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A Systematic Census of Strongly Lensed Population III Galaxy Candidates at $z \sim 6-7$ from JWST VENUS and MUSE

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The first generation of stars, Population III (Pop III), likely played a fundamental role in the formation and evolution of early galaxies. Recent JWST observations have opened a new window for systematically identifying Pop III signatures at high redshift ($z \approx 3-6$), during the universe's first few billion years, including strong hydrogen emission and weak or absent metal lines such as [O III], and have revealed a small but growing candidate sample. We conduct a systematic search for extremely metal-poor, Pop III-like galaxies at $z \sim 6-7$ using JWST/NIRCam imaging from the VENUS survey, the largest lensing-cluster program to date. Combining this data with deep MUSE spectroscopy, we search for strongly lensed Pop III candidates whose light is magnified by foreground galaxy clusters. Our search yields two candidates with spectroscopic redshifts that satisfy our selection criteria, including a highly magnified ($\mu \sim 28$), otherwise inaccessible, intrinsically ultra-faint galaxy ($M_{UV} = -15.3$) at $z = 5.72$. This source exhibits strong, spatially extended Ly α emission, an extreme H α equivalent width (~ 2920 Å), a prominent Balmer jump, and no detectable [O III] in current data—textbook signatures of a young, metal-poor stellar population consistent with Pop III-like systems. MUSE observations reveal multiple Ly α emitters at the same redshift in the field, suggesting that the local environment may help sustain such systems even at $z = 5.7$. We present the source-plane properties of these candidates, their environments, and constraints on the number density of Pop III-like galaxies at $z \sim 6-7$.

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Yes

What is your career level?

Undergraduate

Which keyword describes the area of focus of this talk?

Galaxies

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