Lecture 12 : Life History of Stars II
Intermediate Mass Stars

The Pleiades, seen above, is an open star cluster in the constellation of Taurus. The existence of 7-8 solar mass stars in main sequence, as observed in the Pleiades, provides a vital clue to the life-history of intermediate-mass stars.

The evolution of intermediate-mass stars, with masses between three to ten solar mass, is very different from the life history of low mass stars. These have lifetimes that range between 50 million and 20 billion years and nuclear reactions in them likely make most of the carbon and nitrogen in the universe.

In these stars, there is no 'safety valve' to prevent a catastrophic explosion when carbon, the result of helium fusion, becomes hot enough to fuse. Therefore, when intermediate-mass stars die, they blow off their atmospheres, dispersing large amounts of carbon and oxygen into space. Recent observations (like that of the Pleiades), however, compel us to believe that these stars somehow save themselves from this final catastrophe and find peace as Carbon-Oxygen White dwarfs.

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Suggested Problems

1. Calculate the escape velocity of a self-gravitating object (a low-mass star in Supergiant phase, to be precise) with a mass equal to that of the Sun and a radius 300 times the radius of the Sun.
2. The temperature sensitivity of the Carbon burning is far steeper than that of Hydrogen burning. Explain why that should be so.
3. In order for Carbon detonation to take place, what should be the minimum density of the inert Carbon-Oxygen core of a star?
4. Show (mathematically) why a star goes into a **Red** (Super)Giant phase at the end of each burning phase in the core.
5. Explain the Hertzsprung gap seen in the H-R diagram.
6. Deneb and Betelgeuse both have mass equal to 20 times that of the Sun, but look very different. Deneb has 100 times the radius of the Sun and its temperature is about 8000 K. Betelgeuse has 1000 times the radius of the Sun and its temperature is about 3500 K. What stages of their lives are the two stars in?

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