

The average height of the lower limit is about 106 km.; there is greater scatter for the upper limit, which shows some dependence upon type and distribution of light intensity along the streamers. The near coincidence in height between the average lower level of the aurora and that of the *E*-layer explored by radio-echo observations would appear to be other than fortuitous.

The spectrum of the aurora long presented great difficulty, and although important advances have been made, knowledge of the origin of the spectrum is by no means complete. In 1925, the well-known prominent auroral green line at 5577 Å. (discovered by Angström in 1866) was proved by McLennan and Shrum in their laboratory in Toronto to be due to oxygen in a metastable state. The great intensity of this line is explained by Vegard as being due to oxygen excited to emit this radiation by means of collisions of the second kind with activated nitrogen. Besides the prominent green line, there are two lines in the red, at 6300 Å. and 6365 Å., both of which are thought to be due to oxygen. In addition, the visual spectrum is characterized by the negative band spectrum of nitrogen. A phenomenon of great interest, studied in particular by Lord Rayleigh, is the light of the night sky, the spectrum of which shows the same green radiation at 5577 Å. as does the aurora, although the negative band spectrum of nitrogen is missing. Babcock accurately derived the wavelength as  $5577.35 \pm 0.01$  Å. It has been suggested by Rayleigh (*Proc. Roy. Soc., A.*, 106, 135) that the light from the non-polar aurora (as represented by the night sky luminescence found generally distributed over the world) is of a phosphorescent nature, the luminosity being excited by the sun

during the daytime and carried round by the earth's rotation. It is important to note the distinction between the non-polar aurora and the polar aurora as exemplified by the recent display.

In conclusion, mention may briefly be made of the work of solar observers in trying to identify the precise phenomenon on the sun responsible for the occurrence of magnetic storms and their associated auroras. Replicas of Dr. Hale's spectrohelioscope, perfected by him in 1926, have been systematically used by a number of observatories in searching for and recording bright chromospheric eruptions which might, it was thought, be related to perturbations in the earth's magnetic field. Although no definite progress can be claimed in obtaining observational evidence of corpuscular streams (the search for which had been urged by Chapman), a new relation has been brought to light in which the solar agency appears to be radiation in the ultra-violet. There is now little doubt that sudden bright chromospheric eruptions (usually near sunspots) visible in  $H\alpha$  with the spectrohelioscope or on  $Ca^+$  spectroheliograms produce an immediate (that is, within about the time taken for light to reach the earth from the sun) disturbance in the ionosphere over the sunlit hemisphere, apparently just below the *E*-layer. At the same time, relatively small magnetic perturbations may occur, the effect of which is recorded within a limited distance from the place where the sun is in the zenith at the time of the solar eruption. These small disturbances in the earth's magnetic field are, however, clearly to be distinguished from the magnetic storms and auroras considered above, which are essentially high latitude phenomena.

## Obituary Notices

### Prof. W. H. Pickering

PROF. W. H. PICKERING died on January 21 at his home at Mandeville, Jamaica, at the age of seventy-nine years, after several months of failing health. He was a younger brother of E. C. Pickering, the director of the Harvard College Observatory from 1876 until 1920.

Born at Boston in 1858, Pickering graduated at the Massachusetts Institute of Technology in 1879, and became a lecturer there, and at the same time was an assistant professor at the Harvard College Observatory. His first astronomical observations were at the eclipse of 1878, where he observed the radial polarization of the corona. For a time he was in charge of the Harvard College Observatory Station at Arequipa. Vol. 33 of the *Harvard College Annals* contains his researches on the determination of photographic stellar magnitudes, the Great Nebula in Orion and visual observations of the moon and planets.

In 1900 Pickering established the Harvard College Observatory at Mandeville, and while there published a lunar atlas from photographs taken with a 12-inch lens of focal-length 135 ft. The disk of the moon is divided into sixteen parts, and each part photographed under five different illuminations. In 1898 he discovered by photography a small satellite of Saturn at a distance of 8 million miles from the planet and revolving round it in a year and a half. This satellite, to which he gave the name Phœbe, is remarkable in that it revolves in a direction contrary to the other eight satellites, a peculiarity which was later found in three faint satellites of Jupiter.

