PROGENITORS OF THE LOCAL PULSARS; LOWER MASS LIMIT AND BEAMING FACTOR

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Following up on an earlier paper on the local pulsar population (Blaauw 1985; Paper I), in which it was shown that the majority of their progenitors must be sought among the local field stars between 6 and 10 solar masses (types B2, B3) - the local OB associations accounting for a minority only of the pulsar population - we consider implications of two further restrictions: raising the lower limiting mass for neutron star formation, M_n, above 6 solar masses, and raising the beaming factor, f, above 0.3.

For the estimated local production of observed pulsars we use the number of paper I, 33 pulsars per kpc^2 per 4.6 Myrs. Hence for values of f of 1.0, 0.5, and 0.3 the true number should be 33, 66 and 110, respectively.

Of the 17 (subgroups) of OB associations within 1 kpc, 14 are younger than 16 Myrs (see paper I), hence should still contain stars of 12 solar masses and below; their contribution per kpc^2 per 4.6 Myrs is estimated to be about 9 neutron stars. The three older subgroups currently convert stars around 8 solar masses at the rate of not more than about 6 per kpc^2 per 4.6 Myrs. Hence, for f = 1.0, at least some 18 pulsars per kpc^2 per 4.6 Myrs must originate from the local field stars, and some 50 and 95 for f = 0.5 and 0.3, respectively.

Assuming the field star population, estimated at 350 stars exceeding 6 solar masses within 500 pc (paper I), to have been formed at uniform rate between 50 and 20 million years ago, we estimate by means of the Evaporation Function E(t) (paper I) the number of neutron stars formed over the last 4.6 Myrs per kpc^2 as a function of M_n. For M_n = 8.0 solar masses, the total yield, 24 neutron stars, is about the same as the required production for f = 0.8. For M_n = 7.0 solar masses it is about 39, allowing f about 0.6, whereas for M_n = 6.0 the yield, 73, allows f as low as 0.37.

More stringent specifications for M_n and f than the above rather crude estimates should be possible by means of a more precise inventory of the evolutionary status of the local B star population.

REFERENCE: Blaauw, A. 1985, Birth and Evolution of Massive Stars and Stellar Groups, ed. E. Boland and H. van Woerden, p. 211-224 (Paper I).

D. J. Helfand and J.-H. Huang (eds.), The Origin and Evolution of Neutron Stars, 48.