

High-velocity neutron stars as the remnants of high-velocity runaway stars

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We propose an explanation for the origin of high-velocity neutron stars based on the hypothesis that they could be the remnants of a symmetric supernova explosion of a high-velocity massive star (or its stripped helium core) which attained its peculiar velocity (similar to that of the neutron star) in the course of a strong dynamical three- or four-body encounter in the core of a young massive stellar cluster. To check this hypothesis, we investigated four dynamical processes involving close encounters between: (i) two hard massive binaries, (ii) a hard binary and a very massive star, (iii) a hard binary and an intermediate-mass black hole and (iv) a single star and a hard binary intermediate-mass black hole. We argue that dynamical processes in the cores of star clusters can contribute to the origin of pulsar velocities in addition to asymmetric supernova explosions and disruption of binaries following supernova explosions.