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Bose-Einstein condensate dark matter halos

Wednesday, 7 July 2021 12:05 (20 minutes)

We consider the possibility that dark matter is made of self-gravitating Bose-Einstein condensates (BECs) described by the Schrodinger-Poisson or Gross-Pitaevskii-Poisson equations. We determine the mass-radius relation of self-gravitating BECs with repulsive or attractive self-interaction at zero temperature. When the self-interaction is attractive, we evidence the existence of a maximum mass above which the system (e.g. an axion star) collapses. This leads to a dense axion star, a bosenova, or a black hole. We apply these results to the case of bosonic dark matter halos with a core-halo structure made of a soliton surrounded by an isothermal atmosphere. We determine the core mass-halo mass relation of self-gravitating BECs with repulsive or attractive self-interaction and discuss the possibility of collapse of the quantum core.

[1] P.H. Chavanis, Derivation of the core mass — halo mass relation of fermionic and bosonic dark matter halos from an effective thermodynamical model, Phys. Rev. D, 100, 123506 (2019)

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