HOW DO NEUTRON STAR RADII DEPEND ON THEIR CORE-CRUST EOS?

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Nuclear equation of state (EoS) provides the fundamental property of nuclear many body systems. It is expected to be constrained by ongoing astronomical observations of the mass and radius of neutron stars (NSs). It is known that even the same nuclear EoS gives different behaviors for NS radii on the mass-radius plane depending on the treatment of connecting the EoSs at the core-crust boundary. However, there are no systematic surveys on this issue.
In this paper, we report the results of systematic surveys on NS radii by assuming that NS models consist of crust EoSs and core nuclear EoSs. We adopt a variety of EoSs in the literature [1-5] for crust EoSs, and various parameters [6-9] of relativistic mean field for core nuclear EoSs. It is to be noted that we also apply a density-dependent relativistic Hartree-Fock model [10] for the core EoS. The dependence of NS radii on the core-crust boundary is investigated by solving the Tolman-Oppenheimer-Volkoff equation by taking account the following changes of the boundary: (1) no crust, and (2) the boundary density of 0.1 to 1.0 times the nuclear saturation density (rho_0) in steps of 0.1 rho_0, where the most plausible NS radius is obtained at around 2 rho_0.

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