh, on April 5.

[2] Account of experiments in Wiedemann's "Lehre von der Elektricetät," vol. iv. B. Carl's *Rep.*, xvii. pp. 269–294, 1881. J. J. Thomson, *Phil. Mag.*, pp. 358, 441, 1890.

[3] Hankel, *Phil. Mag.*, p. 542, December 1851; *Phil. Mag.*, p. 9, January 1860. Elster and Geitel, *Wied. Ann.*, vol. xvi., 1882; also *Phil. Mag.*, September 1882. Maclean and Goto, *Phil. Mag.*, August 1890.

[4] Guthrie, *Phil. Mag.*, p. 308, April 1873. Giese, *Wied. Ann.*, vol. xvii. Schuster, Lecture Royal Institution, February 22, 1895.

[5] Guthrie, *Phil. Mag.*, p. 237, October 1873.

[6] Elster and Geitel, *Wied. Ann.*, xxxvii. p. 315, 1889; Elster and Geitel, *Wied. Ann.*, xxxviii. p. 27, 1889.

[7] Kelvin, Maclean, Galt, "Electrification and Diselectrification of Air," *Proceedings* of the Royal Society, London, vol. lvii., February and March 1895; also B.A. Report, 1895.