

Dark Stars: the First Stars Powered by Dark Matter

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Title: Dark Stars

Abstract: The first phase of stellar evolution in the history of the Universe may be Dark Stars (DS), powered by dark matter heating rather than by nuclear fusion. Weakly Interacting Massive Particles which can be their own antipartners can collect inside the first stars and annihilate to produce a heat source that powers the stars. Alternatively, Self Interacting Dark Matter can also heat the star. A new stellar phase results, a Dark Star, which lasts as long as there is dark matter fuel, with lifetimes from millions to billions of years. Dark Stars, while made primarily of hydrogen and helium, are powered by dark matter. They are very bright diffuse puffy objects and grow to be very massive. In fact, they can grow up to ten million solar masses with up to ten billion solar luminosities. Such objects can be seen in James Webb Space Telescope. Once the dark matter fuel is exhausted, the DS becomes a heavy main sequence star and eventually collapses to form massive black holes that may provide seeds for supermassive black holes observed at early times as well as in galaxies today. We have studied pulsations of Dark Stars as an interesting observable.

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