

Milne's original kinematic model of the universe, this outward increase in density is just what would be expected from the fact that we do not have, as it were, an instantaneous view of the universe, but are seeing the more distant nebulae as they were some five hundred million years ago. When the observed density distribution is corrected to the instantaneous view, the resulting spatial distribution turns out to be uniform; since on the kinematic model, however, uniform density distribution can only occur once, Hubble finds it nearly as unsatisfactory to suppose that we are just happening to observe the universe at a special instant in time, as if we were observing from a specially favoured point in space.

Still assuming that the observed red displacement is due to a velocity of recession, and that therefore the apparent spatial distribution of nebulae increases radially outwards, Hubble next examined the apparent distribution of nebulae predicted by the homogeneous expanding models of general relativity, a special case of which also includes in many of its aspects Milne's kinematic model. Tolman has shown that the nebular counts predicted by these models take the form

$$\log N(m) = 0.6 \{m - \Delta m_1 - \Delta m_2 + F(R)\}$$

where R is the radius of space curvature. At the very outset an almost insuperable difficulty is encountered in that the observed counts do not obey a relation of this form. If, however, it be assumed that the observed counts are subject to almost impossibly large systematic errors, the relation and the observations may be used to calculate a value of R . The resulting value is of

the order of five hundred million light years, rather less than the penetrating power of the 100-in. telescope, and since there is a relation between R and the density of matter in space, the density must be 10^{-26} gm. cm.⁻³, which is many times greater than the mean density produced by the nebulae alone. To account for this density we must postulate that inter-nebular space is filled with matter the mass of which is greatly in excess of the total mass of the nebulae, and which is distributed in such a form as to produce no absorption of light in space, since any absorption would demand a still smaller radius of curvature and larger mean density.

If no recession is assumed, the observed nebular counts are satisfactorily described by supposing that we are observing a finite portion of a much larger universe of nebulae, but a universe in which the frequency of light varies uniformly with the distance. If, on the other hand, recession is assumed, the observed nebular counts are not satisfactorily described by any of the homogeneous expanding models of general relativity, but if forced to fit require that the universe be closed, that we have already explored it to its outmost bounds with the 100-in. telescope, and that it is a universe dominantly filled with non-luminous matter distributed in such a way as to absorb or scatter negligibly small amounts of light.

The large and appreciative audiences who followed the three lectures, each a model of exposition and clarity, had little difficulty in agreeing with Dr. Hubble that the consequences of assuming no recession were the less difficult to accept.

H. H. P.

News and Views

Prof. A. N. Talbot

PROF. ARTHUR N. TALBOT, emeritus professor of engineering in the University of Illinois, has been awarded the John Fritz Gold Medal, the highest of American engineering honours. Prof. Talbot, who is seventy-nine years of age, was cited as "moulder of men, eminent consultant on engineering projects, leader of research, and outstanding educator in civil engineering". The award is made annually by a board composed of sixteen past-presidents of the four national societies of civil, mining and metallurgical, mechanical and electrical engineers. Prof. Talbot was born in Cortland, Ill., on October 21, 1857. He has been engaged in engineering work since 1881, his activities embracing railroads, roads, bridges, buildings and municipal public works. Prof. Talbot aided in the development of the testing laboratories and the College of Engineering of the

University of Illinois. He has been active in the formation and development of the Illinois Engineering Experiment Station, in connexion with which he has made numerous investigations in the properties of steel, brick, concrete and reinforced concrete, and in water purification, sewage treatment and hydraulics. Among previous recipients of the John Fritz Gold Medal have been Lord Kelvin, Thomas Edison, Guglielmo Marconi, Elihu Thomson and Sir Robert Hadfield.

Sir Robert Mond

SIR ROBERT MOND has been elected an associate foreign member of the Académie des Inscriptions et Belles Lettres in Paris, in succession to the late King Fuad of Egypt. Sir Robert Mond's wide interests are illustrated by the fact that he is honorary secretary of the Davy Faraday Research Laboratory at the