

Structural properties of Keplerian rotating neutron stars

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All the existing studies indicates that observed neutron stars are rotating namely millisecond pulsars (MSPs). Such rotation affects the global attributes of the neutron stars. The study of structural properties of these objects specifically maximum mass, radii and spin parameter has interested for theoretical astrophysicists over the last decades [1, 2]. The global structure of the neutron star is sensitive to its angular velocity, and the maximum mass increases by increasing of the rotation velocity. Here, we have computed the structural properties of Keplerian rotating neutron star for maximum mass configuration, M_K , R_K , f_K and j_{max} using of the numerical RNS code [3]. We have also proposed a universal formula for maximal mass of the neutron stars in the unit of maximal Keplerian mass [4]. In this work, we have employed the equation of state (EOS) for neutron star matter by describing the neutron star outer crust, inner crust and the liquid core. For the inner crust, the EOS is calculated by Douchin and Haensel [5], and the Baym-Pethick-Sutherland EOS for outer crust [6] have been used. For neutron star liquid core, we have applied the lowest order constrained variational (LOCV) method to generate equation of state [7, 8].

References

- [1] K. W. Lo & L. M. Lin, *ApJ* 728, 12 (2011)
- [2] B. Qi, et al. *RAA*, 16, No 4 (2016)
- [3] <http://www.gravity.phys.uwm.edu/rns/>.
- [4] A.M. Farajian, M. Bigdeli and S. Belbasi, submitted *ApJ*
- [5] F. Douchin and P. Haensel, *Astron. Astrophys.* 380, 151 (2001)
- [6] G. Baym, C. Pethick and D. Sutherland, *ApJ* 170, 299 (1971)
- [7] M. Bigdeli, *Phys. Rev. C*, 82 054312 (2010)
- [8] M. Modarres and G.H. Bordbar, *Phys. Rev. C*, 58, 2781 (1998)

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