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Семинар
"ТЕОРИЯ АДРОННОГО ВЕЩЕСТВА ПРИ ЭКСТРЕМАЛЬНЫХ УСЛОВИЯХ"

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Constraints on the nuclear equation of state. Hyperon puzzle of neutron stars

Measurements of neutron stars with masses larger or about 2 solar masses imply that the nuclear equation of state (EoS) should be sufficiently stiff. The stiffness of the Eos is however restricted from above by the constraint from the analysis of particle flow in heavy-ion collisions. The dilemma sharpens if hyperons are included. Since Lambdas and Xi baryons experience attractive potentials in nuclear matter at the saturation density, a naive extrapolation of these potentials would lead unavoidably to the appearance of hyperons in neutron star interiors. That would soften the EoS and lead to the contradiction with the observable star masses (so-called hyperon puzzle). We show that this problem can be resolved if one takes into account a reduction of the mass of the phi meson which mediates a repulsion among hyperons. We propose a relativistic mean-field model with hadron masses and coupling constants depending on the scalar field. All hadron masses undergo a universal scaling, whereas the coupling constants are scaled differently. The appearance of hyperons in dense neutron star interiors is accounted for. The equation of state satisfies well the constraints known from analyses of the astrophysical data and particle production in heavy-ion collisions.