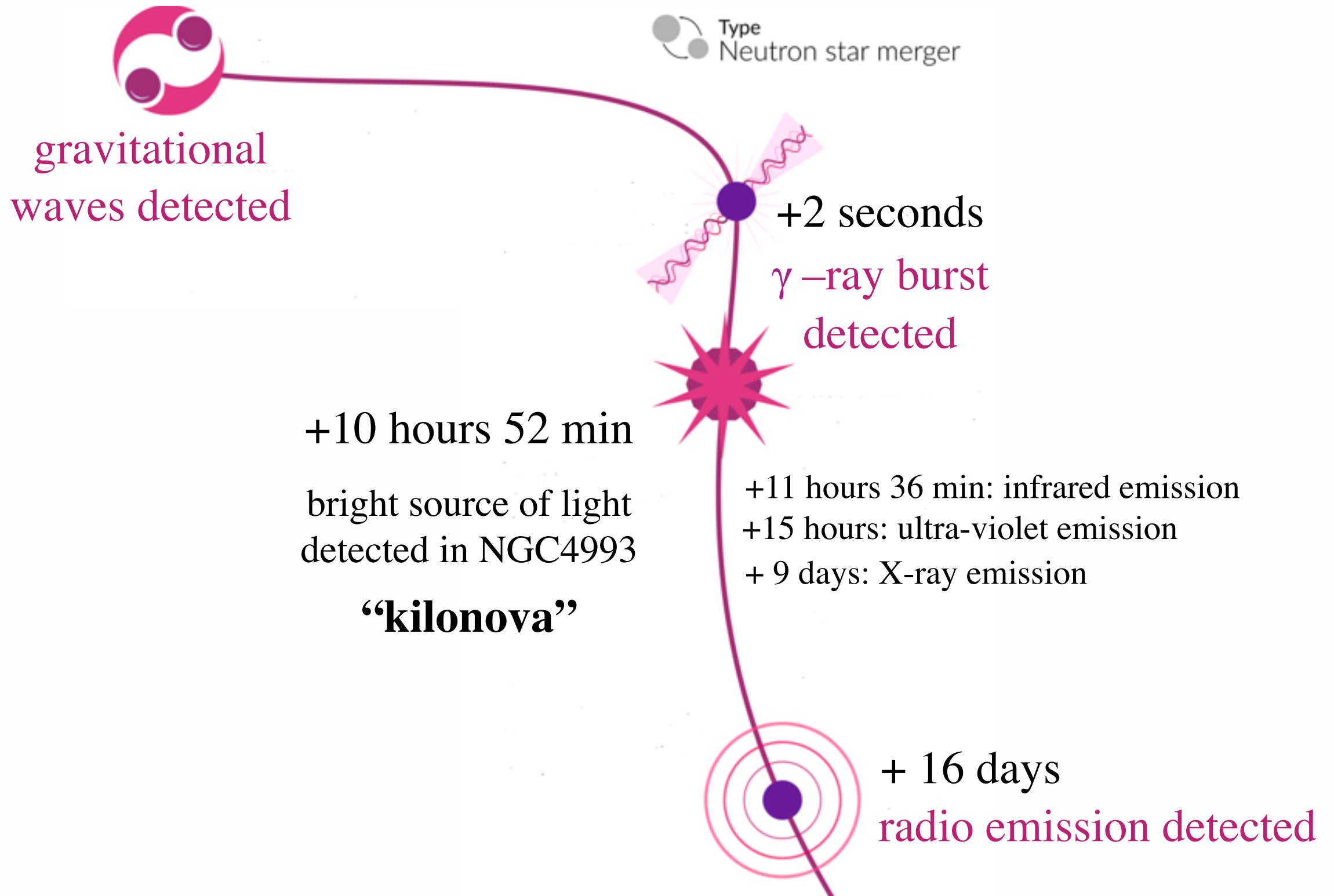


12:41:04 UTC

Type
Neutron star merger

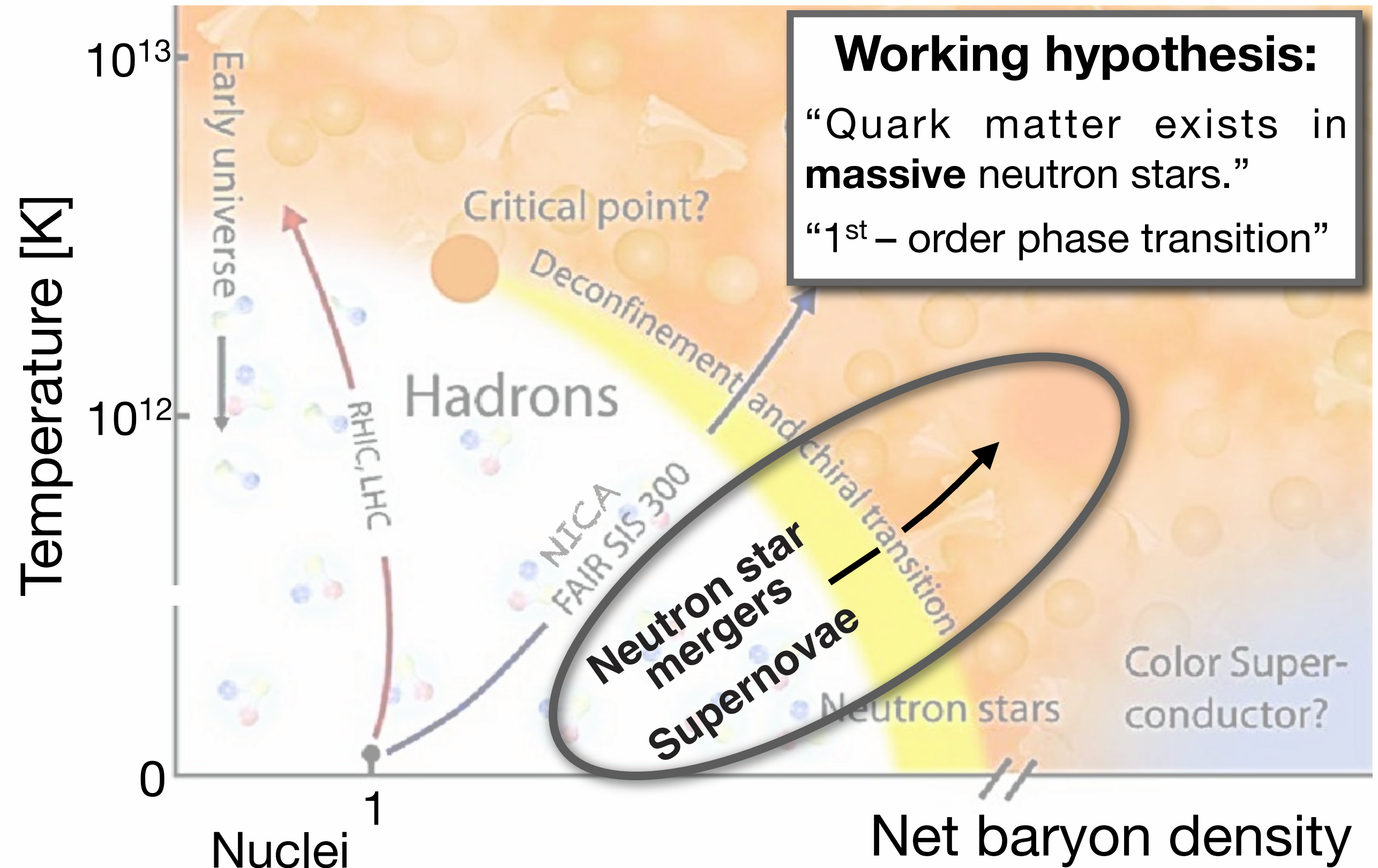


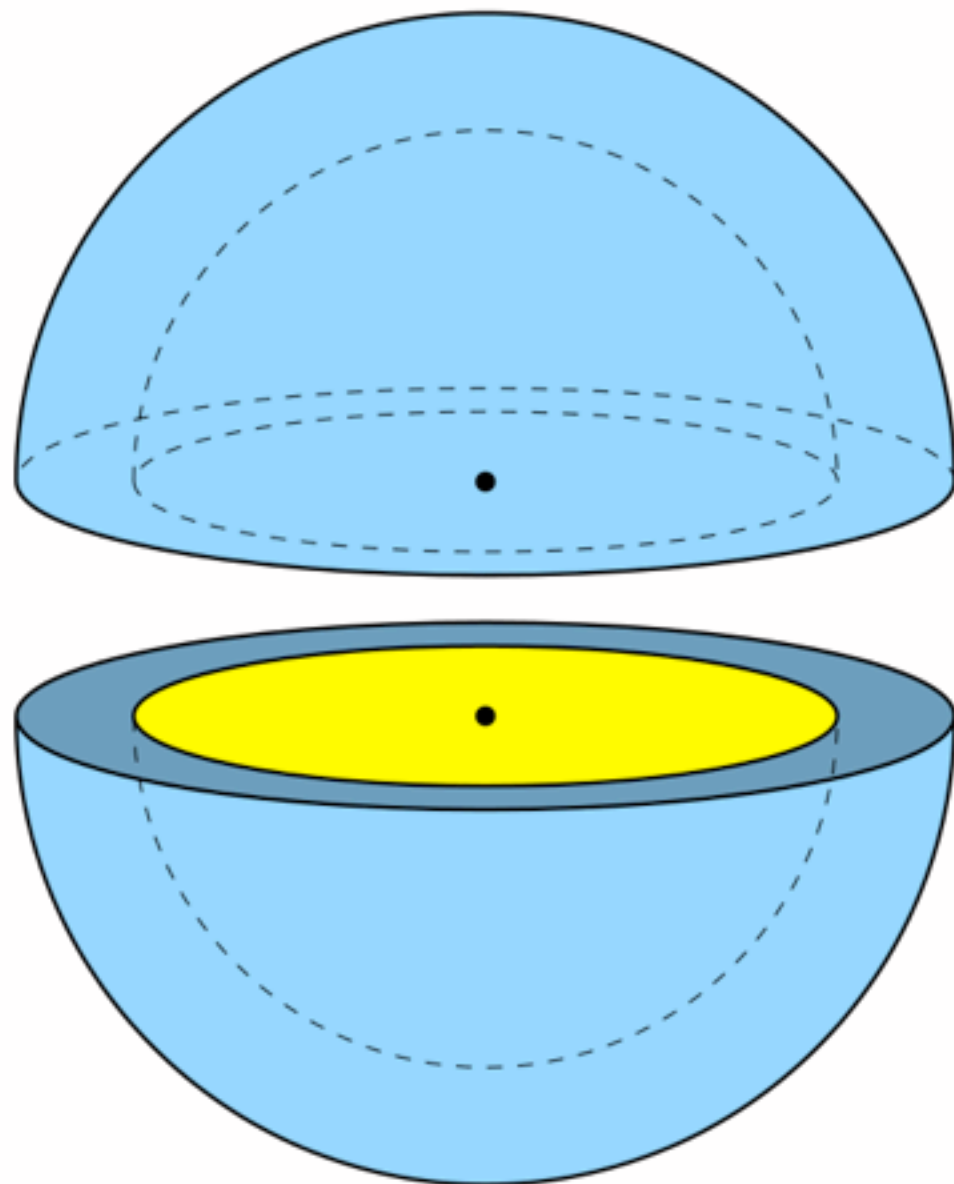
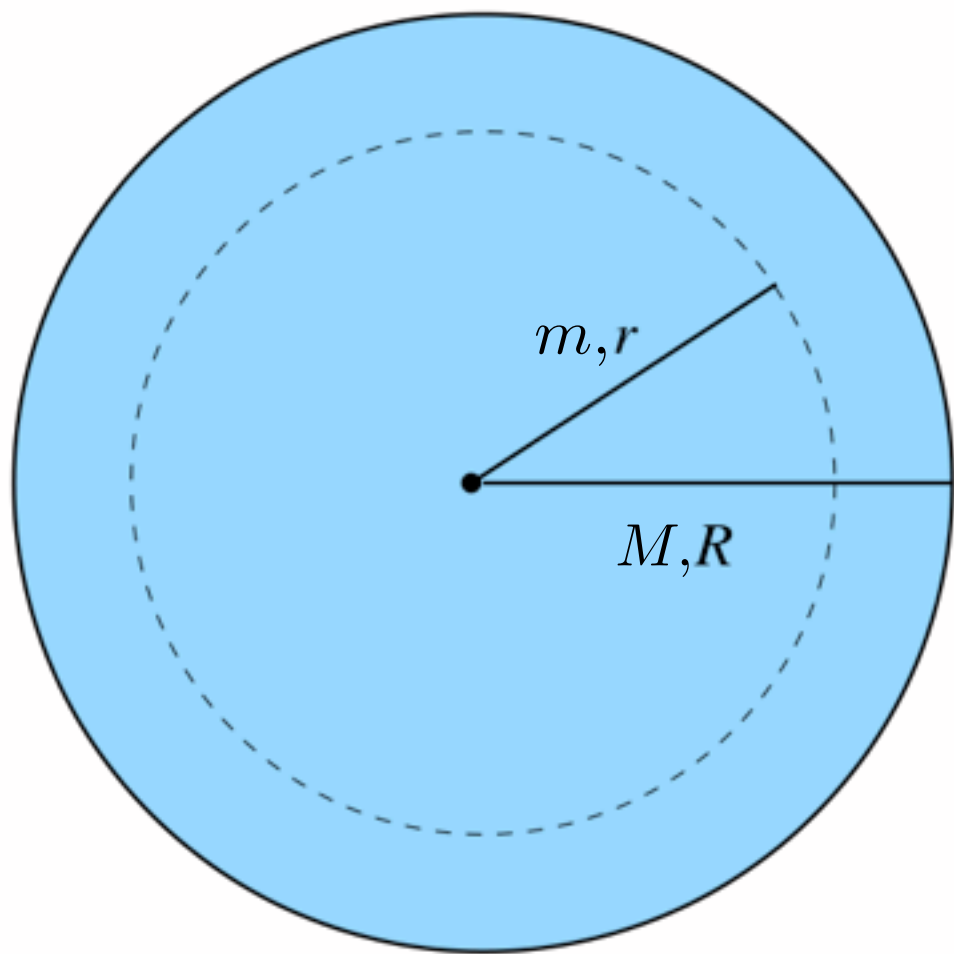
Accurate prediction of **observable** signal(s)

Relation to microscopic models of strongly-
interacting matter

**Astrophysics probes
phase of hot and dense
