A RELATIVISTIC QUANTUM FIELD THEORY FOR NUCLEAR MATTER: THE ROLE OF DIBARYONS IN THE EOS OF NEUTRON STARS

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In this work we analyse the influence of dibaryon resonances in the structure of the nuclear matter equation of state (EOS) and investigate the dibaryon star conjecture. We derive the EOS using a simple hydrodynamical description, i.e., we adopt as a neutron star model, an uniform, homogeneous and isotropic gas of nucleons (and their antiparticles), with attractive σ and repulsive ω mesons, and dibaryons. We use, as a formal basis, a modified version of the relativistic action integral equivalent to the QHD-I model. The Lagrangian density of the theory is chosen in a way to produce a minimum coupling between the fields, to be more specific, the neutral scalar σ field couples to the baryon scalar density, and the neutral vector field ω couples to the conserved vector current of baryons. The scalar and vector contributions are introduced in the Lagrangian density via Lorentz scalar and vector terms. The baryon resonances are treated, in our study, as elementary bosons, nevertheless carrying baryon number and baryon vector current. The QHD-I model is then complemented by scalar and vector sectors that represent the coupling of elementary dibaryons to the scalar and vector meson fields as well as to the dibaryon fields, which yield the dynamical field equations for the mesons, baryons and dibaryons. Through canonical quantization of the baryon fields we determine the nuclear matter EOS. Subsequently, by integrating the Tolman-Oppenheimer-Volkoff equation of the general relativistic metric, the mass of a neutron stars may be obtained as a function of density. The results indicate that the nuclear matter EOS is dominated by the dibaryon phase, giving support to the neutron star conjecture.

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THE POSSIBILITY OF GRAIN ALIGNMENT BY ALFVÉN WAVES IN THE VICINITY OF STARS

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Stellar mass loss has been systematically derived from observations and is present in almost all regions of the HR diagram. Giant and supergiant stars eject mass at a rate of $10^{-6} - 10^{-4} M_{\odot}$ yr^{-1}. This is supported by the data on continuum emission in the infrared as well as on the rotational molecular lines. The infrared emission is due to dust grains radiating at temperatures between 400 and 1000 K in the shell around the star, and the observations indicate that it is polarized. For these stars we have from observations that the terminal velocity inferred (u_{∞}) is lower than the surface escape velocity (v_{eo}). Several acceleration mechanisms have been proposed for driving these winds and one of the most promising involves the mass loss by an outward-directed flux of Alfvén waves. There are also several mechanisms to provide grain alignment. For example, the Gold-type mechanism is caused by the supersonic grain motions ubiquitous in the vicinity of stars due to Alfvénic waves and radiation pressure. Jatenco-Pereira and Opher (1989) developed a model for the mass loss of these stars using a flux of Alfvén waves as a mechanism of wind acceleration. It is asssumed that the magnetic field has a divergent structure, similar to that of a solar coronal hole. We assume that the Alfvén waves are generated near the stellar surface, propagate outward transferring momentum into the wind, as they are damped by the non-linear mechanism. The preliminary results show that, for the stellar parameters studied, a flux of Alfvén waves can both align the grains and accelerate the wind. In this study, we obtained $u_{\infty}/v_{eo} \approx 1/2$ as observed.

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