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Analyzing High-Redshift Galaxy Candidates as Supermassive Dark Star Candidates with JWST Data

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The nature of the first stars in the universe is, of yet, an unresolved problem in cosmology. One theoretical model is supermassive dark stars (SMDS), which would be powered predominantly by dark matter annihilation. The launch of JWST has led to the discovery of many high-redshift galaxy candidates. This presents a dilemma: present cosmological simulations predict a much smaller number of very massive galaxies than we are now observing from JWST. We present a possible solution to this dilemma: that some of these galaxy candidates may actually be supermassive dark star candidates. We compare JWST photometric data for unresolved or poorly resolved high redshift galaxy candidates, including GLASS-z12, JADES-GS-z10, and JADES-GS-z13, with spectral energy distributions from model SMDS and find that SMDS models can better represent observational data in comparison to current Lyman-break galaxy models. To definitively distinguish SMDS from galaxies, we will need to analyze spectroscopic data and look for a He-II feature at 1640 angstroms. In SMDS, this will be an absorption feature, whereas in Population III galaxies this will be an emission feature.

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