matter ?**

Complementary to heavy-ion collisions





$$\frac{dP}{dr} \propto -G \frac{m(r)}{r^2} \left(\varepsilon + \frac{P}{c^2} \right)$$

$$\frac{dm}{dr} = 4\pi r^2 \varepsilon$$

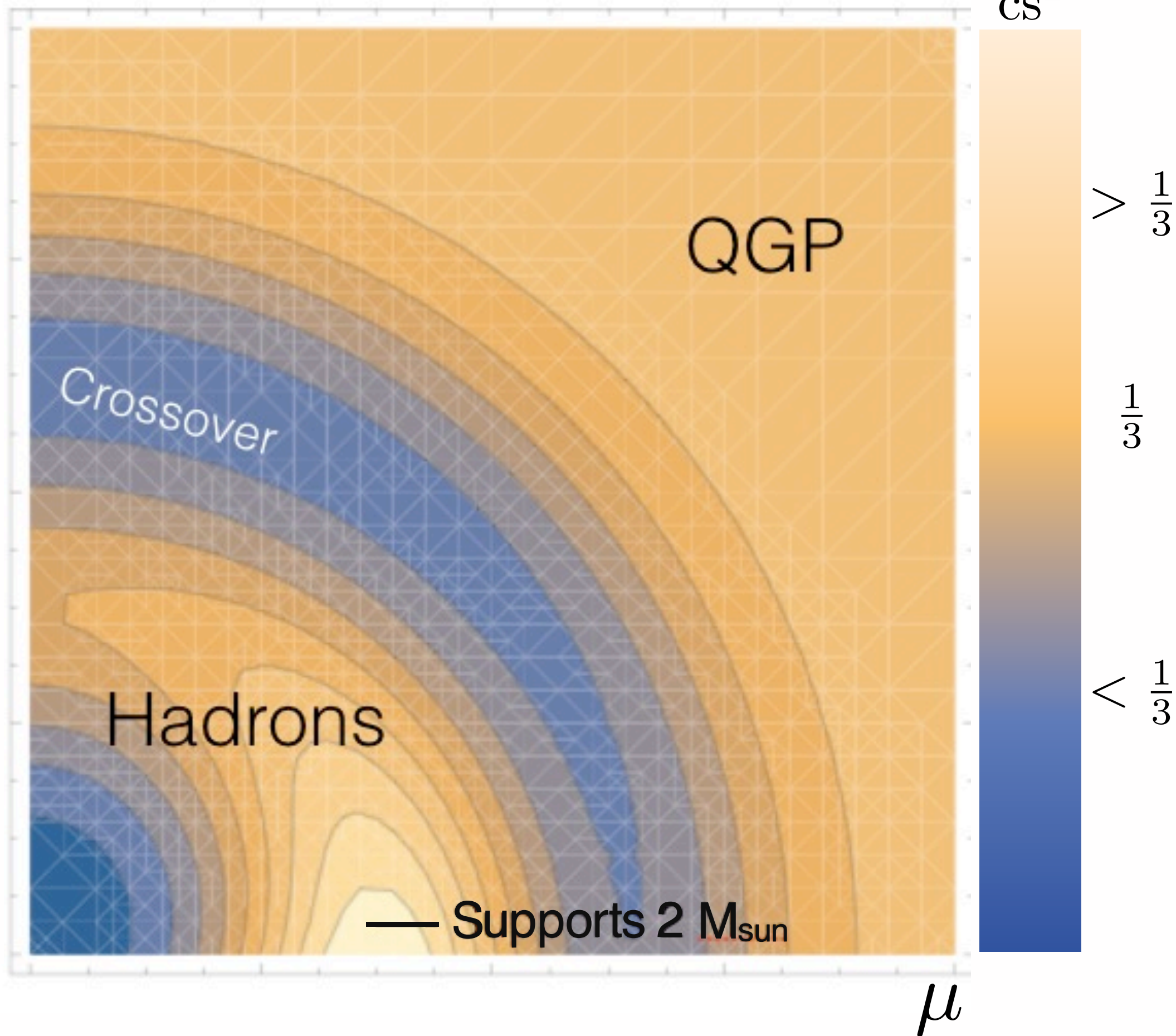
$$\left. \vphantom{\frac{dP}{dr}} \right\} c_s^2 = c^2 \left. \frac{\partial P}{\partial \varepsilon} \right|_{s=\text{const.}}$$

