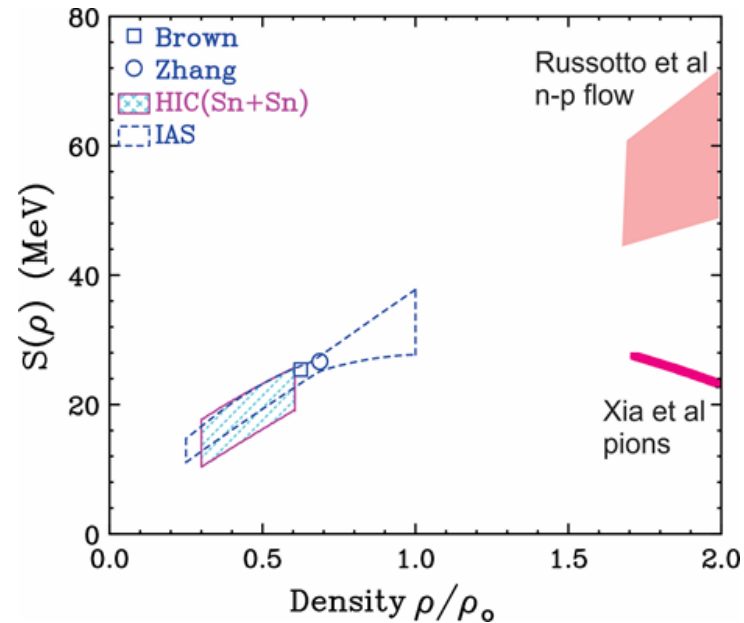
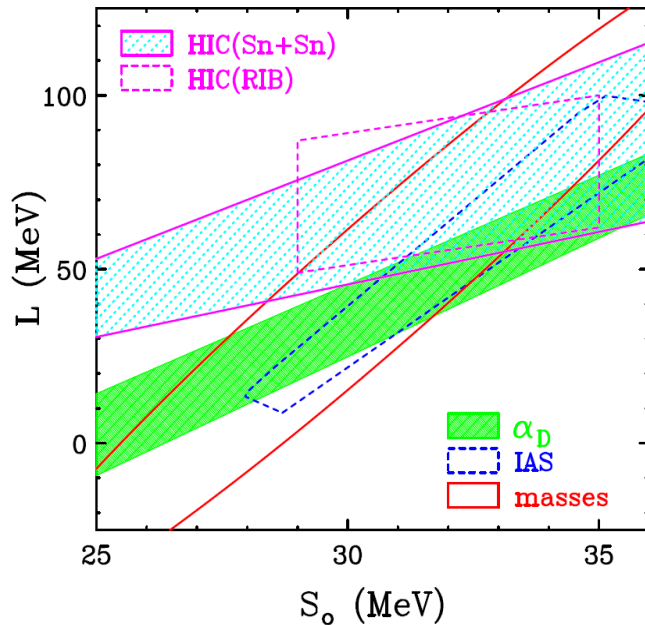


Symmetry Energy Constraints

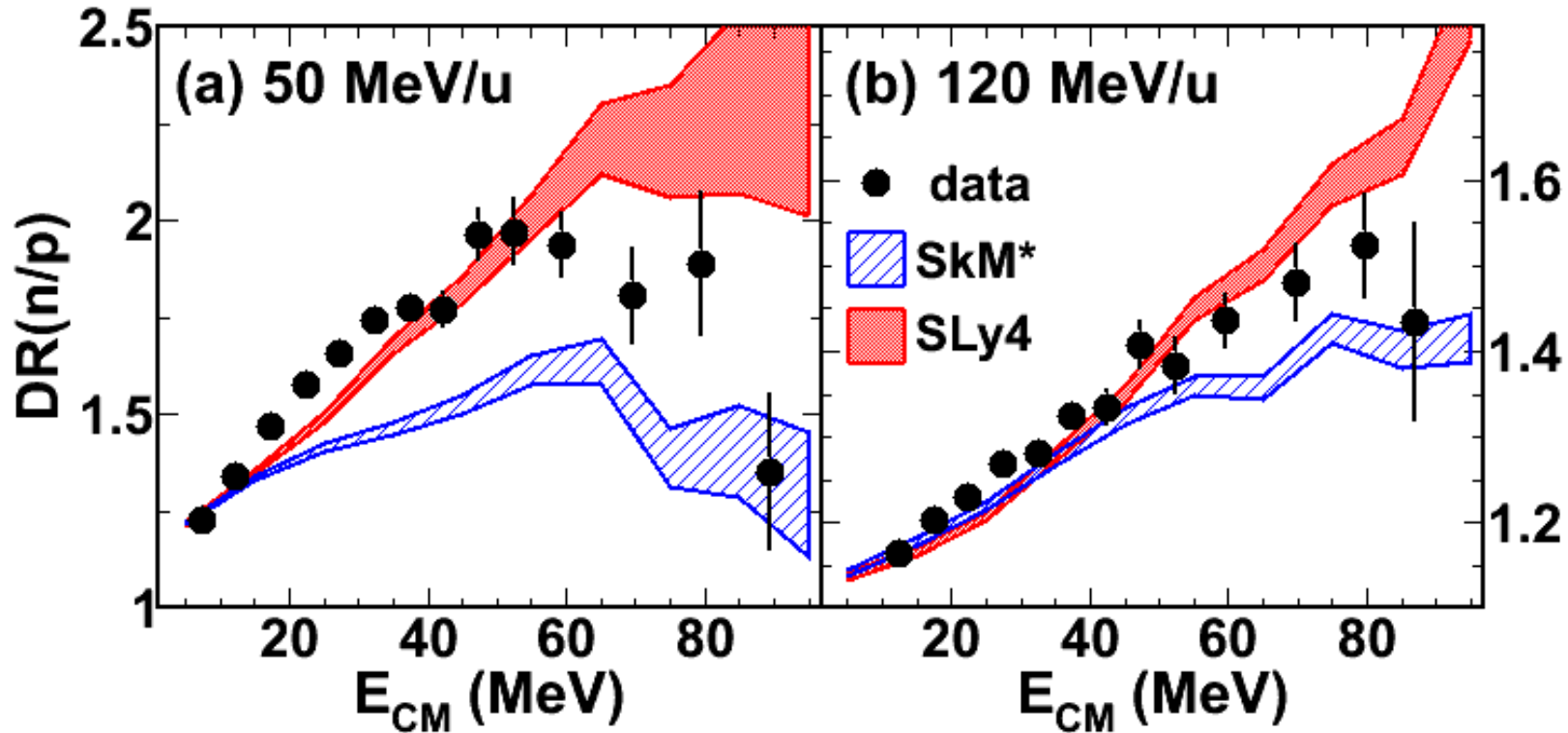
- LRP objectives: *the nature of neutron stars and dense nuclear matter & the nature of the nuclear force*
- Consistent constraints with credible uncertainties obtained from nuclear structure and nuclear reactions : NuSYM13 & ICNT2013 & J. Phys. G (in press)



