Probing matter in extreme conditions using neutron stars

Anthea F. Fantina.

[1] *Institut d'Astronomie et d'Astrophysique, Université Libre de Bruxelles*
CP 226 - Boulevard du Triomphe, B 1050 Bruxelles – Belgium
afantina@ulb.ac.be

The properties of dense matter and exotic nuclei are of fundamental importance in compact stars, especially in core-collapse supernovae (that represent the end point of stellar evolution for stars whose mass exceeds about 8-10 solar masses) and in neutron stars (their compact remnant). These objects are indeed unique "laboratories" to probe matter in extreme conditions. Nuclear physics experiments, in tandem with astrophysical observations, can give valuable insight in to the properties of dense matter encountered in these stellar objects.

Among the most important microscopic ingredients in compact star modelling are the determination of the equation of state and the treatment of the electro-weak processes (beta-decay and electron-capture rates, and neutrino interactions). An accurate treatment of the microphysics, based on the latest experimental data, is indeed essential for modelling these stellar objects, and thus for interpreting astrophysical observations.

In this contribution, I will present some equations of state of dense matter, and the underlying nuclear models will be discussed in connections with present data coming from nuclear physics experiments as well as microscopic calculations. The structure of neutron stars constructed with these equations of state will be discussed in connection with both recent astrophysical observations and nuclear-matter parameters.