HAW05-2005-020222

Abstract for an Invited Paper
for the HAW05 Meeting of
the American Physical Society

**Mean field theory for neutron rich nuclei and EOS**

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We have already shown that there was a clear linear correlation between the neutron skin thickness of stable nuclei, such as $^{208}$Pb, the pressure of neutron matter in the Skyrme Hartree Fock (SHF) and relativistic mean field (RMF) models. Here the pressure $P_n$ of neutron matter is defined by the first derivative of Hamiltonian density in the neutron matter with respect to the neutron density. There are some nuclear properties of infinite nuclear matter, such as the saturation density $\rho_{nm}$, the saturation energy per nucleon $E_0$, the incompressibility $K$, the symmetry energy $J$, the 1st derivative $L$ of $\varepsilon_\delta$ and 2nd derivative $K_{sym}$ of $\varepsilon_\delta$. The isoscalar part $h$ are characterized by $\rho_{nm}$, $E_0$ and $K$, and the isovector part $\varepsilon_\delta$ is characterized by $J$, $L$ and $K_{sym}$. Furthermore these isoscalar part and the isovector part of the Hamiltonian density for infinite nuclear matter play an important role to characterize the equation of state (EOS). In Skyrme Hartree Fock model (SHF) including some parameters in the Skyrme force, there are many versions of Skyrme parameter sets parameterized by the experimental results of finite nuclei such as nuclear mass, charge radii and so on. All Skyrme parameter sets which we use recently can reproduce the empirical $\rho_{nm}$ and $E_0$, whereas the values of $K$, $J$, $L$ and $K_{sym}$ depend on the parameter sets entirely. However we found there were correlations among $K$, $J$, $L$ and $K_{sym}$ in SHF model. Furthermore if we fix the values of $\rho_{nm}$ and $E_0$ to 0.16 fm$^{-3}$ and 16 MeV, respectively, the nuclear matter properties $J$, $L$ and $K_{sym}$ are represented as a function of the incompressibility $K$, the neutron skin thickness of $^{208}$Pb and the power of the total density in density- dependent term of Skyrme force. In addition to the content above, I will discuss the relation between the EOS of the neutron matter and the neutron skin thickness of the finite nuclei.