Contribution ID: **5**   Type: **not specified**

Equation of States of Nuclear Matter and Tidal deformation of Neutron Star

Monday, 16 August 2021 15:30 (15 minutes)

The equation of states of (EoS) of the spin polarized, asymmetric nuclear matter (NM) is studied within the nonrelativistic Hartree-Fock (HF) formalism using realistic choices for the in-medium (density dependent) nucleon-nucleon (NN) interaction, dubbed as CDM3Y4, CDM3Y5, CDM3Y6 and CDM3Y8. Two scenarios for the density dependence of the spin polarization Δ of baryons in NM are considered, and the obtained HF results are compared with the empirical constraints for the nuclear symmetry energy given by the nuclear structure studies and the astrophysical observations of the binary NS merger (GW170817 and GW190425). A partial spin polarization of baryons ($\Delta < 1.0$) at low baryon densities seems more reasonable, with the HF results for the symmetry energy and incompressibility of NM being quite close to the empirical values. The mean-field based EoS of asymmetric NM is used further to construct the β-stable neutron star (NS) matter of strongly interacting baryons (protons and neutrons), electrons, and muons.

The EoS of NS matter over a wide range of baryon densities is used as input for the calculation of the macroscopic configuration of NS within the framework of General Relativity (GR), like the gravitational mass M, radius R, gravito-electric and gravito-magnetic tidal deformability. Given the empirical constrains inferred from the gravitational-wave signals of GW170817 and the mass limit of the heaviest pulsars observed, we conclude that the EoS of NS matter given by the CDM3Y6 and CDM3Y8 versions of the in-medium NN interaction is the most appropriate for the study of NS. The Love numbers of the tidal deformation of NS in a binary system are calculated up to the 4th order and a correlation of the tidal deformability of NS with its gravitational mass is shown.

Keywords: Neutron star, Magnetar, Spin polarization, Equation of state, Nuclear matter, Tidal deformability, Love number, Gravitational wave.

Experimental nuclear physics

Theoretical nuclear physics

1

Primary author: NGUYEN HOANG DANG, Khoa (University of Science and Technology of Hanoi)

Co-authors: Dr NGO HAI, Tan (Phenikaa University, Hanoi); Prof. DAO TIEN, Khoa (INST, Hanoi)

Presenter: NGUYEN HOANG DANG, Khoa (University of Science and Technology of Hanoi)

Session Classification: Young Scientist Session 1