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## Evolutionary Links Between the Isolated Neutron Star Populations

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We have investigated the evolutionary links between the isolated neutron star populations namely radio pulsars (RPs), anomalous X-ray pulsars (AXPs), soft gamma repeaters (SGRs), dim isolated neutron stars (XDINs), high-magnetic-field RPs (HBRPs), central compact objects (CCOs), rotating radio transients (RRATs), and long-period pulsars (LPPs) in the fallback disc model. The results of our simulations can be summarized as follows: (1) These diverse populations emerge as a natural outcome of their evolutions with different initial conditions (initial period, disc mass, and the magnetic dipole moment). (2) Each population has evolutionary connections with at least one other population. (3) HBRPs with relatively strong magnetic dipole moments evolve into AXP/SGR and eventually become LPPs in their late phases of evolution. (4) No evolutionary links exist between persistent AXP/SGRs and RRATs, XDINs, and CCOs. (5) Evolutionary curves of known RRATs which have the highest estimated birth rate pass through a large fraction of the RPs during the initial phases, while a small fraction of the RRAT curves traces the region of all known XDINs. This implies that a significant fraction of RPs are evolving into the RRAT properties, and that a small fraction of RRATs are progenitors of the XDINs. These results provide concrete support to the ideas proposing evolutionary connections between the neutron star families to account for the “birth-rate problem”, the discrepancy between the cumulative birth rate estimated for these systems and the core-collapse supernova rate.

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