

Dark Stars in JWST and Roman Space Telescope

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Dark Stars are stellar objects made (almost entirely) of hydrogen and helium, but powered by the heat from Dark Matter annihilation, rather than by fusion. They are in hydrostatic and thermal equilibrium, but with an unusual power source. The relevant types of dark matter for heating the stars include Weakly Interacting Massive Particles (WIMPs), and Self Interacting Dark Matter (SIDM). Although dark matter constitutes only $\sim 0.1\%$ of the stellar mass, this amount is sufficient to power the star for millions to billions of years. Thus, the first phase of stellar evolution in the history of the Universe may have been dark stars. Starting from their inception at $\sim 1M_\odot$ they accrete mass from their surroundings to become supermassive stars, some even reaching masses $>10^6 M_\odot$ and luminosities $>10^{10} L_\odot$, making them detectable with the James Webb Space Telescope and upcoming Roman Space Telescope. Once the dark matter runs out and the dark star dies, it may collapse to a black hole; thus dark stars may provide seeds for the supermassive black holes observed throughout the Universe and at early times.

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