

Zjazd CAMK

Sprawozdanie za 2025 rok

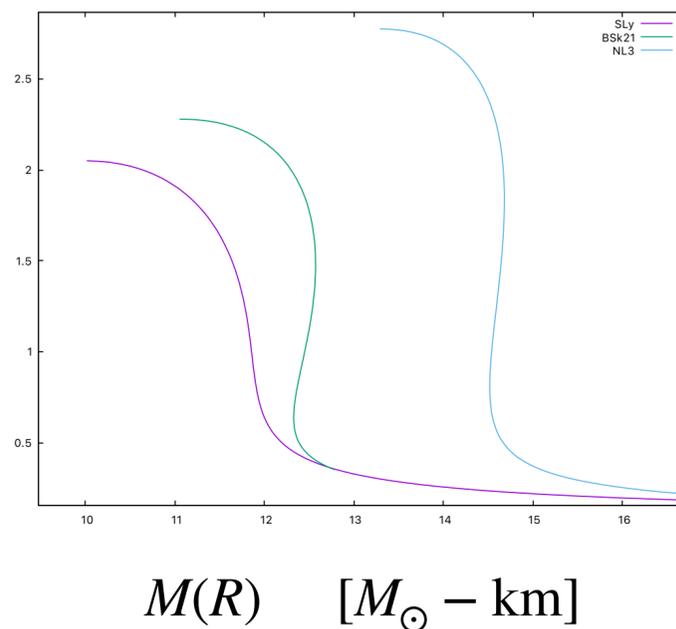
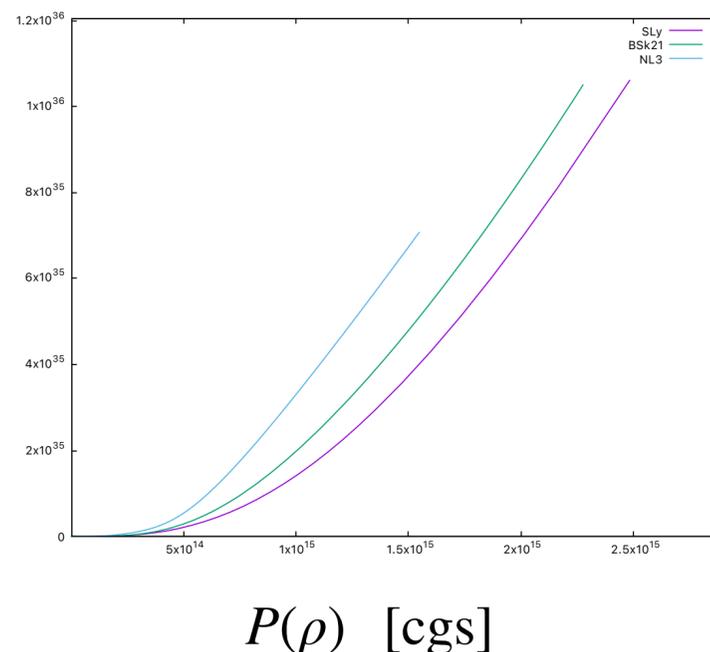
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CAMK
5 lutego 2026

Equation of state and Neutron Star properties

EOS - pressure, density, baryon number density NS - mass, radius, tidal deformability, rotational frequency

- Stiff EOS - $\frac{dP}{d\rho}$ large
 - Exotic particles (hyperons, quarks) softening eos
 - Phase transition (1st order) - density discontinuity, new oscillation modes.
- large maximum NS mass, large radius
- smaller maximum mass, larger central density
- stability of a star with respect to this mode



Dynamical Tides in Neutron Stars with First-Order Phase Transitions: The Role of the Discontinuity Mode

