Presidential Address

ON THE AWARD OF THE GOLD MEDAL TO PROFESSOR V. A. AMBARTSUMIAN

THE GOLD MEDAL of the Society has been awarded, for his outstanding contributions to astrophysics, to Professor V. A. Ambartsumian, who is Director of the Burakan Observatory, Armenia, U.S.S.R., President of the Academy of Sciences of the Armenian S.S.R. and a full member of the Academy of Sciences of the U.S.S.R. in Moscow.

Ambartsumian started his astronomical career as a student at the University of Leningrad and was subsequently a lecturer there for many years, as well as being closely associated with the nearby Pulkovo Observatory. His first papers appeared in the late 1920's and were published in collaboration with N. A. Kosirev. They dealt with the solar atmosphere, with sunspots and with the theory of radiative equilibrium, which at that time was attracting much attention owing to the work of Milne.

Early in the 1930's Ambartsumian turned his attention to questions concerning planetary nebulae and Wolf–Rayet stars. Bowen had recently identified the source of the so-called nebulium lines, and Zanstra had introduced his method of determining the temperature of the exciting star. Ambartsumian formulated Zanstra's ideas in a very elegant way and developed a method of deducing the radiation field in the nebula, both in the ultra-violet continuum and in Lyman-α. A notable result was a demonstration of the importance of radiation pressure from Lyman-α. He also devised methods for determining the electron temperatures in planetary nebulae and the temperatures of Wolf–Rayet stars. He was one of the first to treat a planetary nebula as composed of pure hydrogen; today this seems an obvious approximation, but at that time the view that hydrogen is in overwhelming excess nearly everywhere in the universe was far from being established. It was about this time, too, that with Kosirev he estimated that the mass loss in an outburst by an ordinary nova is of the order of 10^{-5} $M_{\odot}$. This was an early expression of the view, now generally accepted, that a nova outburst is not an explosion involving the whole star, but rather one of the surface layers only.

Later in the 1930's he became interested in the dynamical properties of groups of stars. In 1937 he showed from their statistics that double

stars cannot have existed as such for more than 10^{10} years, in contradiction to earlier work of Jeans, who had advocated the long time-scale of 10^{12} or 10^{13} years, in part also on binary star evidence. Ambartsumian was also one of the first to recognize that the escape of stars from galactic clusters gives us evidence with regard to the time-scale.

Early in the 1940's he made a very important contribution to theoretical astrophysics in demonstrating an invariant property of the law of diffuse reflection by a semi-infinite plane-parallel atmosphere. This was subsequently taken up and generalized by Chandrasekhar in his work on radiative transfer, and has also been discussed appreciatively by Kourganoff and Busbridge. Ambartsumian later formulated principles of invariance to derive integral equations for describing the fluctuations in surface brightness of the Milky Way.

Since the war his best-known work has been in connection with star associations. The roots of this run back to his work in the 1930's but we may confine our attention to more recent years. Whereas a cluster is a relatively dense aggregate of stars of all types, an association is a rather loosely-knit group of stars, all of closely related physical properties. The space density of members of the association may be less than that of the general star field in which it is situated, but it can nevertheless be distinguished because its members are stars of certain definite and unusual properties. Thus Ambartsumian points to O-associations, composed almost entirely of O and early B-type stars, which are rich in multiple stars, star chains, and small groups similar to the Trapezium in Orion. And there are T-associations, composed of T Tauri or closely related variable stars, which are dwarfs and are usually in regions of nebulosity.

It is clear that in terms of the accepted astronomical time scale these associations must be relatively young, for a loose group of this kind has insufficient self-gravitation to hold together against galactic rotation and gravitational disturbances in general. Further, the typical stars of O-associations must be young, from general energy considerations. Ambartsumian stresses that not only must the stars be young; they must also have a common, recent, origin. He estimates that there are about 1 000 O-associations in the Galaxy and that in view of their short life a fresh association must be formed about once per 1 000 years. The importance of these ideas arises from their corollary, that O and B stars are formed in groups, and that the formation is not a matter for the remote past only; it is continuing now, almost before our eyes.

In the T-associations the stars are associated with nebulosity. Some astronomers think that the characteristic variations in the T-Tauri stars are due to collisions between stars and comparatively dense interstellar material. Ambartsumian does not agree: he suggests that the sudden

outbursts of radiation have a source within the star, and that possibly nuclear processes are involved, or even unknown physical processes.

Ambartsumian has made a special study of multiple stars of the type of the Orion Trapezium and has produced a catalogue of over 100 of these. Treating them as open clusters he has concluded that these groups must have an average age less than 2 million years. He has extended these ideas to multiple galaxies, adducing evidence that more than half of these are of the nature of trapezium systems. He urges the view that they cannot have been formed by capture but must have a common origin. Further, these groups are unstable and must be relatively young. He believes that close pairs which are strong radio sources are not in collision but are recently created pairs, not yet fully separated. The nature of some of the most recently identified radio source galaxies has given further support to this view. In other words galaxies too are still being formed today.

Ambartsumian has also been a leader in the teaching of astronomy. In 1934 he was one of the authors of a textbook of astrophysics and stellar astronomy, a collective work written by leading Russian astronomers, mostly members of the Pulkovo Observatory staff. In 1939 he published the first systematic text-book in the Russian language on theoretical astrophysics, based on his lectures at the University of Leningrad. In 1952 he was the editor and senior author of the book *Theoretical Astrophysics*, which in translations has found many appreciative readers in both German and English speaking countries.

It is well known that there has been a most remarkable growth in astronomy in the U.S.S.R. during the past fifteen years. We believe that much of the inspiration for this has come from Professor Ambartsumian himself. We offer him our Gold Medal as a token of our great appreciation of the importance of his work; and with it go our best wishes for his future work and for the future of Russian astronomy.

R. O. REDMAN