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Temporal changes in the infrared molecular spectrum of a Magellanic carbon star

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The mid-infrared spectrum of a carbon star in the Large Magellanic Cloud (LMC) has changed substantially between a recent observation with the Medium-Resolution Spectrometer (MRS) on the Mid-Infrared Instrument aboard JWST and a spectrum obtained over 18 years ago with the Infrared Spectrograph on the Spitzer Space Telescope. The JWST observation is part of a program to capitalize on the spectral resolution of the MRS to study the molecular absorption bands in nine carbon stars in the LMC. The sample spans a range of colors and includes relatively dust-free semi-regular variables and more dust-enshrouded Mira variables. The two spectra obtained so far straddle the boundary between these two groups, and the semi-regular variable looks much as it did when observed with Spitzer. In the Mira, however, the acetylene band at 7.5 um has nearly vanished, the CO at 5 um is weaker, and a new band stretching from 8.5 to 11.5 um has appeared. We have not yet identified this band (at the time we submitted this abstract), but it is real. The overall brightness of the star in the mid-infrared remains approximately the same. This change raises a host of questions about the evolution of carbon stars and underscores the importance of spectroscopic monitoring to better understand their behavior over time scales of decades.

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