

"Emission from Pair Instability Supernovae with Rotation"

abstract:

"Pair Instability Supernovae have been suggested as candidates for some Super Luminous Supernovae, like SN 2007bi, and as one of the dominant types of explosion occurring in the early Universe from massive, zero-metallicity Population III stars. The progenitors of such events can be rapidly rotating therefore exhibiting different evolutionary properties due to the effects of rotationally-induced mixing and mass-loss. Proper identification of such events requires rigorous radiation hydrodynamics and radiative transfer calculations that capture not only the behavior of the light curve but also the spectral evolution of these events. We present radiation hydrodynamics and local thermal equilibrium radiation transport calculations for 90-300 Msun rotating pair-instability supernovae covering both the shock break-out and late light curve phases. We also investigate cases of different ZAMS metallicity and rotation rate to determine the impact of these parameters to the detailed spectral characteristics of these events. We find that for a variety of progenitor masses, rotating pair instability supernovae are red in color in contrast with the observations of super-luminous supernovae and neither seem to match any other observed events also in terms of spectroscopic properties. Our models are in good agreement with models of non-rotating PISN discussed in the literature despite the different radiative transfer codes used. We also find that the ZAMS metallicity and rotation properties of the progenitor are erased after the explosion and cannot be identified in the resulting model spectra. We determine that the combined effects of pre-SN mass-loss and SN ejecta temperature and velocity have the most direct impact in spectra of PISNe."

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