N09a SN 2022crv: Bridging the gap between SN IIb and SN Ib classes

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Stripped envelope supernovae (SNe) are a sub-class of core-collapse SNe that strip off their outer Hydrogen/Helium envelope either due to strong stellar winds or due to accretion with a nearby binary companion. We present a peculiar case of SN 2022crv, which showed H features initially typical of a SN IIb and transitioned quickly to a SN Ib. We carried out long term observing campaign of the SN from Japan and Indian telescopes. The transition is shown by the equivalent width of Hα which diminishes significantly from pre-maximum to post-maximum phase increasing in He strength. The spectral modelling well-reproduces the 6200 Å dip with a combination of Hα and Si. The photometric analytical light curve modeling of the bolometric light curve helps to infer a thin outer H envelope of mass 0.015 $M_\odot$ and a compact progenitor of $R_{env} \sim 4$ $R_\odot$. The radio synchroton self absorption model shows that the shock radius, mean shock velocity and magnetic field varies as $1.07 - 1.79 \times 10^{16}$ cm, 0.1c, and 0.87–0.53 G respectively, at the peak phase. The mass-loss rate is derived to be $(2-3) \times 10^{-5}$ $M_\odot$ yr^{-1} (at v_w=1000 km sec^{-1}) as compared with other compact SNe IIb/Ib. The radio-optical progenitor space indicates a very compact progenitor with a high CSM density and thus, a high mass-loss rate. SN 2022crv, thus, provides a continuity between the compact and extended progenitor scenario of SNe IIb/Ib.