THE PRESIDENT'S ADDRESS ON THE AWARD OF THE GOLD MEDAL TO DR RAYMOND ARTHUR LYTTLETON

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The Society's Gold Medal has this year been awarded to Dr Raymond Arthur Lyttleton for his work on the stability of rotating fluid masses, on the constitution and evolution of the stars, and on the origin and peculiarities of the Solar System.

In awarding the Medal to one of its own members, the Council has followed a precedent set on several previous occasions, the last being in 1942; for it has long been felt that an individual who happens to be giving long service to the Society as a member of the Council should not thereby be debarred from receiving equal consideration along with all other possible recipients of the Medal.

To turn now to Lyttleton's actual work, I can say at once that it spans almost the whole of theoretical astronomy, and is especially remarkable for standing, in several fields, at the beginning of a revival of interest in that field. In a number of instances his work has laid the foundations on which a great amount of subsequent research has rested. His first significant contribution came while he was at Princeton as the Procter Visiting Fellow from Cambridge. At that time, with H. N. Russell as professor, Princeton was an especially stimulating place; and in addition to all his other great merits, Astronomy is indebted to Russell for having secured, for good it seems, Lyttleton's interest in our subject.

One of the most tantalisingly obscure problems of theoretical astronomy was then, as it is now, the question of the origin of the Solar System. In 1936 all theories were completely on the rocks; but Lyttleton in his first major paper showed how the famous angular momentum difficulty could be surmounted in the mode of formation from a binary star, a hypothesis already suggested by Russell, but dismissed by him as involving insuperable objections. At the same time Lyttleton began to examine the various peculiar features of the Solar System that might afford clues to its origin and development. He was particularly interested in accounting for the rotations of the planets and their satellites; and he was the first to develop the hypothesis that Pluto might be an escaped satellite of Neptune.

On returning to England, Lyttleton chanced to become acquainted with Hoyle, just then embarking on a career as a theoretical physicist. He soon began to interest Hoyle in the sort of astronomical problems that were engaging his own attention; and in this way Lyttleton may be said to be the founder of the whole modern Cambridge school of theoretical astronomy.

The two main problems that Lyttleton and Hoyle attacked in the next few years, despite the calls made on their time by war work, were the constitution and evolution of the stars. Before 1938, much attention had been given to the theory of stellar structure in this country by Jeans, Eddington, Milne, Cowling and others. However, all this earlier work was seriously retarded and made difficult and restricted by the then lack of certain knowledge as to the nature of the source of stellar energy. In 1938, Bethe, partly in collaboration with Critchfield, practically solved this problem from the point of view of nuclear physics, but it remained to fit it into the scheme of stellar theory. Lyttleton and Hoyle were

the first to see how this long-awaited piece of information could be applied, and they developed the theory of stellar structure anew on this basis. The first triumph of their theory was to make perfectly clear the position of Eddington's important but obscure " mass-luminosity relation ", and it was Lyttleton and Hoyle who first obtained the true mass-luminosity and mass-radius relations. Shortly afterwards, they turned to problems more difficult than those of the main-sequence stars, and they were the first to give a viable theory of red giant stars.

In the field of stellar evolution, Lyttleton and Hoyle were the first really to appreciate the importance of the interstellar medium to the stars. It is perhaps hard to realise nowadays, when through radio-astronomy and other means so much is known and published about interstellar hydrogen, that, when they first postulated its existence twenty years ago, they had to do so in the teeth of a highly incredulous active opposition from those who were certain that interstellar space must be empty of gas, except perhaps for a few calcium atoms. In this way Lyttleton and Hoyle shed a completely new light on the question of star formation and stellar evolution. Though the problems involved are difficult, and their solution still obscure, it is clear that their intervention brought an entirely new order of development to the subject.

After the War, Lyttleton felt that the moment had come when he could find time to set out his considered conclusions on the classical problem of the stability of rotating fluid masses. With H. F. Baker, he was one of the very few people who had made a thorough study of the vast and forbidding technical literature of this subject, and Lyttleton was certainly the first to appreciate the whole problem in the light of the contributions of Liapounov and Cartan. His monograph on this, published in 1953, remains for the present the last word on this century-old intricate matter, and is a model of rigour and lucidity.

At much the same time, as a by-product of the famous accretion theory, Lyttleton had been led to take up the subject of comets, which from the theoretical side had long been neglected. His entirely novel theory of the formation of these objects throws a fresh light on these numerous but hitherto little-studied members of the Solar System. He has also put this work into book form, and the new interest of this past ten years in the theory of comets dates from his first papers on this subject, communicated to this Society.

Mention should also be made of Lyttleton's important work in theoretical geophysics. He was the first to appreciate the hydro-dynamical significance of the fluid core of the Earth, and the influence it must have on nutation and similar phenomena. Once again his contributions marked the beginning of a new phase of interest and activity in a subject that had almost come to a stop, whereas the end of the resulting developments is not yet in sight.

Dr Lyttleton, it gives me great personal pleasure to hand this Medal to you. On many occasions in the past it has been bestowed towards the end of an astronomer's career, in recognition of the labours of a lifetime. I need hardly say that in your case the Council does not regard the award in this light. On the contrary, it is made in the confident hope that, in the years to come, you will continue to add to the achievements which have already earned this mark of our appreciation.