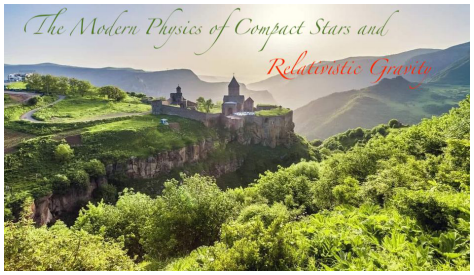

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Thermodynamics of one-component plasma for astrophysical applications

Monday 27 September 2021 15:35 (35 minutes)

We apply path-integral Monte Carlo simulations to calculate the energy of crystallized one-component plasma: the system of atomic nuclei and a uniform incompressible background (electrons). We consider full range of conditions, which are typical for core of white dwarfs and envelope of neutron stars. The results are approximated by analytic formulae, which allow us to obtain various thermodynamic functions. In particular, we demonstrate that the total crystal specific heat can exceed the well-known harmonic contribution by a factor of 1.5 due to anharmonic effects. Combining our results with the thermodynamics of the quantum Coulomb liquid, we determine the density dependence of the melting temperature and the latent heat. The results are necessary for realistic modelling of the thermal evolution of white dwarfs and neutron stars.

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