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

*Thursday, 21 October 2021 10:15 (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 [Mn/Fe] $\sim -0.15\,\mathrm{dex}$ and low [Ni/Fe] $\sim -0.3\,\mathrm{dex}$ Type Ia yields are required to explain the observed trends beyond the [$\alpha$/Fe] knee of the Gaia \emph{Sausage} (approximately at [Fe/H] $= -1.4\,\mathrm{dex}$). 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 [Mn/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

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