$$P_{\max} = P|_{r=0}, \quad P|_{r=R} = 0,$$

$$\rho_{\max} = \rho|_{r=0}, \quad \rho|_{r=R} = 0$$

PSR J0348+0432: $2.01 \pm 0.04 M_{\odot}$

T



c_s^2

QGP

Crossover

Hadrons

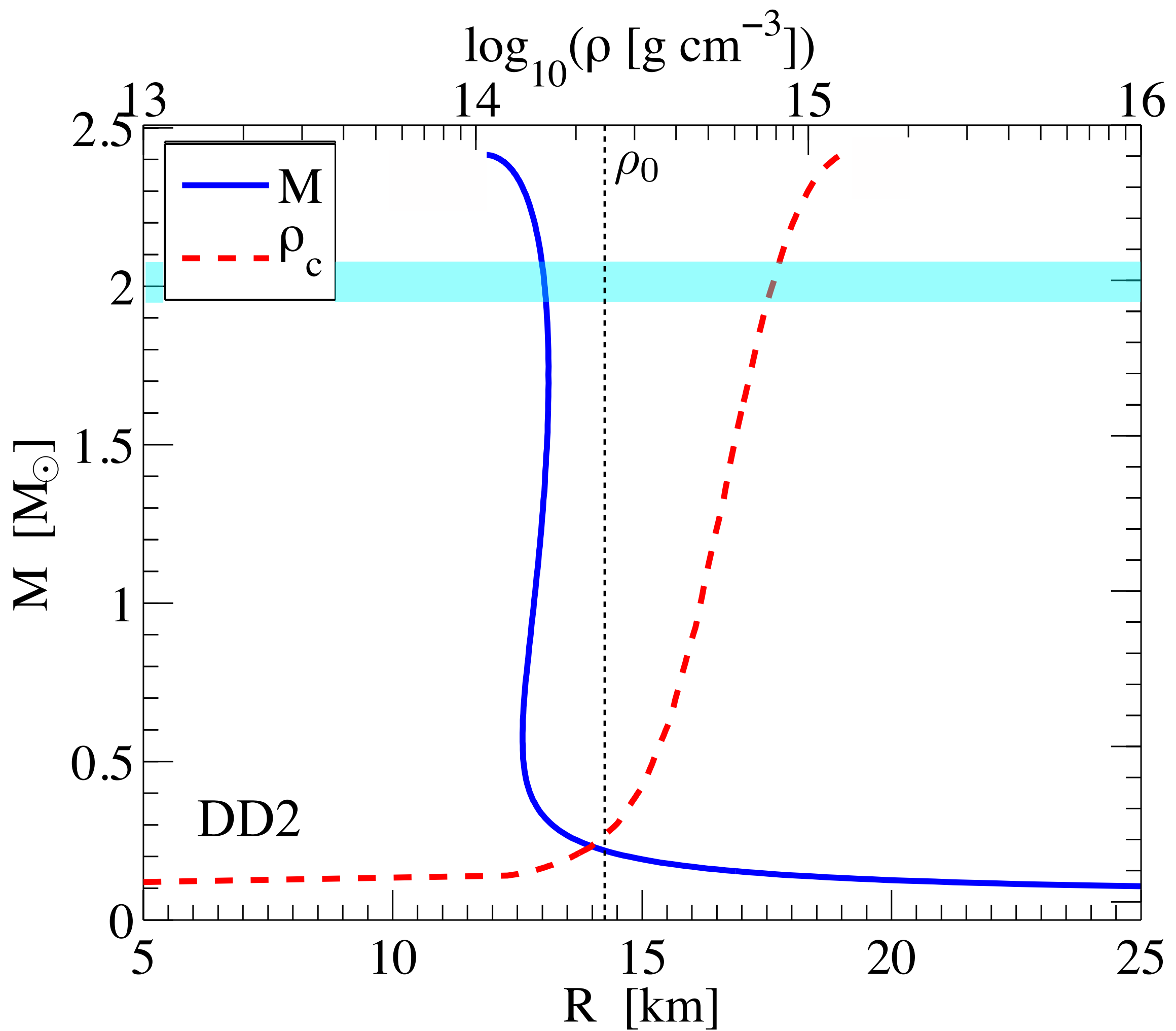
