

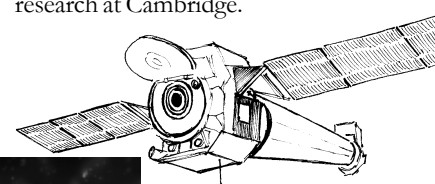
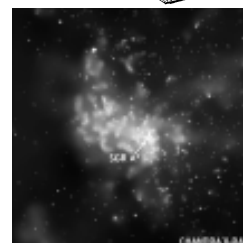
Subrahmanyan Chandrasekhar

(1910 – 1995)

$$M = 0.197 \rho \omega^{-3/2} \left[\frac{h c}{G} \right]^{3/2} \frac{1}{(\mu H)^2} = 6.65 \mu^{-2} = \mathcal{M}$$

The twentieth century witnessed many scientists who revolutionised our understanding of nature. Dr. S. Chandrasekhar, an Indian-born scientist was one such luminary. His contributions to our understanding of physics, astrophysics and applied mathematics were legendary.

Chandrasekhar was born on 19 October 1910 in Lahore (now in Pakistan). He was the son of Sri C. Subrahmanya Iyer, brother of India's first science Nobel Laureate Sir C.V. Raman. Sri Iyer, who worked as an Accountant General for the Indian Railways, had a keen interest in music. Chandra was home schooled until the age of 11. He then joined the Hindu High School in Madras and went on to study BA in Physics at the Presidency College, Madras. He was an outstanding student and destined for great things. At the age of 18 he published his first scientific paper *Compton scattering and the new statistics* in the *Proceedings of the Royal Society*. Before completing his undergraduate studies he had published two more papers in the *Philosophical Magazine*. Because of his brilliance he received a Government of India scholarship to do research at Cambridge.





Cartoon by Gopi Gajwani,
Courtesy IUCAA library

During the ship journey to England, Chandra gave serious thought to an astronomical problem. How does a star (such as our sun - a medium-sized star) finally end? After several years of extensive work he concluded that stars smaller than 1.44 times the solar mass ended up as *White Dwarfs*. This limit of 1.44 times the solar mass has got entrenched in astrophysics as the famous *Chandrasekhar Limit*.

During 1930-36, Chandra worked on this problem at the Cambridge University under Prof. Ralph H. Fowler. In 1933 he obtained his PhD and was elected a Fellow of Trinity College. In

1935 he was invited to present his results by the Royal Astronomical Society. Here he ran into unexpected trouble. Sir Arthur Eddington, the world famous astronomer not only severely criticised Chandra's conclusions but even ridiculed it. Chandra, taken aback by the fierce attack, defended his theory strongly. However, after several years, practical observations settled the issue in Chandra's favour. Eddington's egg-headedness slowed the progress of astronomy by at least two decades!

In July 1936 Chandra married his neighbour Lalitha. It was not an arranged marriage. Lalitha was a graduate and worked as a school head-mistress.

In 1937 Chandra joined the University of Chicago and was posted to its Yerkes Laboratory. He soon rose to become a Professor in 1944. In the early 1950's he became more closely associated with the main University at Chicago. In 1953 he and his wife became American citizens.

Chandra's devotion to his students was legendary, akin to the *guru-shishya* tradition of India. In 1946, he used to drive, once a week, a distance of 250 kilometres from his observatory to Chicago to teach a class of just two students! But he knew exactly what he was doing. These two American-Chinese students Lee and Yang later won the Nobel Prize for Physics in 1957.

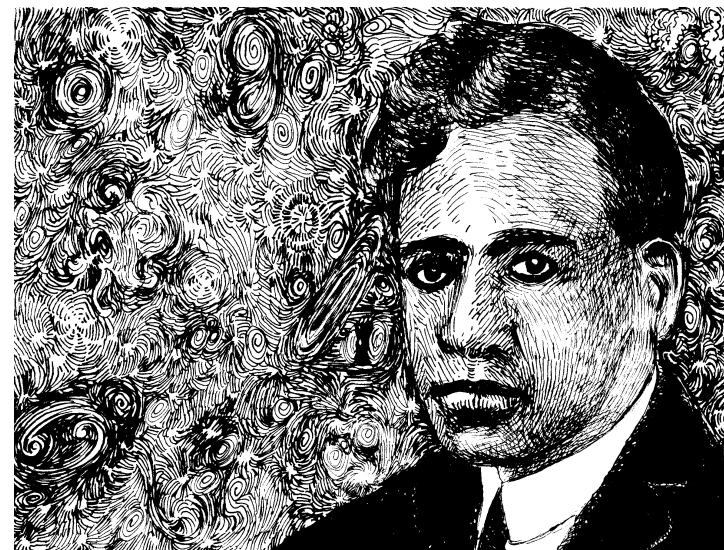
Chandrasekhar's working methodology was unique. He felt that the mind dulled if one continued to work in the same narrow field year after year. So, every decade or so he would venture into something totally new, focus all his energies, master it, make original contributions and sum up his research into one definitive book. Marvin Goldberger said, "*He would produce an infinite series of papers followed by an infinitely thick book on the subject.*" And then he would

