# An accomplished astrophysicist

## Profile: Dr J P Dutta

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This is about nuclear astrophysics, and one of its accomplished practitioners, Prof Bhaskar Datta of the Institute of Astrophysics (IIA) in Koramangala, who passed away at an early age of fifty in Bangalore recently. An important part of astrophysics is the study of stars, which are very large objects by human standards.

Nuclear physics is the study of the tiny core of the atom.

Remarkably, these two subjects have a close connection. For example, the carbon atom, which is part of all our bodies, has six negatively charged electrons moving around the nucleus, with six protons each carrying one unit of positive charge, and six neutrons which carry no charge. These twelve particles are packed into an

incredibly small volume.

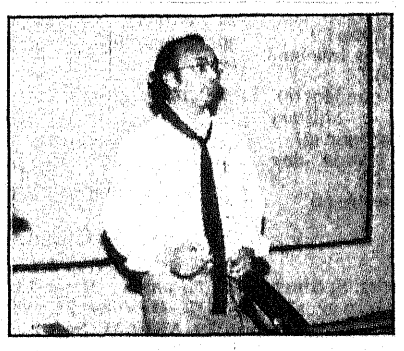
To try and imagine this, start with a table tennis ball, which is three centimetres in size, At each step, reduce its diameter tenfold. At the eighth step, you have the size of the electron orbits in an atom, which is approximately 0.00000003 centimetres. At the thirteenth step, you have the size of a nucleus, 0.0000000000003 centimetres. Clearly the atom is much larger than the nucleus. and in ordinary chemical reactions, between atoms, like the burning of coal, the nucleus is hardly involved.

But in the centre of the sun and other stars, the electrons are stripped off by the high temperatures and occasionally, the nuclei come into contact. i.e undergo fusion, which is an example of a nuclear reaction.

From the point of view of a single pair of nuclei, this sticking together is a very rare process. From our earlier discussion, the space occupied by the matter in this form would be five powers of ten (i.e one lakh times) smaller than in the form of atoms. A mass equivalent to our Sun would fit into a ball as big as Bangalore.

It was largely with the physics and astrophysics of such objects that Bhaskar Datta worked during his seventeen years - 1982 to 1999 - in Bangalore. The University of Delhi where he studied for his bachelors and masters degrees, has a strong tradition of research and teaching in nuclear and particle physics, and its alumni are all over the world.

Bhaskar was one of those who came back, after spending time at the City University of New York, the NASA Goddard Institute for Space Studies, University of Florida in the US and NORDITA, Copehagen in Sweden, among other places. On his return, he was first at the Tata Institute of



Fundamental Research in Mumbai and then at IIA, Bangalore.

His expertise in two technically demanding fields, nuclear physics and Einstein's theory of gravitation enabled him to analyse many interesting problems. For example, since the density in a neutron star is greater than in an atomic nucleus, laboratory experiments are only a partial guide to the pressures that the neutrons exert on each other in such a star. Some of his work used the stars themselves to look into this unexplored range of densities.

For example, one neutron star was found in 1982 spinning six hundred and thirty two times a second(!!!).

Bhaskar was recognised with the fellowship of the Indian Academy of sciences five years ago. He received the Biren Roy trust Golden Jubilee fellowship from the Indian National Science Academy in 1984. He was active research and teaching till his untimely death. In the twin communities of nuclear/ particle physics and astrophysics, his work as well as the style in which he worked has earned the respect and affection of all his colleagues. He will be sorely missed.

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