— Supports $2 M_{\text{sun}}$

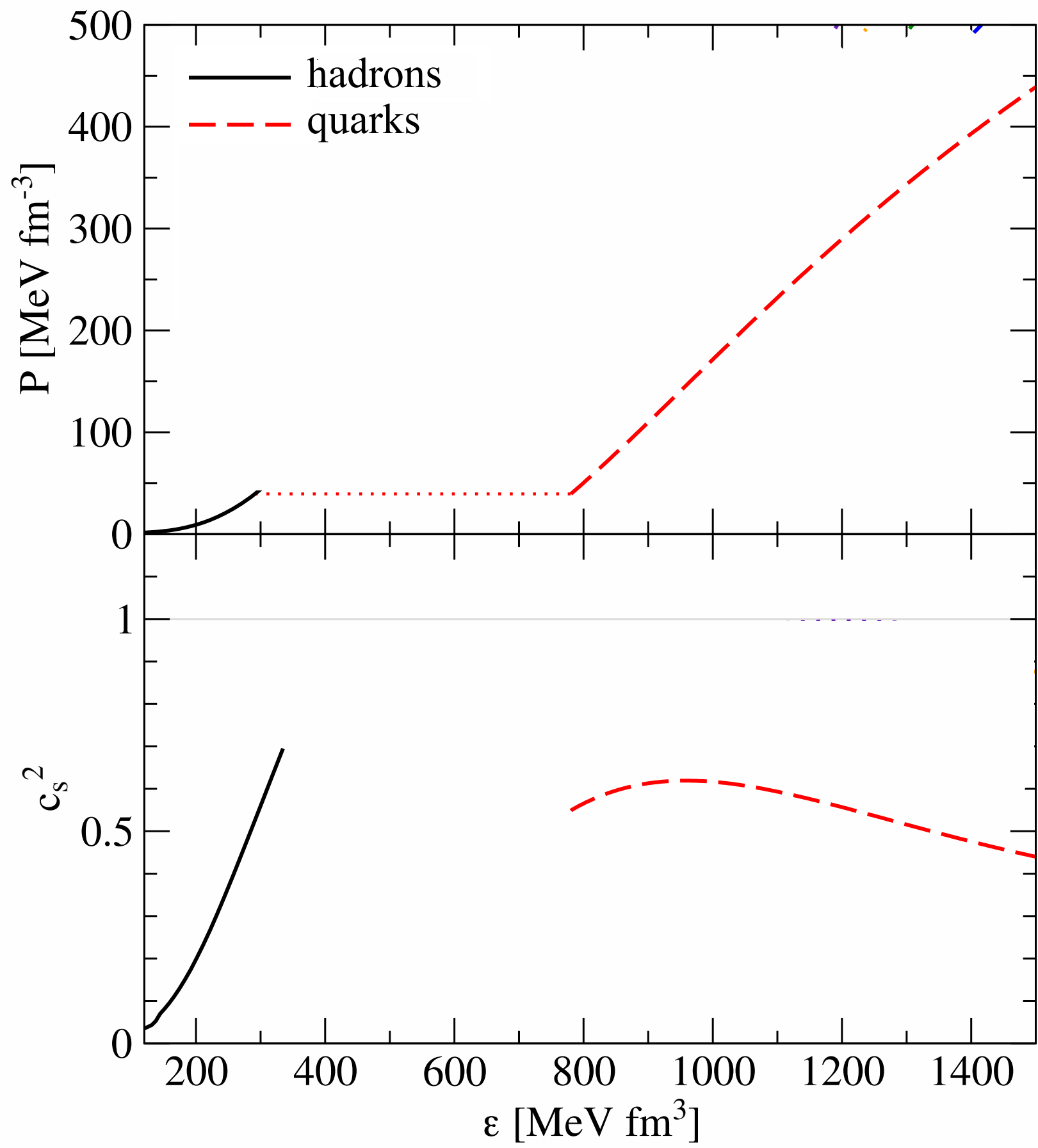
μ

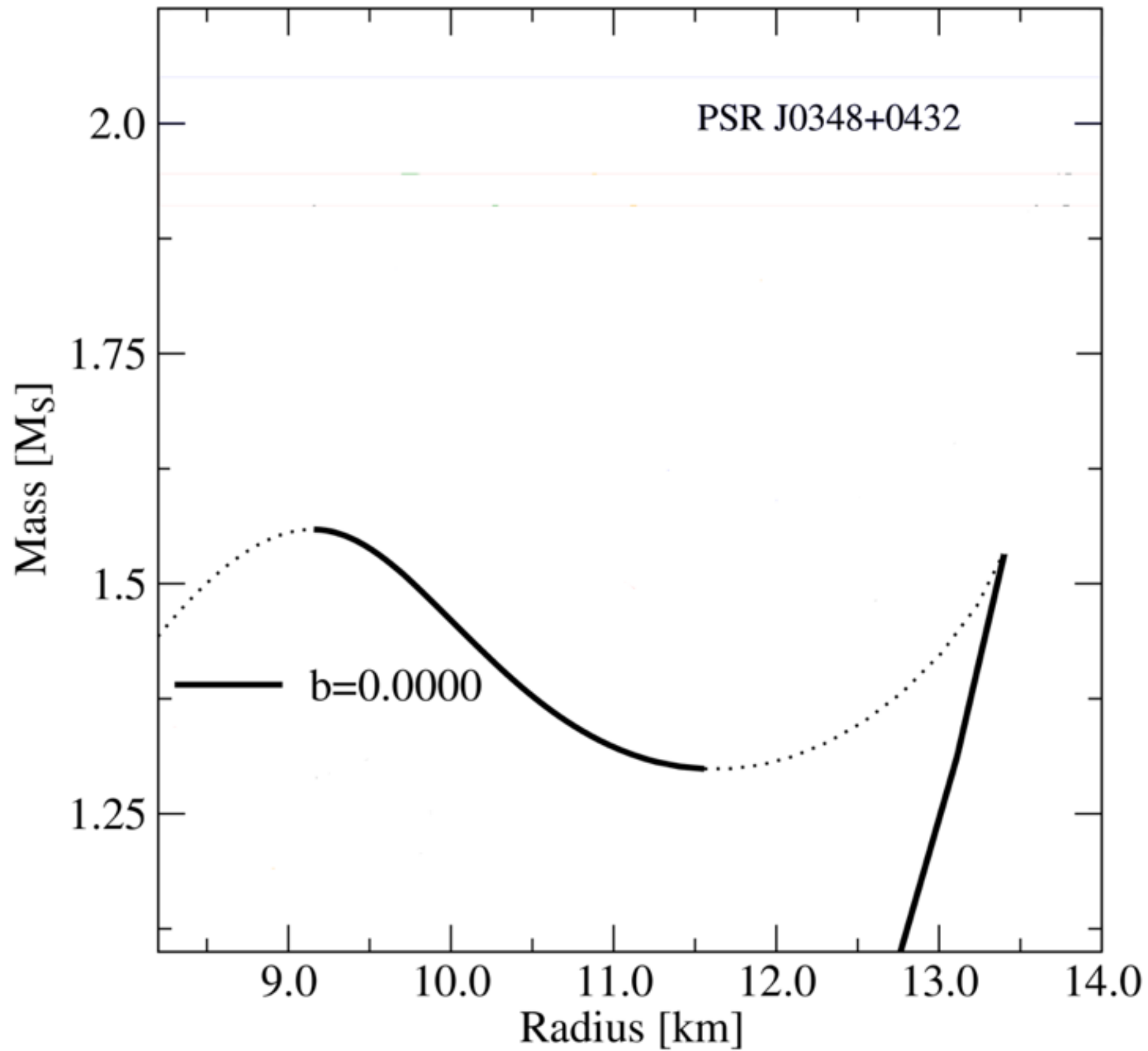
$< \frac{1}{3}$

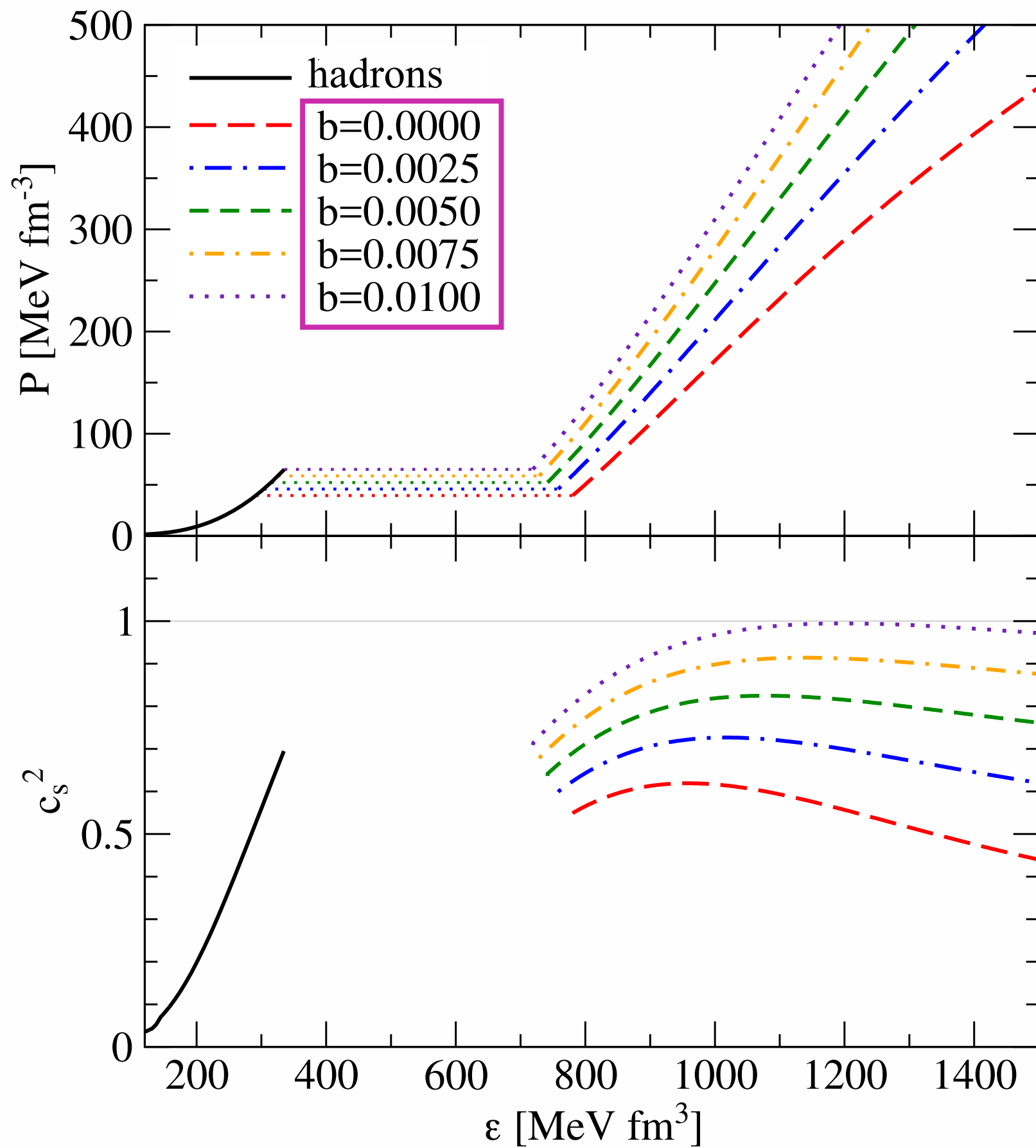
$\frac{1}{3}$

$> \frac{1}{3}$

