W23a Synchrotron Boilers in Embryonic Neutron-Star Wind Nebulae

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The rotation and magnetic energy of fast-spinning strongly-magnetized newborn neutron stars are a promising energy source of energetic transients including gamma-ray bursts, hypernovae, super-luminous supernovae (SLSNe), and fast radio bursts (FRBs). In general, these energies are extracted by a relativistic wind, shocking into the surrounding ejecta to form a wind nebula, which can be a smoking gun of the neutron-star central engines. Here we focus on the radio and submm emission from such a wind nebula with an age less than ~ 100 year. We calculate how the emission spectrum evolve with time depending on the history of injection, heating, and cooling of the parent electrons/positrons in the nebula. In particular, we clarify the importance of the synchrotron self-absorption heating or the so-called synchrotron boiler mechanism. We apply the model to the radio counterparts of SLSN PTF10hgi and FRB 121102, and discuss the implications.