THE LIMITS OF INTELLECT©

Down to Earth, July 15, 1993.

"Chandrasekhar and his Limit", by G.Venkatraman, Universities Press, 1992, Rs. 35/-.

In January 1935, the monthly meeting of the Royal Astronomical Society in London was unusually acrimonious. A young researcher from India, Subrahmanyam Chandrasekhar had presented a paper, proposing a revolutionary theory regarding the fate of certain kinds of stars. The preeminent astrophysicist of the time, Sir Arthur Eddington had not only tried to disprove the theory but had joked about the young Indian and ridiculed him. At that moment, given Eddington's position in the scientific community, not many took Chandrasekhar's theory seriously, but as is often the case, history proved that Chandra (as he is universally known in the scientific community) was correct.

The short book under review is a semi-popular account of this theory which is meant for the serious and interested student. Starting with a short biographical sketch of Chandra, the author takes the reader through the whole gamut of topics which are of relevance to an understanding of the Chandrasekhar limit.

Though humankind has been fascinated by stars since recorded history, it is only recently that we have started to understand some of the basic mechanisms which make the stars shine. Big blobs of hydrogen gas somehow come together and start contracting. In the process the inner part gets compressed and heated up to phenomenal temperatures, enough for the hydrogen atoms to come together and fuse into helium. This nuclear fusion (the same process which is operative in thermonuclear weapons) releases an enormous amount of energy which stabilizes the star's collapse against gravity. These kinds of stars are called the Main Sequence stars and our Sun is an example of it.

This process continues till all the hydrogen "burns up". Then another stage of contraction, followed by a stage of helium burning and so on till we have only iron left in the core of the star. Thermonuclear burning is then no longer possible and now the star is "dead". What happens to a star when it reaches this stage? This is the question which Chandra addressed. There are a number of scenarios possible, depending upon a lot of factors like the mass and composition of the star. Using a beautiful and elegant synthesis of the theory of relativity

and quantum mechanics, he was able to show that there exists a maximum amount of mass which is allowed if the star (called a white dwarf) has to stabilize itself against the inevitable gravitational collapse. This mass, which is about 1.4 times the mass of our sun, is now famous as the Chandrasekhar limit.

The book discusses a lot of background material required for an understanding of this important result in astrophysics. From stellar physics to thermodynamics, from quantum statistics to white dwarfs, the author has to talk about a lot of things to make the result comprehensible. The result is an almost too brief a discussion of all the important concepts; too brief and sketchy for a beginning reader to learn and follow and superfluous for the specialist. The style is "chatty" and this can get annoying at times. There are some very interesting historical boxes as well as good illustrations. The book is short on biographical details of Chandra, but then those are adequately covered in Kameshwar Wali's comprehensive biography, "Chandra".

Chandrasekhar is undoubtedly one of the finest minds of our present century. His rigour of scholarship, the sheer breadth and range of his work is astounding. Even today, at 83, he is still as active as ever. This short book, though somewhat out of reach of the interested lay reader, should certainly be read by all students of science for an inspiring account of the work done by one of our greatest scientists.