Symmetry energy : properties of nuclear matter, nuclear mass models and neutron stars

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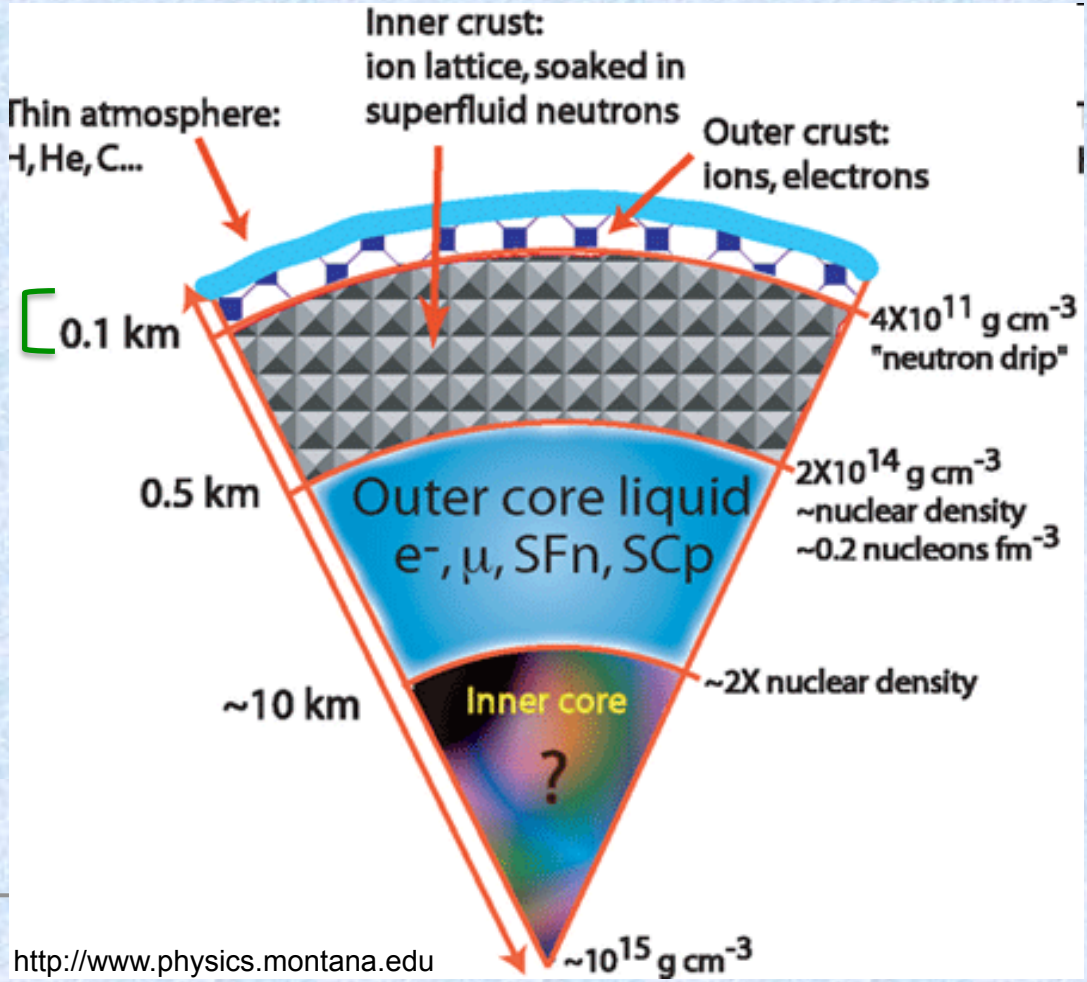
Neutron stars & Symmetry energy

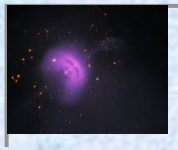
NSs are unique "cosmic laboratories" to probe properties of asymmetric matter

$$S_1(n) = \frac{1}{2}\left.\frac{\partial^2(\mathcal{E}/n)}{\partial\eta^2}\right|_{\eta=0} \approx J + \frac{1}{3}L\left(\frac{n-n_0}{n_0}\right) + \frac{1}{18}K_{\rm sym}\left(\frac{n-n_0}{n_0}\right)^2$$

This work : study the role of *Esym* on :
- ✓ **composition of outer crust**
- ✓ **properties at *neutron-drip***

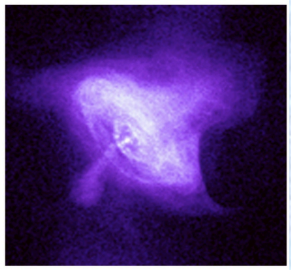


only microscopic inputs are *nuclear masses*
- ➢ experimental masses (AME2012)
- ➢ Brussels-Montreal HFB mass models from corresponding EDFs **BSk22** to **BSk26** (J = 32 to 29 MeV)
  → see N. Chamel's talk



