

Mahendra Singh Vardya (1933–2013)

Mahendra Singh Vardya, a well-known astrophysicist, passed away on 20 January 2013 in Mumbai after a brief illness at the age of 80 years.

Among his many accomplishments, Vardya was internationally known for his fundamental contributions in the area of stellar atmospheres, which plays a crucial role in the overall structure of a star. For late-type main-sequence stars, the convection zone has to be represented by better models. This requires knowledge of various basic thermodynamic quantities for neutral and ionized gas. He developed computational techniques relating to various thermodynamic and statistical mechanical properties and functions.

Vardya was the first to construct hydrogen–helium adiabats with the inclusion of molecular hydrogen. Based on this work he calculated better models that were used in the study of the march of molecular abundances in late-type stars. These studies elucidated many earlier problems, and his results were widely used by others. He was the first to propose the idea of pressure dissociation and its importance. This affects the abundance of molecular hydrogen, and may be important in models of late-type main-sequence stars and in white dwarfs.

A problem known as missing solar opacity referred to the difference in observed flux in the Sun in the UV region compared to the calculated flux. Vardya proposed molecules to be the source of missing solar ultraviolet opacity. He also showed the importance of opacity arising out of negative ions. He was associated in a detailed study where the forbidden absorption nebular and auroral lines of oxygen were identified in the spectra of a large number of G and K stars, mostly giants and interpreted in terms of nucleosynthesis in the galaxy.

Vardya also contributed to several other research areas such as calculation of opacity cross-sections for ions and Rayleigh scattering cross-sections for He, C, N, interstellar grains with surface roughness, etc. As the foremost authority in the area of stellar atmosphere, he spent time at the University of California, Berkeley, with Henyey, an expert in the

area of stellar evolution. The group developed a highly complicated stellar evolution code, now widely known as Henyey's method, and Vardya's pioneering contributions to this project are well recognized.

In addition to his work on various aspects associated with stellar atmospheric physics, Vardya was also involved in a National Research Council, UK project to look for molecules in celestial objects with the IUE satellite. These observations led to the discovery of the circumstellar CO molecule around a hot Supergiant star.



Vardya was born on 22 February 1933 in Fatehpur (Uttar Pradesh). After his initial education, Vardya started his professional career with a B Sc in 1951 and M Sc in 1953 from Banaras Hindu University, Varanasi and a Ph D from the Yale University, USA in 1959. He worked closely with L. H. Aller at the University of Michigan and R. Wildt at the Yale University, who were stalwarts in the area of stellar atmospheres. He was then at the Physics Department, University of Delhi from 1960 to 1962.

After spending several years in USA at the University of California, Berkeley and the Joint Institute for Laboratory Astrophysics, Boulder, and also in The Netherlands at the University of Utrecht, Vardya joined the Tata Institute of Fundamental Research (TIFR), Mumbai in 1966 to start the Theoretical Astrophysics Group. At that time, TIFR was very active in the areas of radio and X-ray astronomy, and there was a need to develop a theoretical group to supplement the above experimental and observational

activities. Vardya took up this challenge, and in just a few years he was primarily responsible for building a growing group of young astrophysicists at TIFR, who were well-known experts in their own fields. His effort in building the Theoretical Astrophysics Group is highly credited, and the Group is well reputed in India and abroad.

As astronomy and astrophysics became a major activity and study in India over the subsequent years, Vardya played a key role in establishing the Astronomical Society of India (ASI). When the members of the Society later wanted to start a journal in astronomy and astrophysics, Vardya, on account of his vast experience, was entrusted with its development as the first editor. With his tireless effort, the *Bulletin of the Astronomical Society of India* came into existence and is now a well-recognized journal worldwide.

During his research career, Vardya was invited to visit various astronomical centres around the world for scientific interaction and collaboration. This included the time spent at the Goddard Space Flight Centre, NASA, Maryland, USA. He was elected a Fellow of the Indian Academy of Sciences, Bangalore (1972) and of the Royal Astronomical Society, London.

Vardya enjoyed deep affection and esteem from his colleagues. He was a kind-hearted and approachable person. His valuable advice was sought at every stage, both within and outside TIFR, on any aspect connected with astronomy and astrophysics. He also gave unselfishly his time and expertise to convey the excitement of astronomy and astrophysics to all those interested in the subject.

My close association with Vardya in various capacities covering a period of more than five decades have left me lasting memories. His helpful nature and jovial spirit will be greatly missed. He is survived by his wife, a son and a daughter.

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