- Extend strategies developed at low energy to explore symmetry energy in high density.

Nucleon Effective Mass

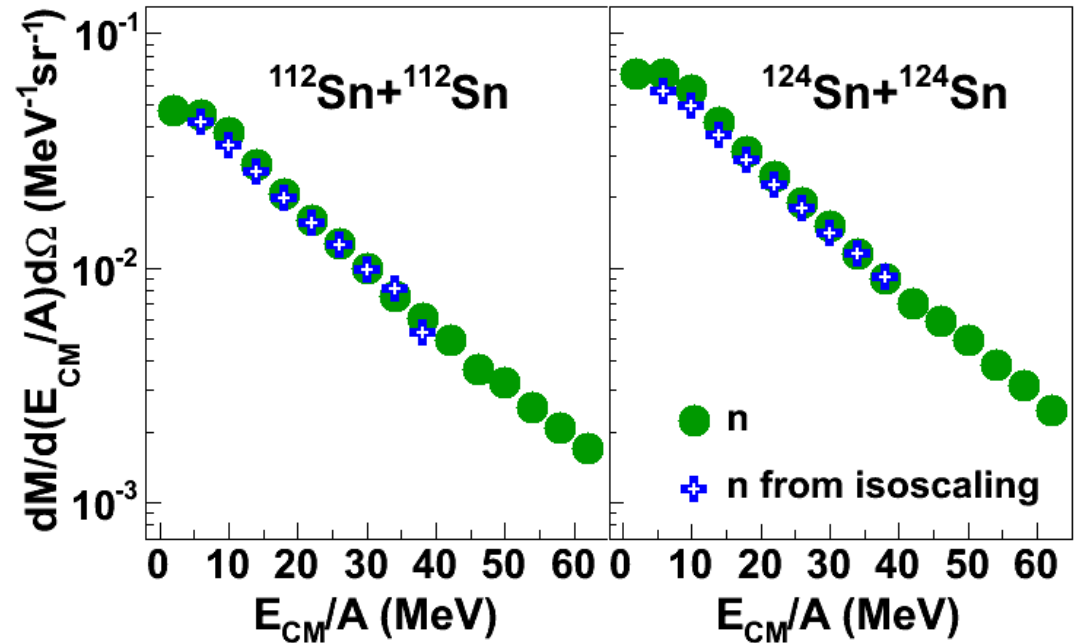
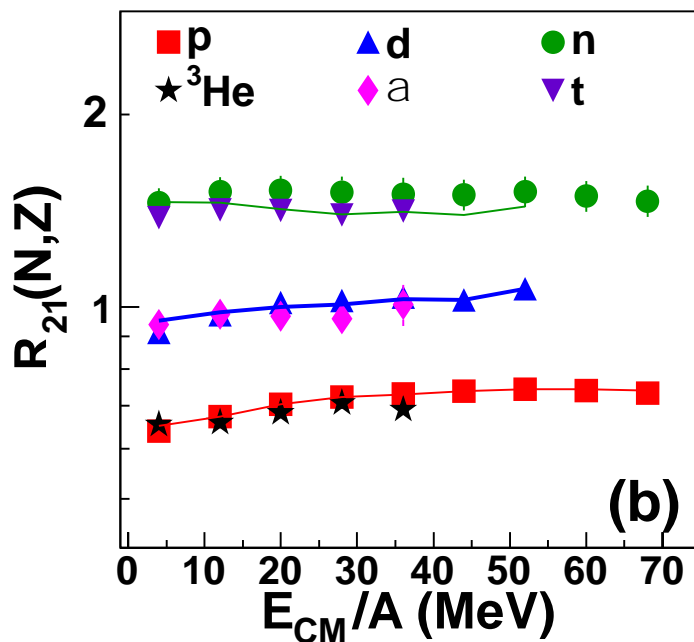
- Affects symmetry energy constraints
- Influences the thermal properties of neutron-rich matter



- First results indicate that the effective mass splitting is small.
- Approved experiment with upgrade HiRA to extend E_{CM} range.

Isoscaling and Neutron Spectra

- Neutron spectra are critical to explore effective nucleon mass and density dependence of symmetry energy
- Neutrons are difficult to measure and efficiency corrections not better than $\sim 15\%$



- Excellent agreement between n spectra extracted from isoscaling of particle energy spectra and measured n spectra