Phases of the strong force and neutron stars (NSs)



Simple equation of state



Possibilities for the high-density NS equation of state



Global properties from microphysics

- composition, multi-body forces, ..., reflected in the Equation of State (EoS)
- EoS determines observables (mass, radius, ...)



Tidal effects during a binary inspiral



Tidal deformability parameter for "realistic" NS matter

"I-Love-Q": approximate universal relations

relations for appropriate dimensionless versions of parameters for moment of inertial (I), tidally (Love) and rotationally induced quadrupole (Q)

E.g. data for rescaled Q vs. rescaled λ , different EoS:

Boson stars: configurations of complex scalar fields described by

$$S = \int d^4x \sqrt{-g} \left[\frac{R}{16\pi} - \nabla^{\alpha} \Phi \nabla_{\alpha} \Phi^* - V(|\Phi|^2) \right]$$

popular choices for $V(|\Phi|^2)$:

compactness of resulting objects:

Tidal deformability for exotic objects: boson stars

tidal deformability parameters for $V(|\Phi|^2) = \mu^2 \Phi^2 + \frac{\lambda}{2} |\Phi|^4$

calculation and figures by Noah Sennett et al

GW signals from black hole-neutron star binaries

Numerical relativity (NR) data from F. Foucart, SXS collaboration

GW signals from double neutron star binaries

