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The spin evolution of the pulsars with non-rigid core

We investigate the neutron star spin evolution (braking, inclination angle evolution and radiative precession), taking into account the non-rigidity of star core rotation. We consider a Newtonian star which core is described by linearised quasistationary hydrodynamical equations in the one-fluid and two-fluids (neutron superfluidity) approximations. Two limiting cases have been considered: 1) the case of strong coupling between crust and "charged" component (protons, electrons and normal neutrons) when the differential rotation only of the superfluid neutrons is taken into account, 2) and the case of weak coupling when the magnetic field does not penetrate the core and the crust-core interaction occurs through the viscosity. It is shown that the non-rigidity of core rotation accelerates the inclination angle evolution and makes all pulsars to evolve to the orthogonal state. The effect depends on the amount of the non-rigid rotating matter and the mechanism of its interaction with the rest of the star. Since rapid inclination angle evolution seems to contradict the observation data, the results probably may be used as an additional test for the neutron star core matter theories.
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