

FROM NUCLEAR REACTIONS TO STELLAR MATTER: A UNIFIED APPROACH

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We carry out a systematic study of the symmetric nuclear matter (SNM) and isospin-dependent bulk properties of asymmetric nuclear matter. An equation of state (EoS) for symmetric nuclear matter is constructed using the DDM3Y effective interaction and extended for isospin asymmetric nuclear matter. In particular, we study the density dependence of the nuclear symmetry energy (NSE) and extract the slope L and the curvature K_{sym} parameters of the NSE and the isospin dependent part K_{τ} of the isobaric incompressibility [1]. This knowledge is important for understanding not only the structure of radioactive nuclei and the liquid-gas phase transition in asymmetric nuclear matter, but also many critical issues in astrophysics. Folded microscopic potentials using the DDM3Y effective interaction, whose density dependence is determined from nuclear matter calculations, provide excellent descriptions for proton, alpha [2] and cluster radioactivities, elastic and inelastic scattering. The nucleon-nucleon effective interaction used in the present work is found to provide a unified description of elastic and inelastic scattering, various radioactivities, nuclear matter properties and the β -equilibrated NS matter with and without quark core [3, 4].

[1] Partha Roy Chowdhury et al., *Physical Review C* 80, 011305 (Rapid) (2009)

[2] Partha Roy Chowdhury et al., *Physical Review C* 83, 027601 (2011)

[3] Partha Roy Chowdhury et al., *Physical Review C* 81, 062801 (Rapid) (2010)

[4] Partha Roy Chowdhury et al., *Astroparticle Physics* 36, 42–46 (2012)