K20a Radio Emission from Embryonic Super-Luminous Supernova Remnants

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A central engine, like a fast spinning newborn pulsar, is thought to power the extremely rare Type-I superluminous supernovae (SLSN). Quasi-thermal optical supernova emission can not differentiate between different engines, but there may be non-thermal emission unique to a pulsar engine. Young NSs and magnetars are also candidate progenitors for long Gamma-Ray Bursts, type Ibc supernovae, and the recently discovered fast radio bursts (FRBs), and the recent localization of the source for the repeating FRB 121102 with a host galaxy similar to observed SLSN hosts motivates follow-up observations of candidates for pulsar-driven supernovae, for which SLSN are among the most interesting. We gathered suitable optical SLSN data from six supernovae that we fit with a NS-driven model to obtain possible NS parameters. We then calculated radio light curves while varying observed frequency, absorption, and NS parameters to understand the full range of possible emission. We then compare the calculated fluxes to previous observational limits from VLA and ALMA to determine the feasibility of observational follow-up. We found that at 1 GHz, two to five supernovae would be detectable on a timescale of $\sim$ 10-30 years. These supernovae also show emission broadly consistent with the persistent source of FRB 121102. In the 100 GHz band, three to six supernovae are detectable on a timescale of $\sim$ 1-3 years. With this, we show that ALMA detection of NS-driven SLSN non-thermal emission is feasible.