Photometry of Tungsten Filament Lamps. The manufacture of tungsten filament incandescent lamps has changed very rapidly during recent years and this has made necessary a change in the methods of lamp photometry. Twenty years ago, all lamps had squirrel cage filaments in clear bulbs and were rated by the manufacturers at 'efficiencies' expressed in watts per mean horizontal candle. Inside-frosted diffusing bulbs are used now on all lamps which take 100 watts or less. The ring-wound coiled filament has replaced the squirrel-cage type. In addition, practically all lamps of 40 watts or more are gas-filled. For these reasons spherical candle power, that is, the mean candle power in all directions, has to be measured. The result is given in lumens per watt, a spherical candle being equal to 4π (12·57) lumens. In the *Bureau of Standards Journal of Research*, vol. 9, December 1932, L. E. Barbrow and J. Franklin Meyer publish a paper on the characteristic equations of tungsten filament lamps which show how, when one measurement of the pressure, the current, the lumens and the lumens per watt has been made, then all the corresponding values at other pressures, etc., can be found. They also compare the results obtained by computation with experiment, the agreement being most satisfactory. The Bureau of Standards has used the equations and tables given in this paper for the routine testing of lamps for several years. It appears that the efficiency in lumens per watt is a very definite function of the voltage. For example, if, for a gas-filled lamp taking 60–150 watts, the efficiency is 12·50 lumens per watt at 230 volts, then at 184 volts its efficiency would be 7·55, and at 276 volts its efficiency would be 17·84. The life would be much shorter at the high voltage.

Electron Optics. The May *Journal of the Franklin Institute* contains an interesting article by Zworykin on "Electron Optics". Bundles of electrons in high vacuum can be partially focused by suitable magnetic or electrostatic fields, and images may be formed of the electron-emitting surfaces or of diaphragms placed in the beam. The arrangements described include the long uniform magnetic field used in Busch's determination of e/m, the short magnetic field, and various electrostatic arrangements, mostly employing coaxial cylindrical electrodes. The focusing arrangements show effects comparable with spherical and chromatic aberration in the optical case, but a further limitation arises from the self-repulsion of the electrons in the beam. The electron microscope which has been described in the German literature and is referred to in the present article, consists of electrostatic or electromagnetic 'lenses' which form a magnified image of the emitting surface. The arrangement may be used to study the surface distribution of emission from a thermionic source or from a target bombarded by a primary electron beam.

Astronomical Topics

Meteorites. *Popular Astronomy* for May contains an article on meteorites of which the fall has been observed, by Mr. Willard J. Fisher. He points out that these are more frequently observed by day than by night. They differ from meteors in an important respect. More meteors come from the region of the earth's apex than from the antapex; this is from the same cause that makes us meet more vehicles when walking along a street than those that overtake us. But the speed of meteors from the apex is so great (71 km./sec. for parabolic motion) that they are consumed in the upper air, and cannot fall as meteorites. Hence the latter come by preference from the antapex. The minimum speed at which meteors can enter the atmosphere is given as 11·15 km./sec.; this is the speed that the earth's attraction would produce if the earth and meteor were originally at relative rest. Many hundreds of meteor falls have been recorded; of these, thirty have fallen on roads or buildings; this obviously increases the chance of detection. The earth's antapex rises about noon; this helps to explain the greater number of falls by day. Most of those referred to were of the detonating class, and bright enough to be conspicuous in the sunshine.

The same publication contains an article by C. C. Wylie on a remarkable meteor that was seen about dawn on March 24 over a large area in the south-western United States. The dust-cloud remained visible for a long time. Fragments probably reached the ground, but none has yet been found.

Early History of Solar Spectroscopy. An interesting paper on this subject has recently been published by Prof. Pio Emanuelli (*Memorie della Soc. Astron. Italiana*, vol. 6). The existence of dark lines in the solar spectrum was announced by Fraunhofer in 1817. The explanation of the lines was given by Kirchhoff and Bunsen in 1859. The first observer to make detailed observations of the spectra of different regions of the sun, and especially of sunspots, appears to have been Sir Norman Lockyer. Vol. 15 of the *Proceedings of the Royal Society* contains a paper by him bearing the date October 11, 1866, in which he says: "On March 4 of this year I commenced a spectroscopic study of sunspots; . . . All the absorption bands visible in the spectrum of the photosphere, above and below, were visible in the spectrum of the spot; they, moreover, appeared thicker where they crossed the spot-spectrum." Lockyer gave a more detailed account in vol. 17 of the *Proceedings* (March 1869), in which he mentioned the lines of sodium, magnesium and barium as being widened in the spot-spectrum. Secchi, who apparently had not noticed Lockyer's announcement, made similar observations at the Observatory of the Roman College, beginning in January 1869. He considered that the widening was restricted to lines in the red and orange regions, and noted the further fact that some of the lines appeared double and triple.

The year 1870 brought further knowledge of spot spectra from observations by Young in the United States and Respighi at the Campidoglio, Rome. The principal aim of the latter was the study of prominences by the spectroscopic method which was discovered in 1868. It was perhaps for this reason that he paid special attention to the red hydrogen line in the spot spectra, as that was the line usually employed in the study of the prominences.

Prof. Emanuelli wrote this article in order to vindicate Lockyer's position as a pioneer, which some recent writers have overlooked.