At Mandeville, Pickering continued his visual observations of the moon and planets. He observed Mars under good climatic conditions and was satisfied of the existence of the "Canals" and drew the more important ones in agreement with Lowell. He regarded them as belts of vegetation of widths up to 150 miles along assumed water courses. In 1921 he



challenged the view taken by astronomers that the moon was dead and that no changes took place on its surface in a paper contributed to the Royal Astronomical Society on "Seasonal Changes occurring in certain Lunar Craters". These he attributed to patches of snow which disappeared gradually and reformed. These changes have not been confirmed, and must be attributed to differences of definition.

Pickering, Percival Lowell and George Forbes all made calculations to discover an extra-Neptunian planet. Pickering used the slight deviations of the orbit of Uranus, Lowell and Forbes the slight deviation of the orbit of Neptune (and in the case of Forbes the existence of a so-called family of Neptunian comets), as data for the existence of this body. The position of the planet was found by both Pickering and Lowell from these wholly insufficient data, and strangely enough a planet was found by Tombaugh

at the Lowell Observatory on January 21, 1930. Judging from its brightness, the mass of the planet is too small to exercise any appreciable perturbation on Uranus or Neptune.

Prof. Pickering married Anne Atwood, daughter of Mr. Isaac Butts of Boston. They visited England a number of times and made many friends. Prof. Pickering spoke several times at the Royal Astronomical Society, of which he was elected an associate in 1910. He has also addressed the British Astronomical Association, as he was greatly in sympathy with amateur observers. F. W. D.

WE regret to announce the death of Sir James Crichton-Browne, F.R.S., a pioneer in the treatment of mental disease, which occurred on January 31, aged ninety-seven years.

## News and Views

### Mr. W. M. H. Greaves

THE King has approved, on the recommendation of the Secretary of State for Scotland, the appointment of Mr. W. M. H. Greaves, chief assistant of the Royal Observatory, Greenwich, to be astronomer royal for Scotland and professor of astronomy in the University of Edinburgh, in succession to Prof. R. A. Sampson, who retired recently. Mr. Greaves entered St. John's College, Cambridge, in 1917. He obtained a first class with distinction in Part II of the Mathematical Tripos and was awarded the Tyson Medal for astronomy. He obtained a Smith's Prize in 1921 for an essay on the movement of asteroids of the Trojan group, was awarded an Isaac Newton Studentship and in 1922 was elected a fellow of his College. Mr. Greaves was appointed chief assistant at the Royal Observatory, Greenwich, in 1924. The most important work undertaken by Mr. Greaves at Greenwich has been the development of methods for the determination of the colour temperatures of stars. The observations are divided into two parts: the determination of the relative gradients of the spectral energy curves and the fixing of the zero point of the temperature scale. The determination of the zero point is a long and intricate investigation, requiring reference to a terrestrial source; it has been undertaken twice with concordant results. The mean colour temperature for stars of spectral type A0 was found to be 18,000° K.; this value is appreciably higher than had previously been accepted but has since been confirmed by other investigators. Mr. Greaves has also been in charge of the magnetic work at Greenwich and has made some valuable investigations of the relationships between sunspots and magnetic storms. Mr. Greaves was secretary to Section A (Mathematics and Physical Science) of the British Association from 1924 until 1931, and has been secretary of the Royal Astronomical Society since 1932.

### Accident to Dr. W. W. Vaughan

MOST of the members of the British Association delegation to the jubilee meeting of the Indian Science Congress Association have now returned, and one of them has kindly told us the circumstances of Dr. W. W. Vaughan's lamentable accident at Agra. It appears that Dr. Vaughan, with Mrs. Vaughan and other members of the delegation, had gone to the Taj Mahal before moonrise on the night of the party's arrival at Agra. In the darkness, he missed his footing on the upper of two terraces between which there is a fall of several feet, without any parapet. He fell on to the lower terrace, and his leg was broken above the knee. Help was obtained from other members of the delegation, and also, very fortunately, from an Indian friend of one of them, who, as a resident in Agra, knew what to do. But there was a weary wait for the sufferer before an ambulance could be got, during which he retained both consciousness and, by all accounts, the bravest bearing. The Thomason Hospital at Agra received him with every attention. It is now known that the leg, which had not been healing satisfactorily, was amputated on Monday, January 24; a private message on the following Thursday spoke of the patient's condition as "improving", and a press bulletin on January 31 appeared equally favourable.

### International Economic Collaboration

THE able report by M. Van Zeeland on his mission of inquiry to various countries, directed to "the possibility of obtaining a general reduction of quotas and of other obstacles to international trade", was published in the press on January 28. His proposals in the main are very much in line with views that have been repeatedly expressed in NATURE, and they should receive serious consideration by all Governments. His immediate object is to bring together