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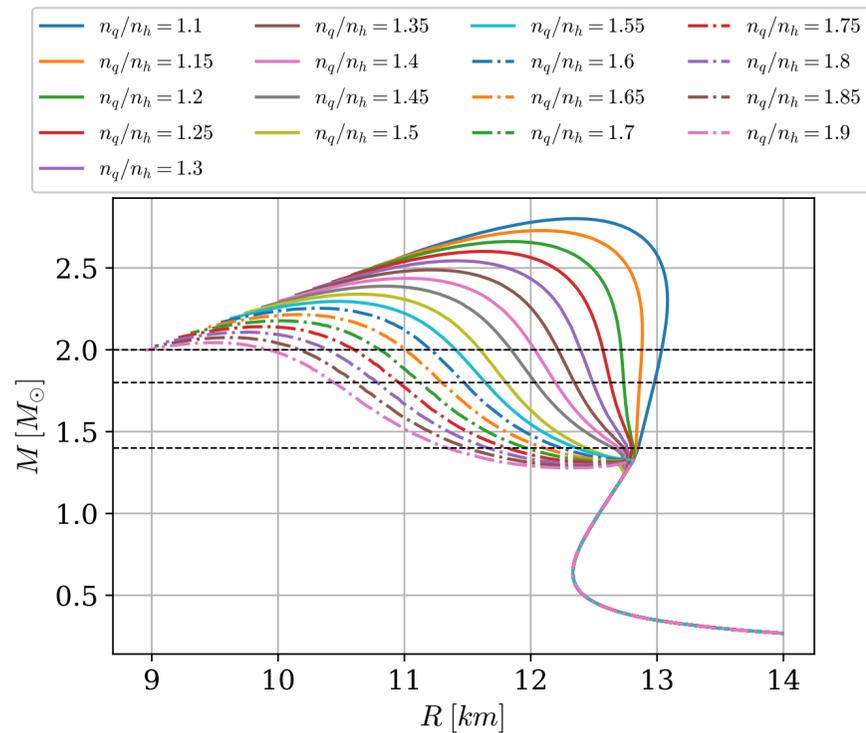


FIG. 1. Mass-radius relations for hybrid stars for various EOSs characterized by n_q/n_h values ranging from 1.1 to 1.9, spanning scenarios from weak to strong phase transitions. To facilitate identification of the properties of the stellar models analyzed, dashed lines have been plotted at $1.4M_\odot$, $1.8M_\odot$, and $2.0M_\odot$.

