OBITUARY

Edward Arthur Milne

We regret to record the death of Dr. Edward Arthur Milne, F.R.S., Rouse Ball Professor of Mathematics in the University of Oxford, on Sept. 21, 1950, while on his way to a colloquium in the rooms of the Royal Irish Academy, Dublin, convened by the Royal Astronomical Society.

Edward Arthur Milne, the eldest son of Sydney Arthur Milne, was born on Feb. 14, 1896, at Hull, and received his early education at his father's school there and later at Hymers College. In 1914 he entered Trinity College, Cambridge, as a mathematical scholar, and two years later he became a member of the Anti-Aircraft Experimental Section, Munitions Inventions Department, at Portsmouth. In 1919 he was elected to a prize fellowship at Trinity College, Cambridge, and was awarded the Smith Prize three years later. In 1922-23 he served under Newall as Assistant Director of the Solar Physics Observatory, Cambridge, and was also University lecturer in astrophysics as well as mathematical lecturer at Trinity College. In 1924 he was appointed professor of Applied Mathematics in the University of Manchester, and in 1928 he went to Oxford as the first Rouse Ball Professor of Mathematics and was also elected a Fellow of Wadham College. The importance of his work had been recognised before this; he was elected a Fellow of the Royal Society in 1926 and three years later was invited to give the Society's Bakerian Lecture. He joined the British Astronomical Association in 1935, having been a Fellow of the Royal Astronomical Society since 1921.

Before leaving Cambridge for Manchester Milne had commenced his investigations on the equilibrium of a calcium chromosphere under gravitational force and radiation pressure and, in collaboration with Fowler, on pressure in stellar atmospheres. In 1930 he put forward a new theory of the cause of novae—a theory which included not only novae but also the internal constitution of stars. His investigations led him to the conclusion that the luminosity of a star depended not only on its mass but also on the relative amounts of degenerate and perfect gas in its constitution. A star which had part of its material at its centre in the form of a degenerate core would have a slightly greater luminosity than the same star if constituted entirely of a perfect gas, and the luminosity would increase with the relative increase in the degenerate core. If the luminosity decreased, part of the degenerate core would overflow into the surrounding shell of perfect gas, and if the core disappeared completely and the star continued to decrease in luminosity the interior could not support the outer layers. The result would be a collapse of the star into the degenerate state—a white dwarf with only a relatively shallow layer of perfect gas. The sudden collapse would be accompanied by an enormous release of energy which would expel the surface layers, producing the first nova stage. When the continuity of the expanding surface was broken and while the ejected gases continued to expand it becomes possible to see the main body of the star, then in a collapsing stage. Observational data gave a considerable amount of support to this theory of novae, but of course other theories have since been propounded which also receive support from observational data, and the last word has not yet been spoken on the problem of novae.

It is impossible to deal here with all the subjects included within the scope of Milne's investigations but some reference should be made to his Kinematic Relativity which is based on a new theory of the measurement of time. So long as we are not concerned with stretches of time far removed from the present, time as measured by atomic processes, such as a radioactive clock, can be regarded as identical with time as measured by a chronometer or by the rotating Earth, but Milne held that this would not be true over a long period. He distinguished between ephemeral or dynamical time, τ, which is the time recorded by a molar timekeeper such as the rotating Earth, and absolute or kinematic time, t, which is the time recorded by any form of timekeeper based on atomic processes. In terms of τ—the time of Newtonian dynamics—a particle moving under no force has a constant velocity, but the period of the radiations emitted by a radiating atom is constant only when measured in kinematic time, t, which is the time kept by an atomic clock. If t_0 is the present value of t, say about 4×10^9 years—the age of the universe in t-time—the relation between τ and t is given by

$$\tau = t_0 \log t/t_0 + t_0$$

At the present instant the two scales are momentarily the same, but when the motion of a dynamical system like the rotating Earth is described in terms of t-time, the period of rotation shortens as we recede in history, and at any instant is proportional to the value of t then, that is, to the kinematical time elapsed since the Creation. Many important consequences follow from this; for instance, an increase in frequency in a unit interval of τ-time and a corresponding decrease in the wave-length implies that the light emitted by a standard atom in a distant nebula will appear to be redder than the light from a similar source in the laboratory, the natural wave-length of the light now received being longer than when it originated. Hence the red-shifts in the spectra of nebulae are explicable in different ways, depending on our choice of the flow of time. On Milne's theory it seems that some phenomena are uniform in one scale and some in another. Thus, on the t-scale the constant of gravitation and Planck's constant are proportional to the time since zero epoch, but on the τ-scale they are constant. Milne's work has an important bearing on the problem of determining the distance of the faint nebulae which, statistically, can be regarded as of uniform absolute brightness, so that their apparent brightness can be used to find their distances. But the relation of apparent brightness to distance depends on the motion or otherwise of the nebulae. If we regard them as receding the amount of light that we receive from them in unit interval of time is diminished and we shall attribute less distances to them than if we regarded them as stationary.

Amongst his most important works are "Relativity, Gravitation and World Structure", "Kinematical Relativity" and "Vectoral Mechanics". Shortly before his death he edited the Mathematical and Physical Sciences Section of Hutchinson's University Library.

Some additional honours not previously referred to were the Gold Medal of the Royal Astronomical Society, 1935; Royal Medal of the Royal Society, 1941; Bruce Medal of the Astronomical Society of the Pacific, 1945; President of the London Mathematical Society, 1937-39 and of the Royal Astronomical Society, 1943-45; Foreign Hon. Member of the American Academy of Arts and Science.

His first wife, Margaret Scott Campbell, by whom he had two daughters and a son, died in 1938. His second wife, Beatrice Brevoort, whom he married in 1940, and by whom he had one daughter, died in 1945.—M.D.