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Influence of the tetra-neutron condensate on properties of neutron stars

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Based on recent experimental and theoretical hints on possible formation of a resonant four-neutron system we study effects of appearance of such a cluster in neutron rich baryon matter inside neutron stars. For this purpose we employ a relativistic mean field approach which includes nucleons, Δ -baryons as well as light nuclear clusters. The Pauli blocking which suppresses tetra-neutrons and stable clusters is explicitly included to the model as well. Our analysis demonstrates that tetra-neutrons are able to exist as the Bose-Einstein condensate. Such a condensate weakens the nucleon Cooper pairing and significantly suppresses formation of the superfluid phase inside neutron stars. Tetra-neutrons are also found to strongly feed vector meson fields and suppress Δ -baryons leading to stiffening of equation of state.

Authors: IVANYTSKYI, Oleksii (University of Salamanca); PEREZ-GARCIA, M. Angeles (University of Salamanca and IUFFyM); Dr ALBERTUS TORRES, Conrado (University of Salamanca)

Presenter: IVANYTSKYI, Oleksii (University of Salamanca)