

Impurities in neutron matter

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1 REPORT of the STSM in Coimbra

The mission was executed from Monday January 12th to Friday January 16th of 2015.

During the stay in Coimbra and together with Dr. Isaac Vidaña we have been mainly working in the study of the self-energy of a neutron with a fixed spin in neutron matter with opposite polarization. We have adapted the G-matrix codes to treat the impurity problem, with the possibility to take into account or not the nucleon-nucleon interaction in the polarized background. At the moment we have been considering the realistic nucleon-nucleon interaction Av18. Preliminary results indicate that the binding energy of the impurity at zero momentum is not affected if we consider a free or an interacting background. We have also checked that polarized neutron matter up to the empirical saturation density of nuclear matter behaves almost as a free Fermi gas. Besides the fact that there are many partial waves that are forbidden in polarized neutron matter, there are also many cancellations of the energy contributions of the active partial waves.

The binding energy of a neutron with opposite spin in polarized neutron matter at $\rho = 0.069 \text{ fm}^{-3}$ turns out to be 48.82 MeV. We are presently analyzing the full spectrum and its characterization by means of an effective mass. We have also confirmed the results of the recently published paper on the realization of the polaron in neutron matter (Phys. Rev. **C89**, 041301 (R) (2014)).

We have started to prepare a preprint with the main results of the investigation, including also the comparison to effective interactions.