

## To Victor Ambartsumian on His 80th Birthday\*

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It is a privilege to join Academician Victor Ambartsumian's many friends and colleagues all over the world in congratulating him on his eightieth birthday and to express gratitude for a lifetime of efforts towards scientific ends. The only other astronomer of this century who compares with Academician Ambartsumian in his constancy and devotion to astronomy is Professor Jan Oort; but they would appear to be dissimilar in every other way. It will be a worthy theme for a historian of science of the twenty-first century to compare and contrast these two great men of science.

Academician Ambartsumian's realm does not divide astronomy and astrophysics into its conventional parts: theoretical and observational. He is an astronomer *par excellence*.

As one whose main interests during the past thirty or more years have been outside the mainstream of astronomy, the task of writing an essay encompassing all of Ambartsumian's wide range of accomplishments is outside the circumference of my comprehension. And since many others more conversant than I will be writing about him for this issue, perhaps I may recall some of Ambartsumian's discoveries which reveal the elegance and clarity of his ideas.

1. One of Ambartsumian's earliest papers was concerned with Zanstra's method of determining the temperature of the central star illuminating a planetary nebula. Here is Ambartsumian's formulation which led to a first treatment of the radiative equilibrium of a planetary nebula:

*There is a probability,  $p$  that an ultraviolet light quantum (that is a quantum beyond the head of the Lyman series) will be transformed into a Lyman-alpha quantum by the process of ionization and recombination followed by cascades: a simple statement that succinctly epitomizes Zanstra's idea.*

2. The 'blanketing' effect of absorption lines, in warming a stellar atmosphere, can be formulated in a first approximation by postulating that *in a given frequency interval there is a probability,  $p$ , that an absorption line will occur.* With such a formulation, the equations of radiative transfer governing thermodynamic equilibrium can be readily written down; and one obtains a satisfactory theory for the underlying phenomenon.

3. The formulation of the principles of invariance in the theory of radiative transfer: a theoretical innovation that is of the greatest significance. Many papers were contributed to a symposium on this topic at Byurakan in the fall of 1982; and in my contribution to that symposium I narrated the influence of Academician Ambartsumian's ideas on my own related work

4. Ambartsumian's marvelously elegant formulation of the fluctuations in brightness in the Milky Way: *in the limit of infinite optical depth, the probability*

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\* This is the text of Chandra's tribute to Ambartsumian on his 80th birthday, and has been reproduced from the *Astrophysics* (A translation of the *Astrophyzika*), January 1989.

*distribution of the fluctuations in the brightness of the Milky Way is invariant to the location of the observer.* In the related series of investigations, in part in association with Academician Markarian, Ambartsumian introduced for the first time the now commonly accepted notion that interstellar matter occurs in the form of clouds.

5. Ambartsumian's discovery of the role of the escape of stars from galactic clusters resulting from the relatively short times of relaxation is as simple as it is profound.

6. Ambartsumian's recognition of stellar association as a dynamical entity with far-reaching implications for subsequent theories relating to star formation. I recall the scepticism with which his ideas were received when I first gave an account of Ambartsumian's ideas at a colloquium at the Yerkes Observatory late in 1946.

It was about this time that my own interests began to diverge from astronomy. But I am aware of Ambartsumian's founding of the Byurakan Observatory in Armenia, of the extremely important work that continues to be carried out at the Observatory, including of course Markarian's brilliant work on the discovery and cataloging of galaxies known by his name; and of the discovery and of the prevalence of flare stars.

There can be no more than two or three astronomers in this century who can look back on a life so worthily devoted to the progress of astronomy. It is a privilege to have known him and to wish him the very best on his reaching his eightieth birthday.