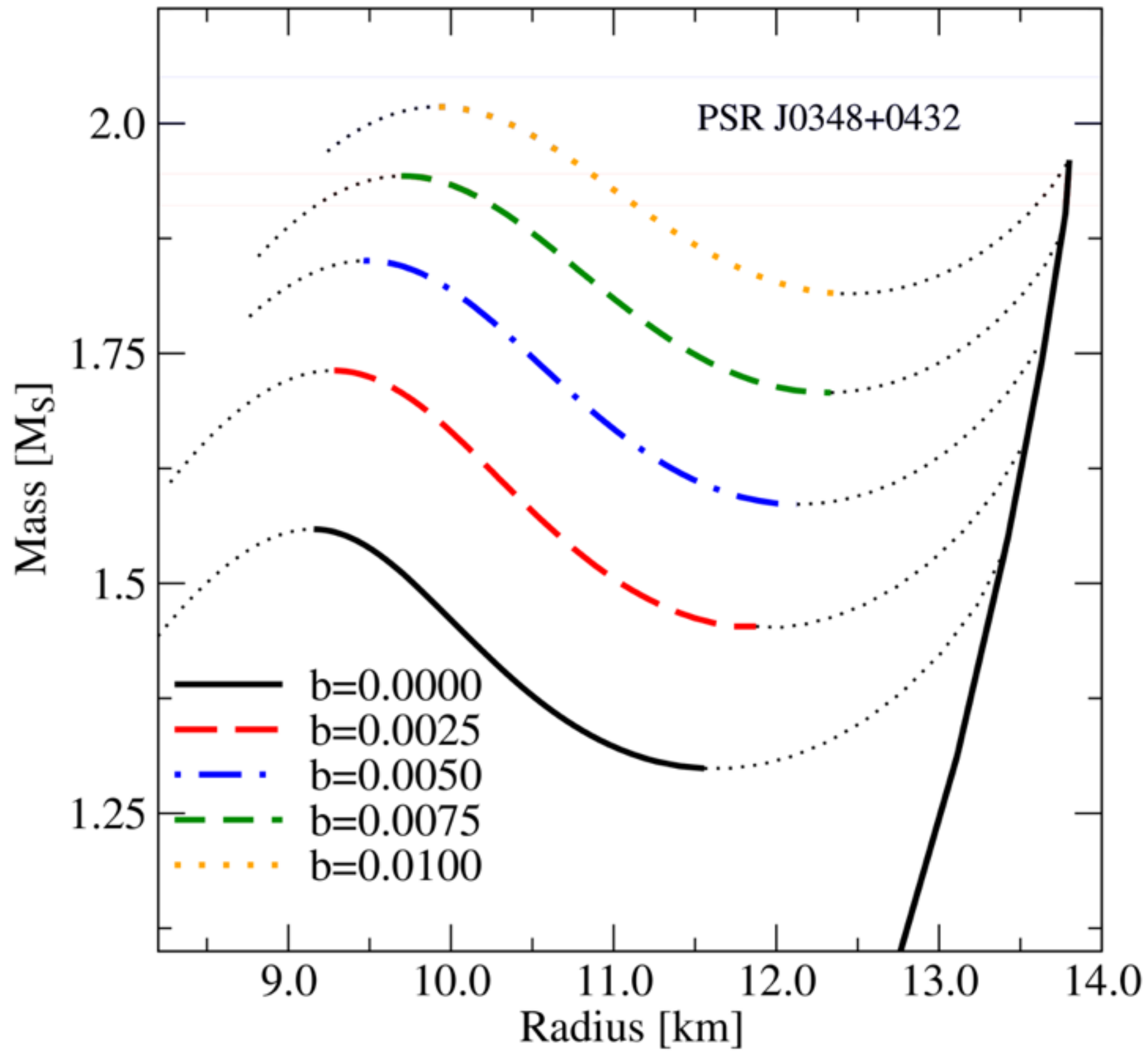


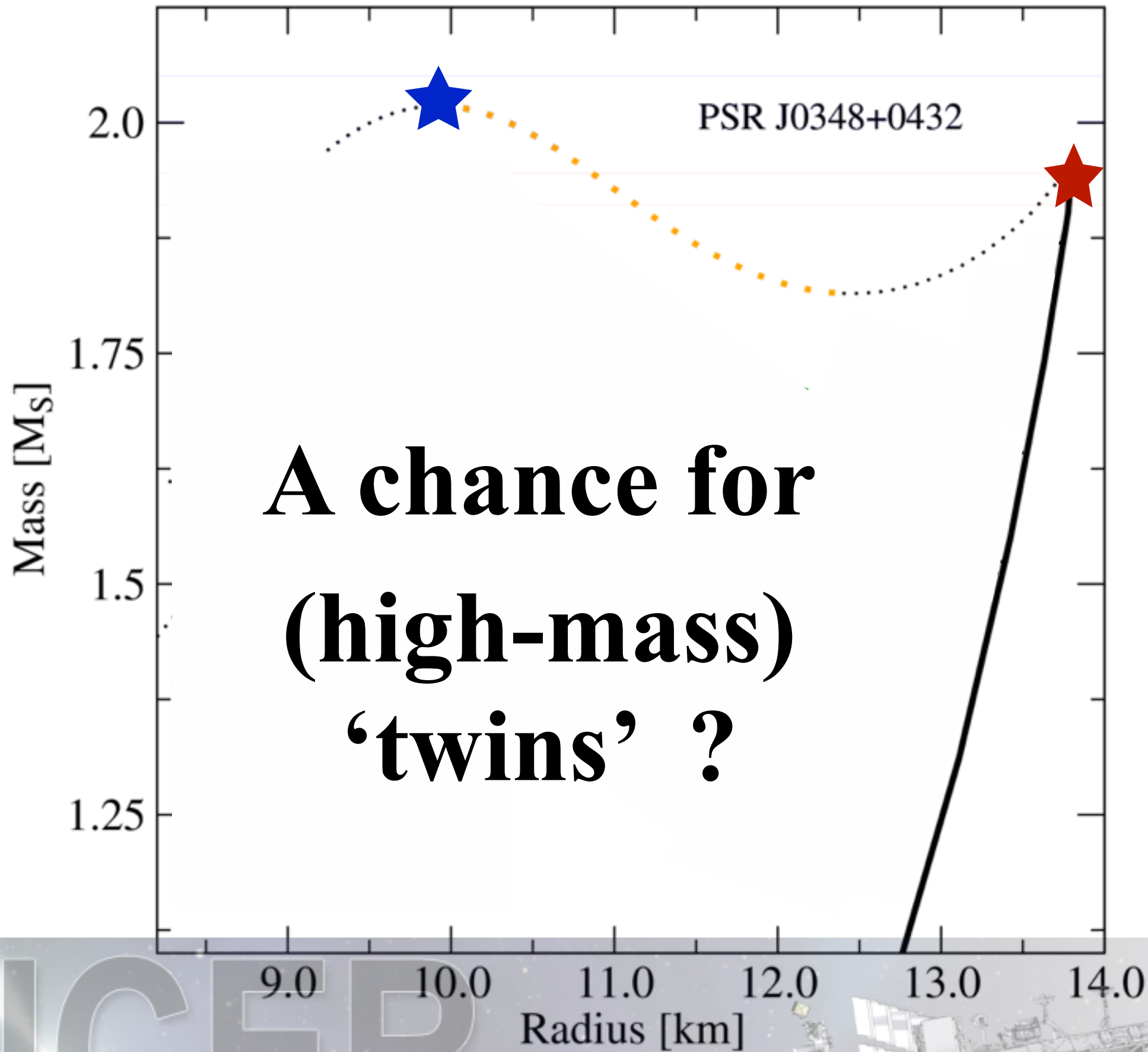




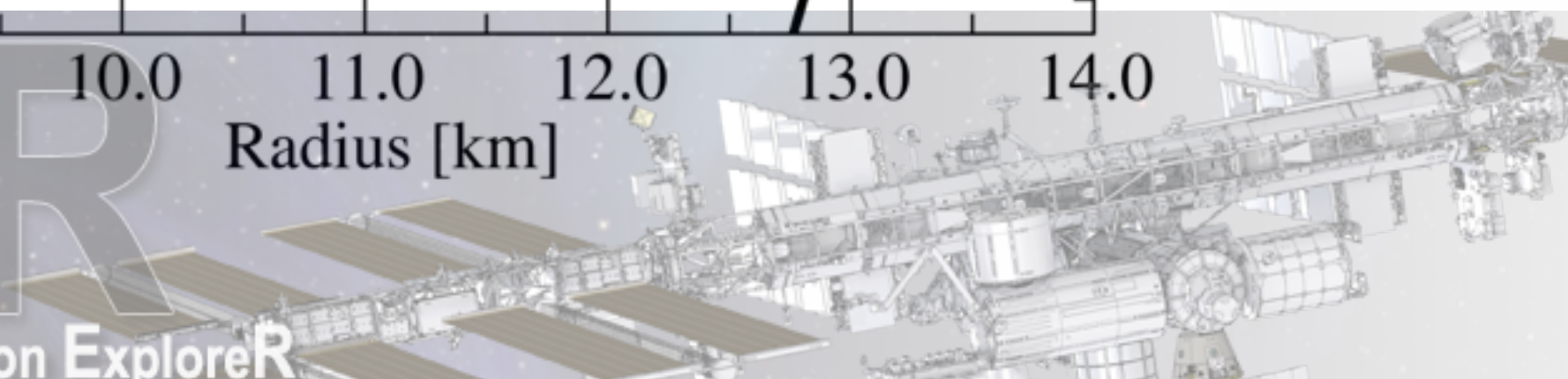


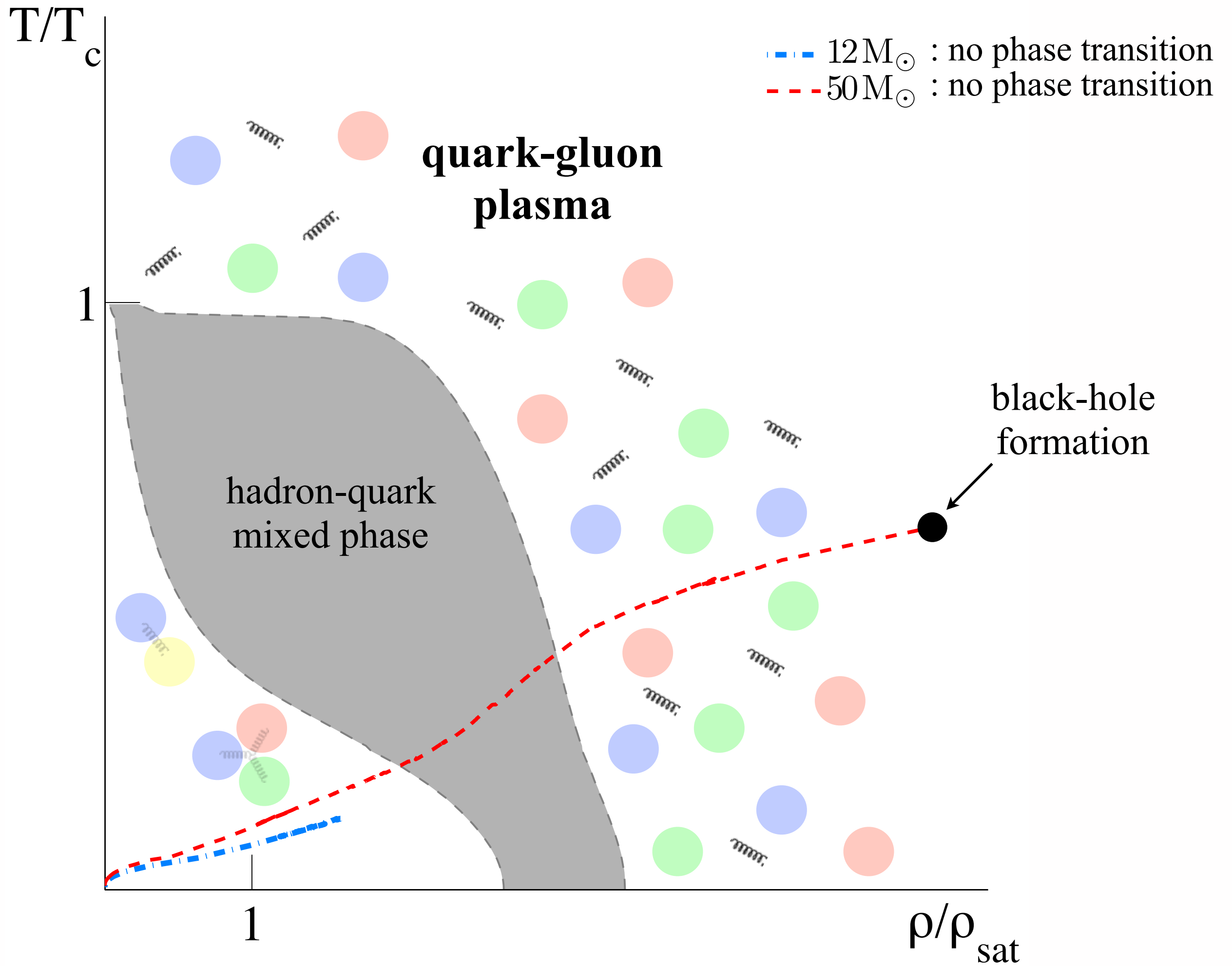
repulsive vector interaction: $\mu^* = \mu - b\rho$