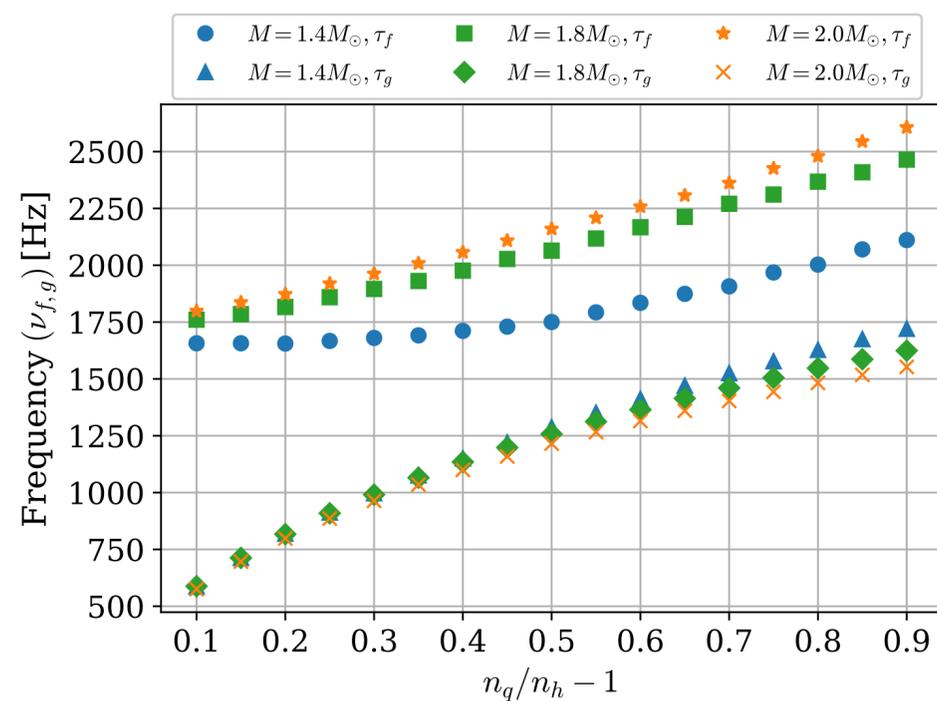


FIG. 5. Frequencies for the f mode and g mode for stars with $1.4M_\odot$, $1.8M_\odot$, and $2.0M_\odot$ and different number baryon density jumps.

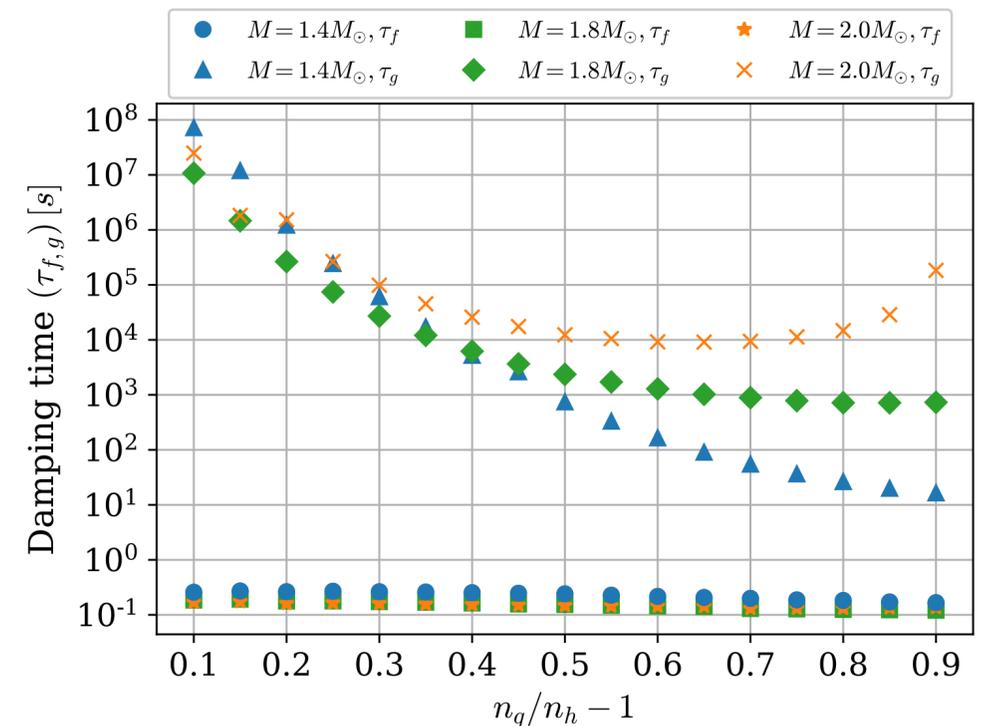


FIG. 4. Damping times for the f and g modes of hybrid stars with masses of $1.4M_\odot$, $1.8M_\odot$, and $2.0M_\odot$. The damping times of g modes display nonlinear behavior with n_q/n_h , owing to their dependence on buoyancy. These damping times span roughly seven orders of magnitude and can reach values as large as $\sim(10100)\text{s}$ for hybrid stars with significant density jumps.

Conclusions

- Dynamical tides during the late stages of a binary neutron star inspiral
- Tidal interactions excite the oscillation modes in neutron stars
- This coupling can modify the emitted gravitational-wave signal.

Additional oscillation mode:

- A g-mode associated with a first-order phase transition and buoyancy (discontinuity mode) is present
- Similar frequencies of g-modes and f-modes (~ 1 kHz)
- g-mode can contribute non-negligibly to gravitational wave phase shifts (at a level comparable to f-mode)
- If the presence of g-mode is not taken into account one can overestimate for example radius by 1-2%.