# STATIC HOT RELATIVISTIC WHITE DWARF STARS AT FINITE TEMPERATURES

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The properties of non-rotating hot white dwarfs were studied in the framework of the general theory of relativity. To this goal, the Tolman-Oppenheimer-Volkoff equation together with the mass balance equation were integrated numerically using the Chandrasekhar equation of state ($\mu$=2) at finite temperatures [1, 2]. As a result, the central density-mass, central density-radius, mass-radius relations for hot white dwarfs were obtained.

Studies show that effects of finite temperatures significantly affect the structure of white dwarfs at low densities, that is, they play a key role for low-mass white dwarfs. In addition, it was shown that taking into account the effects of finite temperatures can explain the estimated masses and the radii of white dwarfs from the Sloan Digital Sky Survey Data Releases 4. Therefore, in order to construct a realistic model of white dwarfs, the effects of the final temperatures must be taken into account properly. Our calculations fully confirm the correctness of the conclusions made in [3].

The temperatures of the isothermal cores of some white dwarf satellites of millisecond pulsars PSR J1738 + 0333, PSR J1012 + 5307 and PSR J1911-5958A were also estimated in the work [4, 5]. In parallel, these estimated temperatures were verified using the Koester relation. The approach used in this paper can be considered as an alternative way of calculating the core and the surface temperatures of a white dwarf. In future works, for the sake of completeness, non-rotating and rotating hot white dwarfs will be considered in the general theory of relativity, taking into account the nuclear composition, the Coulomb interaction, the Thomas-Fermi correction, etc.

References

1. K. Boshkayev, B. Zhami, Zh. Kalymova, Zh. Brisheva, NAS RK, 6, 27, 2017.
2. K. Boshkayev, J.A. Rueda, B. Zhami, Zh. Kalymova et al, IJMP: CS, 1660129, 2016.
3. S. M. de Carvalho, M. Rotondo, J. A. Rueda and R. Ruffini, Phys. Rev. C, 89, 015801, 2014.
4. P.-E. Tremblay, P. Bergeron, and A. Gianninas, Astrophysical Journal, 730, 128, 2011.
5. J. A. Panei, L. G. Althaus, X. Chen, Z. Han, MNRAS, 382, 779, 2007.