

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

A Blaauw
Kapteyn Astronomical Institute
Groningen, The Netherlands

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).