Contribution ID: **8** Type: **not specified**

The nuclear matter equation of state: from nuclei to neutron stars

Friday, 19 May 2017 15:00 (1h 30m)

I'll present a general overview of the current theoretical models adopted for the derivation of the equation of state (EoS) for nuclear matter over a large density range, i.e. from finite nuclei to the inner core of neutron stars (NS), spanning about 14 orders of magnitude. In particular, I'll compare a set of EoS derived within microscopic many-body approaches, and study their predictions as far as phenomenological data on nuclei from heavy ion collisions, and astrophysical observations on neutron stars are concerned. It is found that all the data, taken together, put strong constraints not easy to be fulfilled accurately.
Besides a conventional description where nucleons and leptons are taken into account, I'll discuss the appearance of strange baryonic matter in NS, as well as the consequences of a hadron-quark phase transition. A survey of the currently existing quark matter (QM) models shows that the predicted maximum mass of NS is not larger than 2 solar masses, and that the observation of a more massive NS would require additional repulsion, thus giving access to the QM equation of state.

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