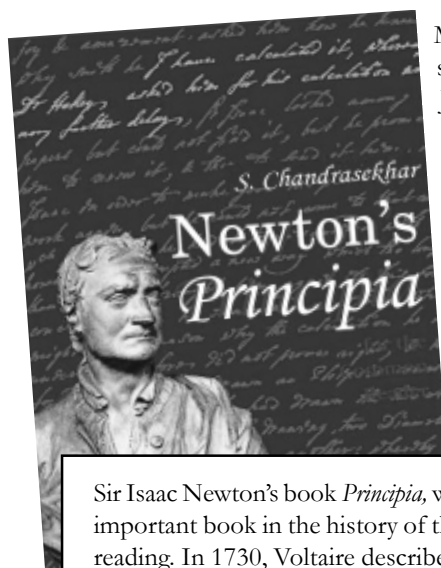
move to another field. Until his very end he frequently switched subjects but made original contributions to every single field he chose to study. He believed in systematic hard work.

Many great scientists become victims of their own success by succumbing to positions of power. Chandra on the other hand rejuvenated himself constantly in the company of young scientists. He was happiest when problems took on their own momentum and one problem generated another. In the end he felt obligated, almost compelled to solve them.

First he worked on *Stellar Dynamics* – which deals with the evolution of galaxies. In the 1940's he moved to *Radiative Transfer* – dealing with the passage of radiation through a star's atmosphere. In the 1950's he worked on *Hydrodynamic Stability* – the study of turbulence - which is an extremely complicated natural phenomenon. In the 1960's sophisticated telescopes led to exciting discoveries of pulsars and quasars. This observed phenomenon needed a theoretical explanation. He used the General Theory of Relativity to study Black Holes and summarised it in his classic book, *The Mathematical Theory of Black Holes*, published in 1983. He continued to work on this subject till his death on 21 August 1995.

Though Chandra lived most of his life abroad, India was always on his mind. Ramanujan – the great Indian mathematician - was Chandra's role model for a life dedicated to science. He helped in founding the Ramanujan Institute of





Sir Isaac Newton's book *Principia*, written in 1687, is regarded as the most important book in the history of the physical sciences. But it is not easy reading. In 1730, Voltaire described the book as incomprehensible and obscure. Chandra derived the important results of the *Principia* by modern techniques. He conceded, however that Newton's methods were aesthetically better.

Chandra's books and monographs have all become classics. In addition to their thoroughness, lucidity and accuracy they have a highly personal and distinctive style.

Chandra had an abiding interest in music and literature and had lapped up the works of all the great Russian masters – Dostoevsky, Turgenev, Tolstoy and Chekov. Hardy, Ibsen, Shaw and Shakespeare were his favourite writers. He lectured frequently on the relationship between the arts and the sciences, and expounded on this at length in his book *Truth and Beauty: Aesthetics and Motivations in Science*.

While other illustrious scientists' work might have had greater impact, Chandra stands alone in a broader perspective of a life devoted to science. As a mark of respect, the most sophisticated X-ray observatory to date launched by NASA in 1999, was fittingly named **Chandra** to immortalise this luminary.

Mathematics in Madras. He also helped secure a pension for Ramanujan's wife Janaki who was languishing in poverty.

Such total dedication naturally brought its rewards in results and recognition. He was elected a Fellow of the Royal Society of London in 1944, awarded the National Science Medal of the United States in 1966, the Padma Vibhushan from the Government of India in 1968 and to crown it all the Nobel Prize for Physics in 1983.