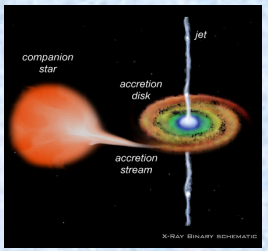
Symmetry energy & neutron drip

CATALYSED NS CRUST

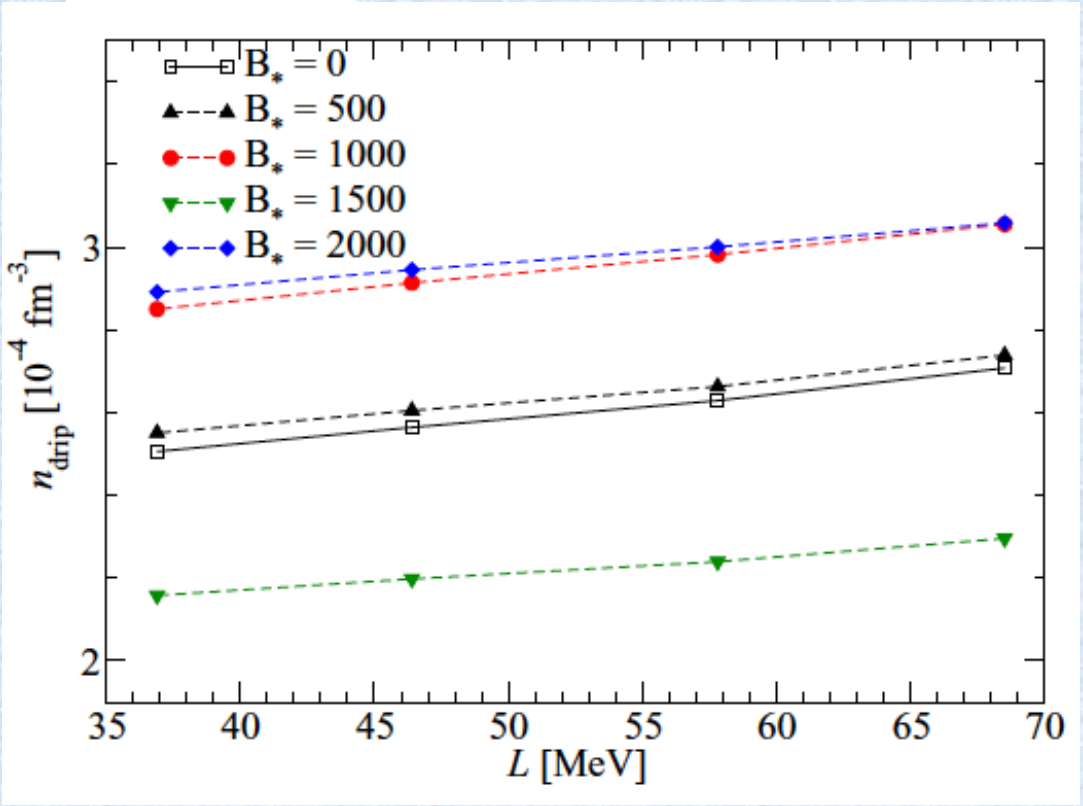


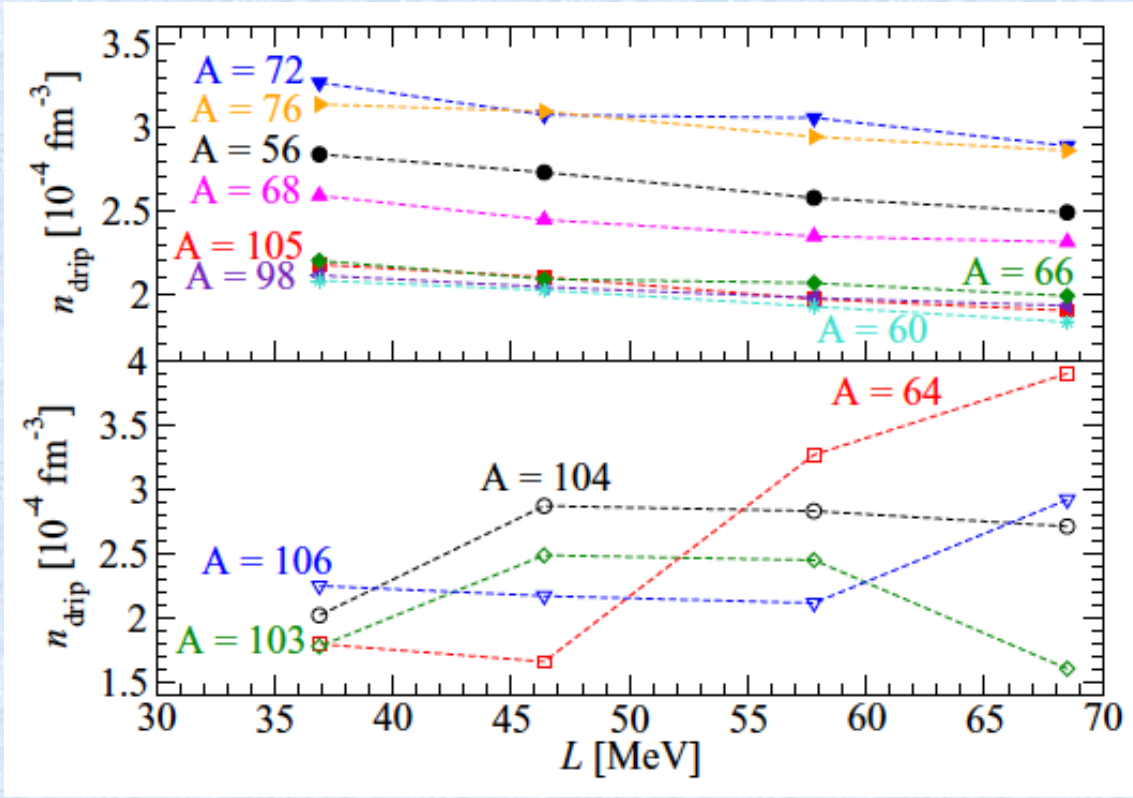
full thermodynamic equilibrium at T=0

ACCRETED NS CRUST



matter off-equilibrium





(see Fantina *et al.*, PRC 93, 015801 (2016) and refs. therein)

Properties of NS (outer) crusts very sensitive to the details of the nuclear structure far from the valley of stability !