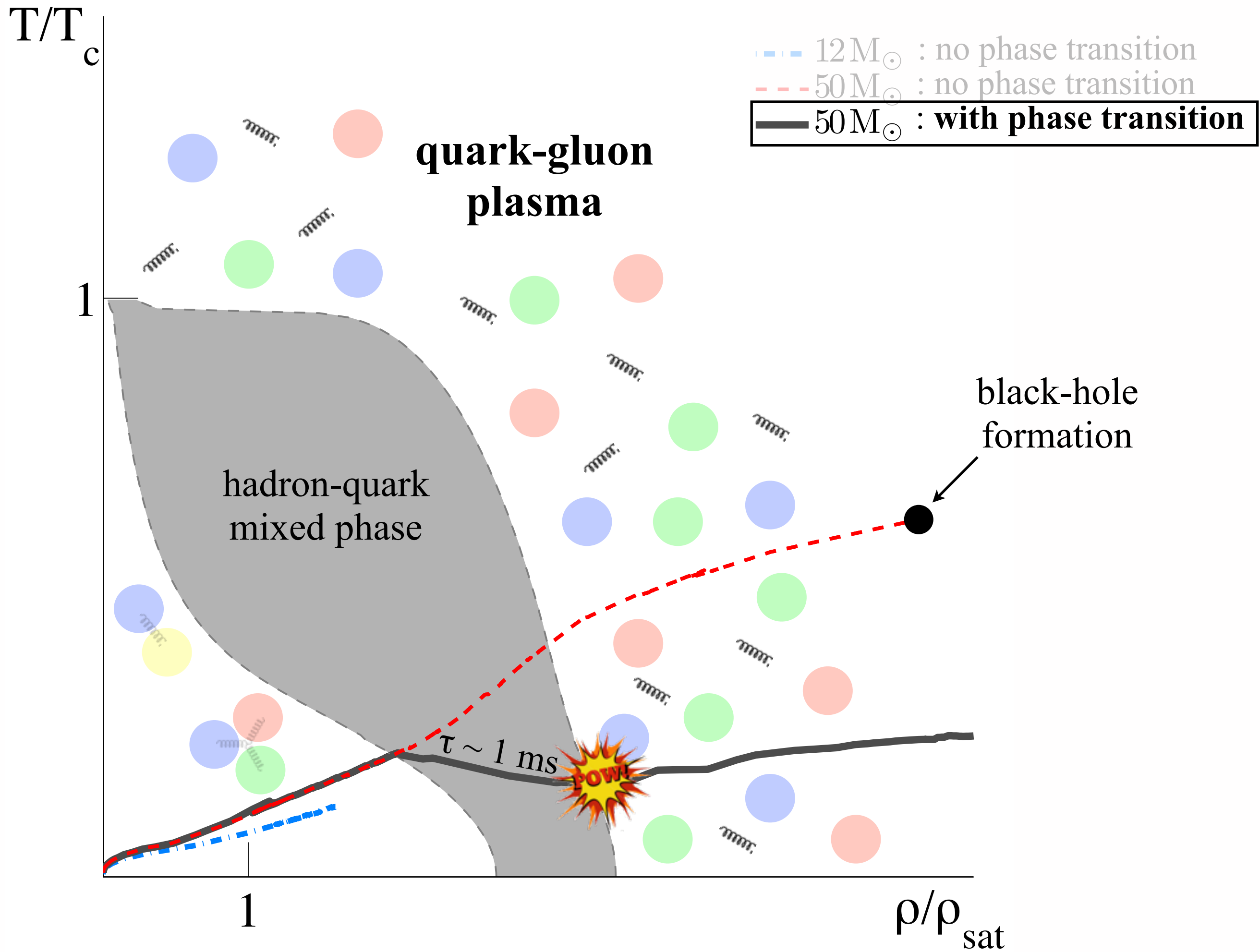




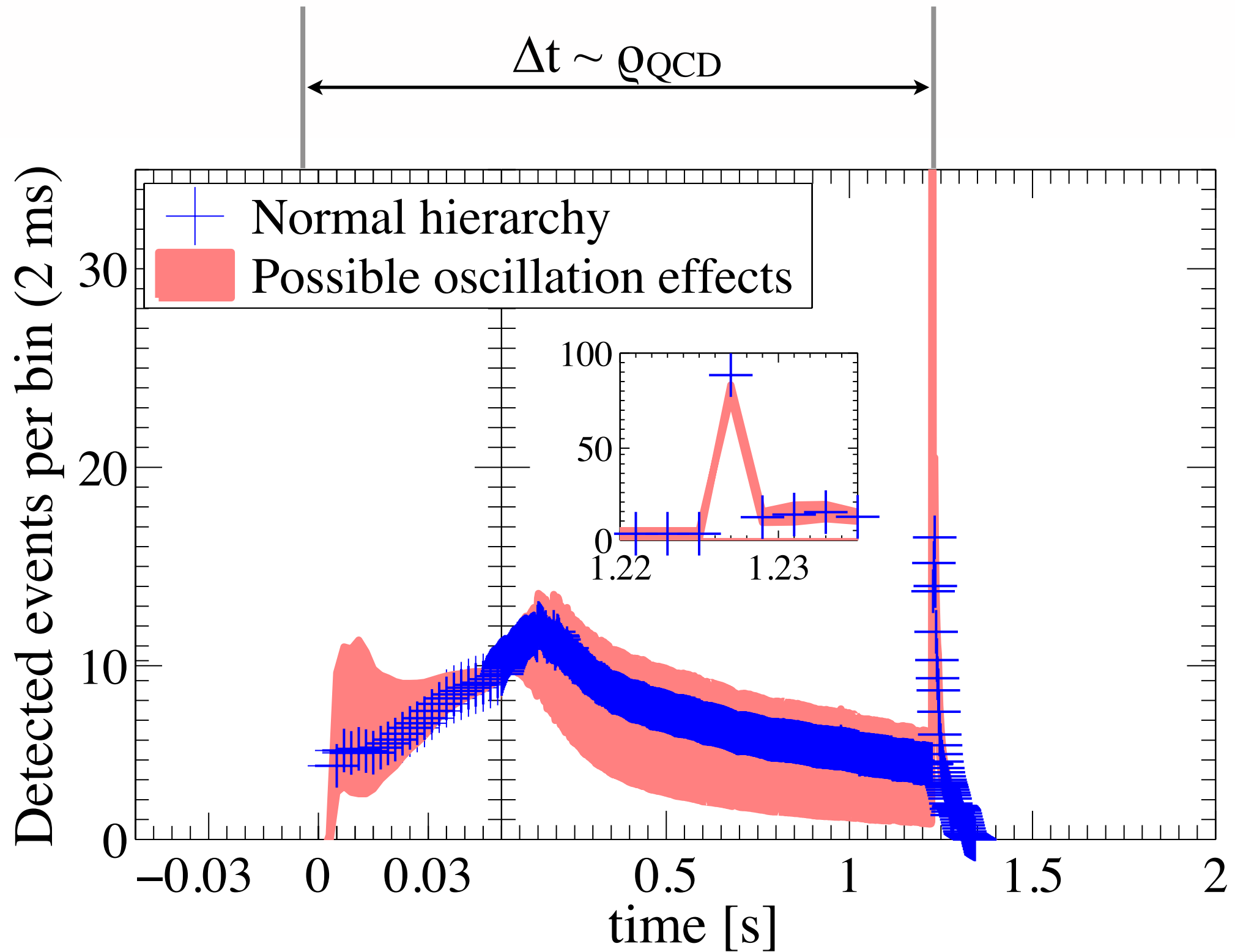
**A chance for
(high-mass)
'twins' ?**

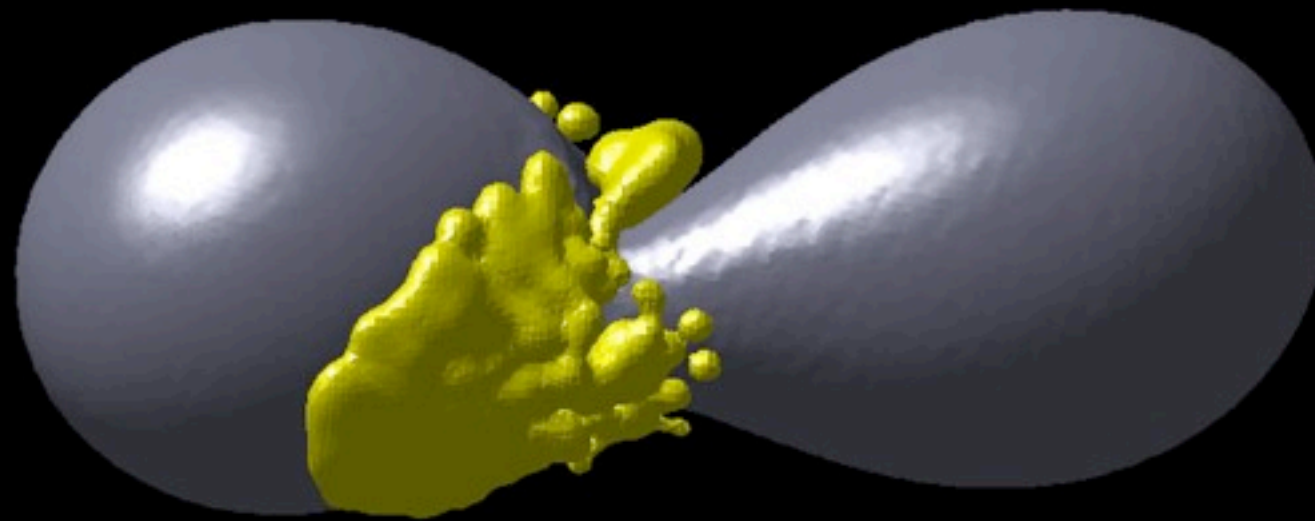






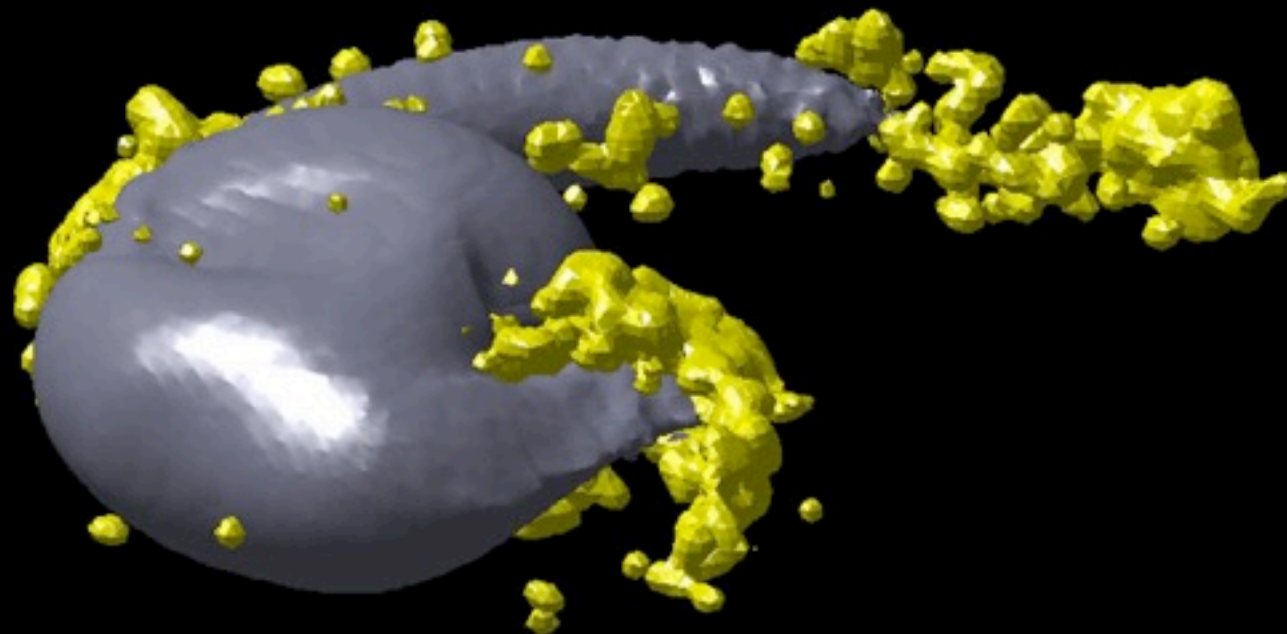
ν – signal @ Super-Kamiokande ($d \sim 10$ kpc)





