

# Evidence for sub-Chandrasekhar Type Ia supernovae from the last major merger

Thursday, October 21, 2021 10:15 AM (15 minutes)

We investigate the contribution of sub-Chandrasekhar mass Type Ia supernovae to the chemical enrichment of the Gaia Sausage galaxy, the progenitor of a significant merger event in the early life of the Milky Way. Using a combination of data from Nissen & Schuster (2010), the 3rd GALAH data release (with 1D NLTE abundance corrections) and APOGEE data release 16, we fit analytic chemical evolution models to a 9-dimensional chemical abundance space (Fe, Mg, Si, Ca, Cr, Mn, Ni, Cu, Zn) in particular focusing on the iron-peak elements, Mn and Ni. We find that low  $[\text{Mn}/\text{Fe}] \sim -0.15$  dex and low  $[\text{Ni}/\text{Fe}] \sim -0.3$  dex Type Ia yields are required to explain the observed trends beyond the  $[\alpha/\text{Fe}]$  knee of the Gaia *Sausage* (approximately at  $[\text{Fe}/\text{H}] = -1.4$  dex). Comparison to theoretical yield calculations indicates a significant contribution from sub-Chandrasekhar mass Type Ia supernovae in this system (from  $\sim 60\%$  to  $100\%$  depending on the theoretical model with an additional  $\pm 10\%$  systematic from NLTE corrections). We compare to results from other Local Group environments including dwarf spheroidal galaxies, the Magellanic Clouds and the Milky Way's bulge, finding the Type Ia  $[\text{Mn}/\text{Fe}]$  yield must be metallicity-dependent.

Our results suggest that sub-Chandrasekhar mass channels are a significant, perhaps even dominant, contribution to Type Ia supernovae in metal-poor systems, whilst more metal-rich systems could be explained by metallicity-dependent sub-Chandrasekhar mass yields, possibly with additional progenitor mass variation related to star formation history, or an increased contribution from Chandrasekhar mass channels at higher metallicity.

## Type

contributed talk

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