**Title:** The Search for Failed Supernovae with JWST’s Mid-Infrared Instrument

**Abstract:**

Since the deaths of the first stars, core-collapse supernovae (SNe) have shaped the elemental and structural history of the universe. Typical core-collapse (type II) SNe are the result of gravitational core collapse in red supergiants, the final evolutionary stage of stars with masses greater than 8 MꙨ. Despite this, no type II SN with a progenitor mass greater than ~18 MꙨ has been observed. The absence of high mass progenitors suggests that massive red supergiants end their lives as failed SNe, collapsing directly into black holes. Ongoing searches for failed SNe have uncovered a few potential candidates. However, no confirmed case of a failed SN exists. Current failed SNe candidates may only appear to vanish, shrouded by gas too cold to probe with pre-JWST instruments. We propose to image failed SNe candidates with the F1500w filter of JWST’s Mid-Infrared Instrument (MIRI). MIRI observations in F1500w are unique in their ability to directly probe the 10-20 μm region essential for detecting stars inside cold dust clouds, i.e. failed SNe imposters. These critical observations will verify the existence of failed SNe and constrain the properties of the stars that impersonate them. Understanding the nature of failed SNe imposters will enable strong observational constraints on the frequency of failed SNe and on the expected results of JWST’s search for the first stars.