Lattimer et al.,(1974) ApJ 192, L145

1st binary neutron star merger
detection: **GW170817**

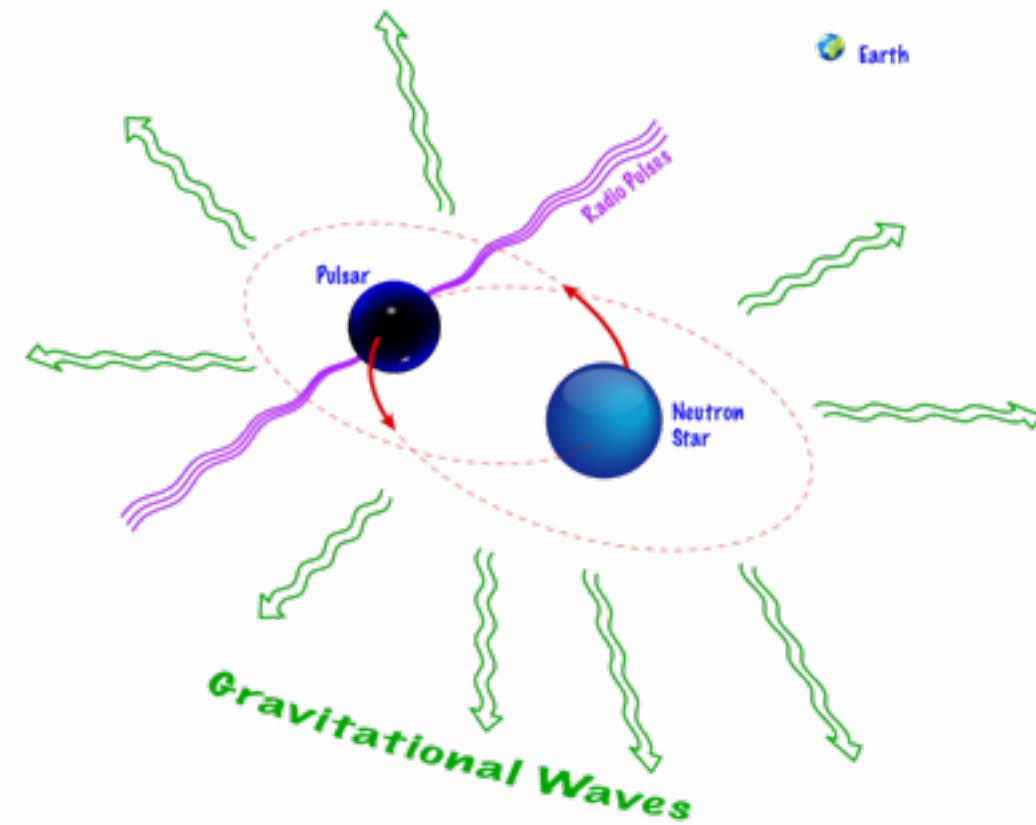
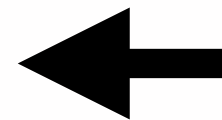
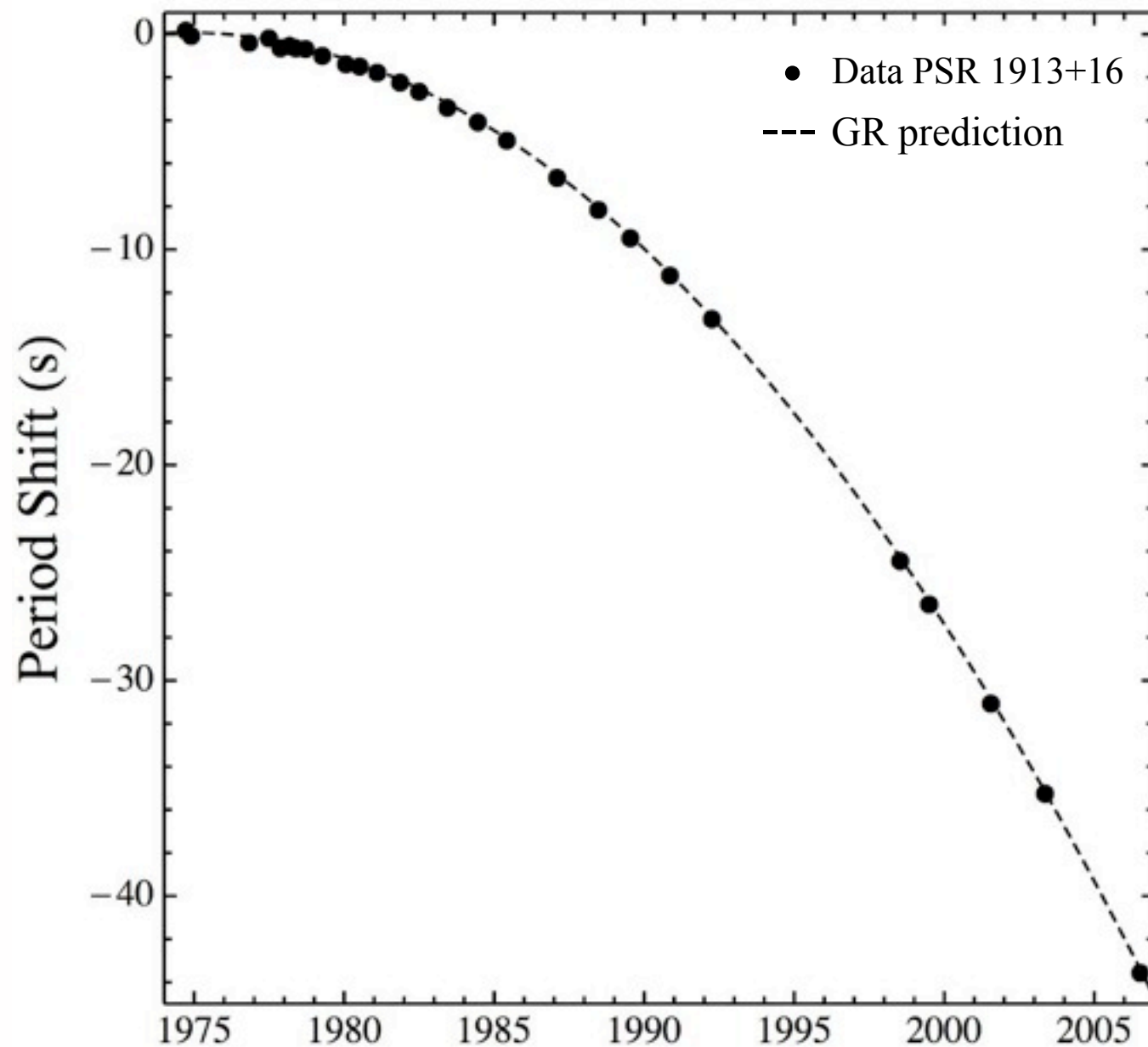




