

# THE EVOLVING STAR

## SUBRAHMANYAN CHANDRASEKHAR [1910-1995]

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BIG HISTORY PROJECT | Art by Kay Sohini

HIGH  
MASS STARS

LOW  
MASS STARS

As a child in British India, Subrahmanyan Chandrasekhar —“Chandra” for short —had limitless curiosity. He published his first scientific paper at 19. In 1930, he sailed to England to get his PhD in physics at Cambridge. **WHILE SAILING, CHANDRA STARED INTO THE NIGHT SKY AND WONDERED HOW STARS DIED.**

In 1930, astrophysicists believed that all stars ended their lives as white dwarfs. Chandra calculated that only stars of a certain mass would become white dwarfs. Stars with higher mass collapsed into incredible density. **THIS WAS LATER CALLED THE CHANDRASEKHAR LIMIT.**

$$M_{\text{limit}} = \frac{\omega_3^0 \sqrt{3\pi}}{2} \left( \frac{\hbar c}{G} \right)^{3/2} \frac{1}{(\mu_e m_H)^2}$$

When he first presented his ideas to the Royal Astronomical Society in 1935, Chandra was ridiculed by his mentor, astrophysicist Sir Arthur Eddington.

Chandrasekhar—  
“A star of large mass cannot pass into the white dwarf stage, and one is left speculating on other possibilities.”

Eddington—  
“Stellar buffoonery!...I think there should be a law of Nature to prevent a star from behaving in this absurd way!”

The next year, Chandra married and moved to the University of Chicago. An Indian immigrant, he faced prejudice in America, but he continued his scientific work, developing more theories of how stars behave.

“My motivation has not been to solve a single problem but instead to acquire a perspective of an entire area. . . If you make a sculpture, you finish it— you don’t want to go on chipping it here and there.”

Decades later, astrophysicists finally accepted the Chandrasekhar limit, which predicted the destiny of stars: with mass below the limit, they faded into a white dwarf; above the limit, they imploded spectacularly into either a black hole or a neutron star.

**CHANDRA WON THE NOBEL PRIZE IN 1983.**

“The kinds of truth which underlie nature transcend the most powerful minds. . . a certain modesty toward understanding nature is a precondition to the continued pursuit of science.”

In later life, he was grateful for the challenges of the 1930s. They pushed him to explore other scientific domains including general relativity and black holes. We owe our knowledge of the life—and death—of stars to Chandra’s math.

MAIN SEQUENCE

MAIN SEQUENCE

GIANT / SUPERGIANT

RED GIANT

PLANETARY NEBULA

SUPERNOVA

WHITE DWARF

BLACK HOLE

BLACK DWARF

NEUTRON STAR