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Direct Constraints on Strongly Interacting Dark Matter from the James Webb Space Telescope

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Direct-detection searches for dark matter are insensitive to dark matter particles that have large interactions with ordinary matter, which are stopped in the atmosphere or the Earth’s crust before reaching terrestrial detectors. We use “dark” calibration images taken with the HgCdTe detectors in the near-infrared spectrograph (NIRSpec) on the James Webb Space Telescope (JWST) to derive novel constraints on sub-GeV dark matter candidates that scatter off electrons. We supplement the JWST analysis pipeline with additional masks to remove pixels with high-energy background events. For a 0.4% subcomponent of dark matter that interacts with an ultralight dark photon, we disfavor all previously allowed parameter space at high cross sections, and constrain some parameter regions for subcomponent fractions as low as ~0.01%.

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