

## Cyclotron Colloquium, Wednesday, May 12, at 3:45 pm

"Probing the Nuclear Symmetry Energy with Heavy-Ion Reactions and Neutron Skin Thickness of Heavy Nuclei"

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Heavy-ion reactions induced by neutron-rich nuclei and the neutron skin thickness of heavy nuclei provide a unique means to investigate the equation of state of isospin asymmetric nuclear matter, especially the density dependence of the nuclear symmetry energy. We review the recent progress on the determination of the density dependence of symmetry energy from both heavy ion reactions and nuclear structure. In particular, using a novel correlation analysis, which allows us to explore transparently the correlation between observables of finite nuclei and nuclear matter properties within the Skyrme-Hartree-Fock approach, we find that the existing neutron skin data of Sn isotopes can give important constraints on the value  $E_{\text{sym}}(\rho_0)$  and its density slope  $L$  of the nuclear symmetry energy at saturation density  $\rho_0$ . Combining these constraints from nuclear structure with those from recent analyses of isospin diffusion and double neutron/proton ratio in heavy ion reactions at intermediate energies leads to a quite accurate value of  $L=58 \pm 18$  MeV approximately independent of  $E_{\text{sym}}(\rho_0)$ . This result allows us to rule out a number of nuclear effective interactions and also has important ramifications in neutron star physics.

Main references:

B.A. Li, L.W. Chen, and C.M. Ko, Phys. Rep. 464, 113 (2008)

L.W. Chen, C.M. Ko, B.A. Li, and J. Xu, arXiv:1004.4672, 2010.