

Observational appearance of supernova shock interaction with neutron star magnetosphere: A model for millisecond extra-galactic radio burst

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We propose a possible physical model for a millisecond extra-galactic radio burst (Lorimer et al. 2007) based on the interaction of a supernova (SN) shock with a neutron star (NS) magnetosphere in a binary system. The shocked NS magnetosphere relaxes through magnetic reconnection in a cylindrical current sheet, where particles can be accelerated to relativistic energies. If the NS magnetosphere was filled with pair plasma before the explosion, the beam instability can be induced by accelerated positrons, resulting in the conversion of the beam kinetic energy into plasma oscillations. Electromagnetic radio waves with steep spectrum can thus be formed (like in pulsars). This mechanism can explain the observed properties of the enigmatic millisecond radio burst serendipitously discovered by Lorimer et al. in 2001.