The Nobel Prize in Physics 1993

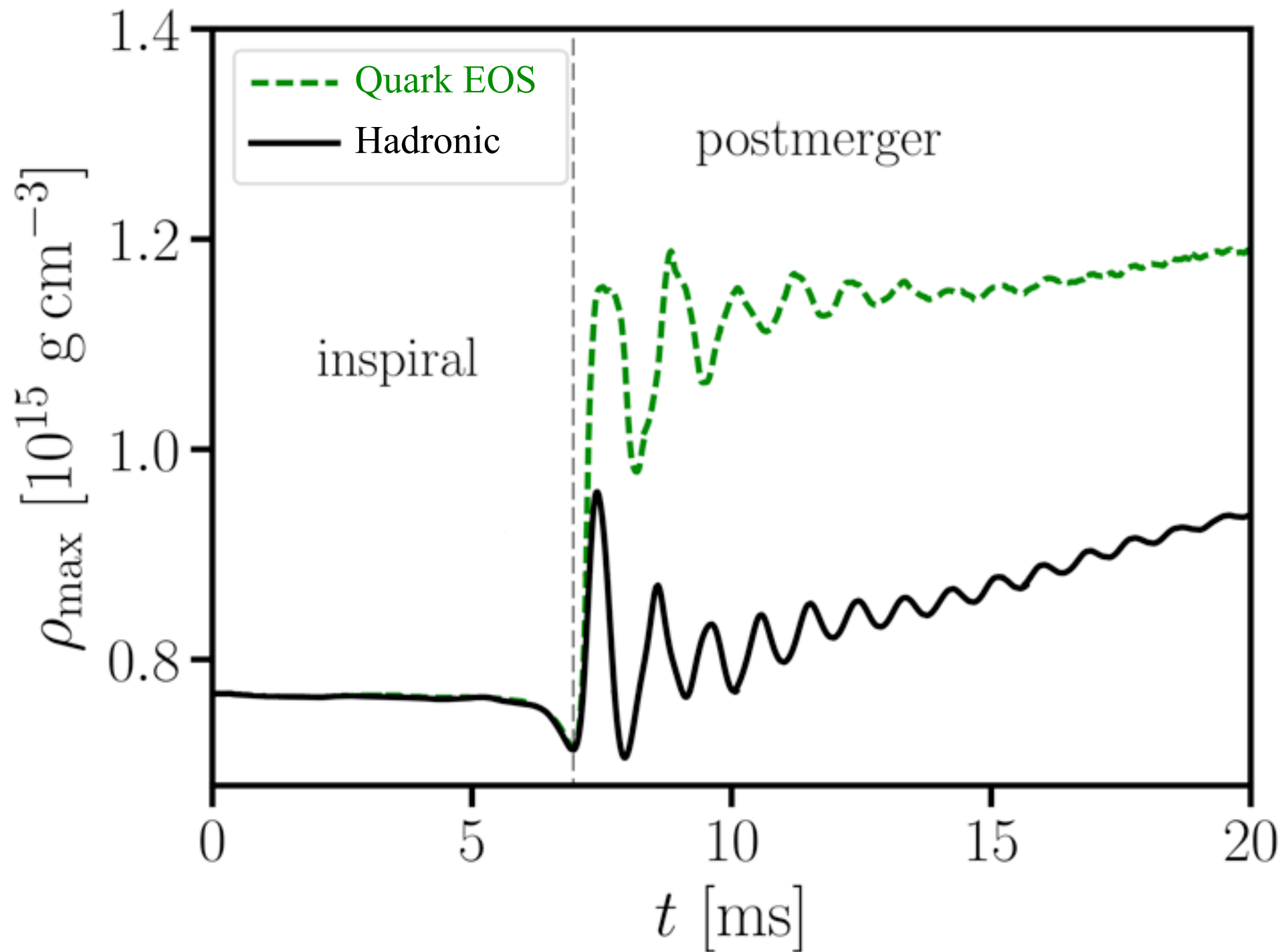
Russell A. Hulse, Joseph H. Taylor Jr.

"for the discovery of a new type of pulsar, a discovery that has opened up new possibilities for the study of gravitation"



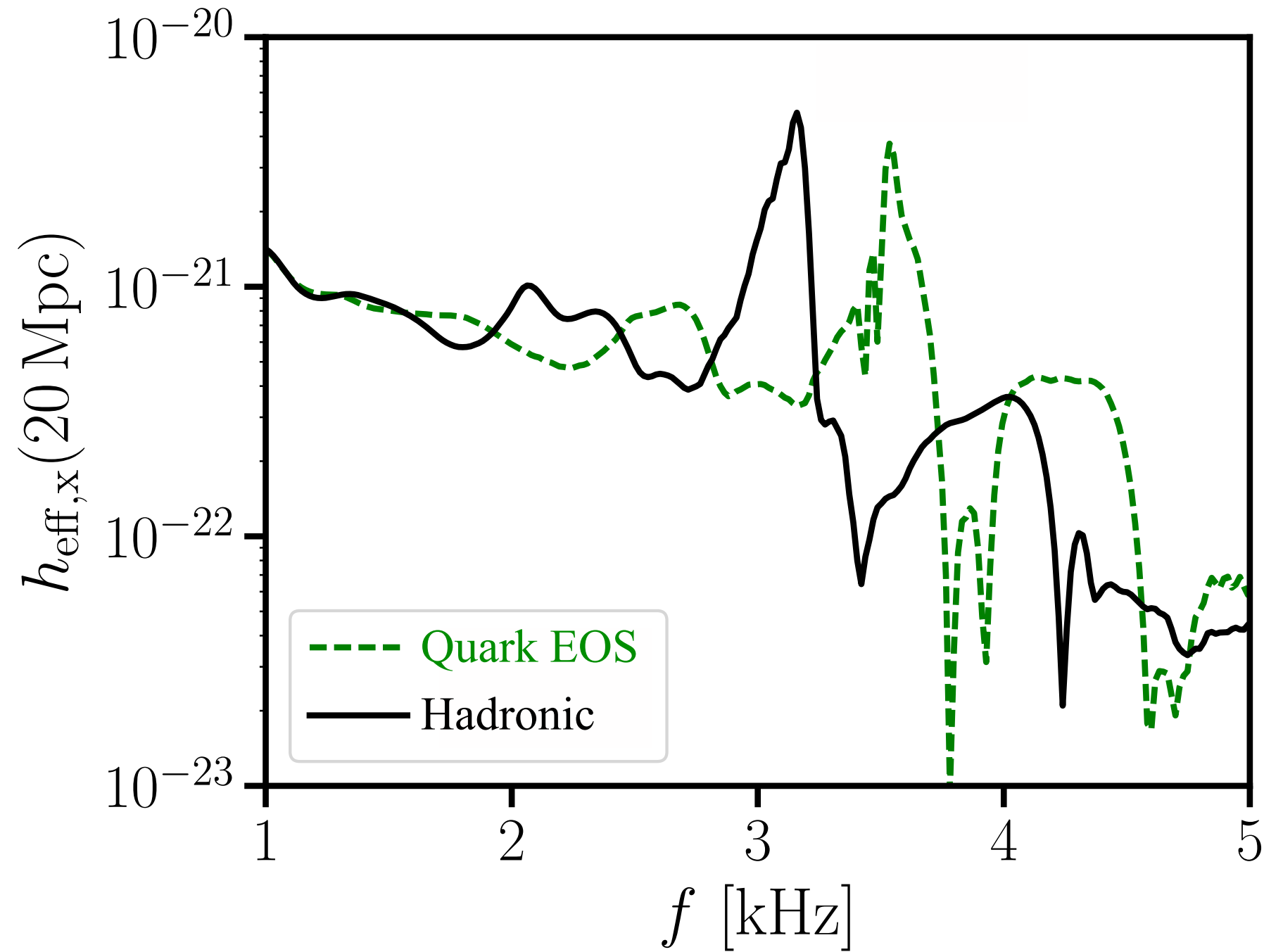
$1.35 \times 1.35 M_{\odot}$

1st-order phase transition

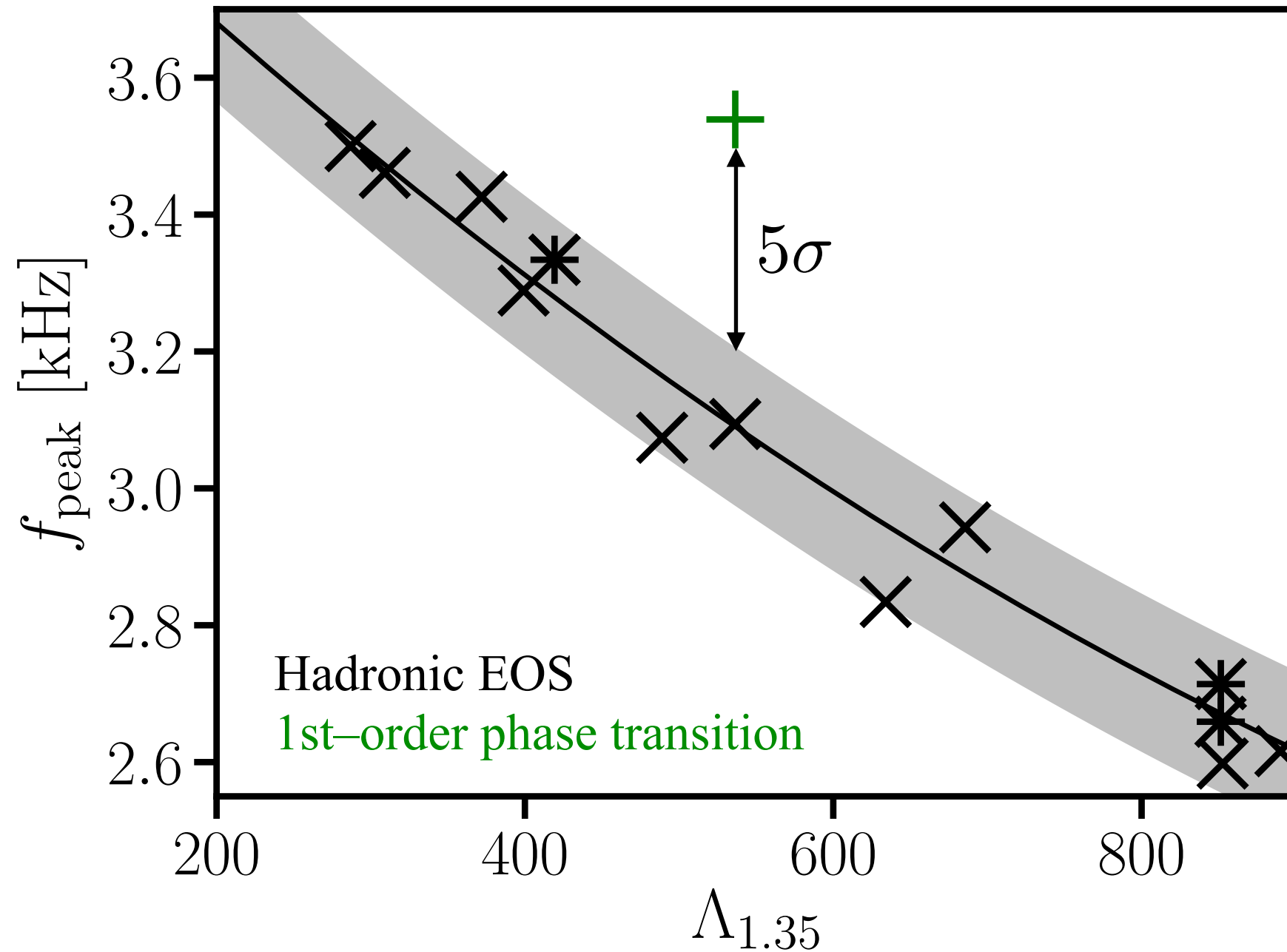


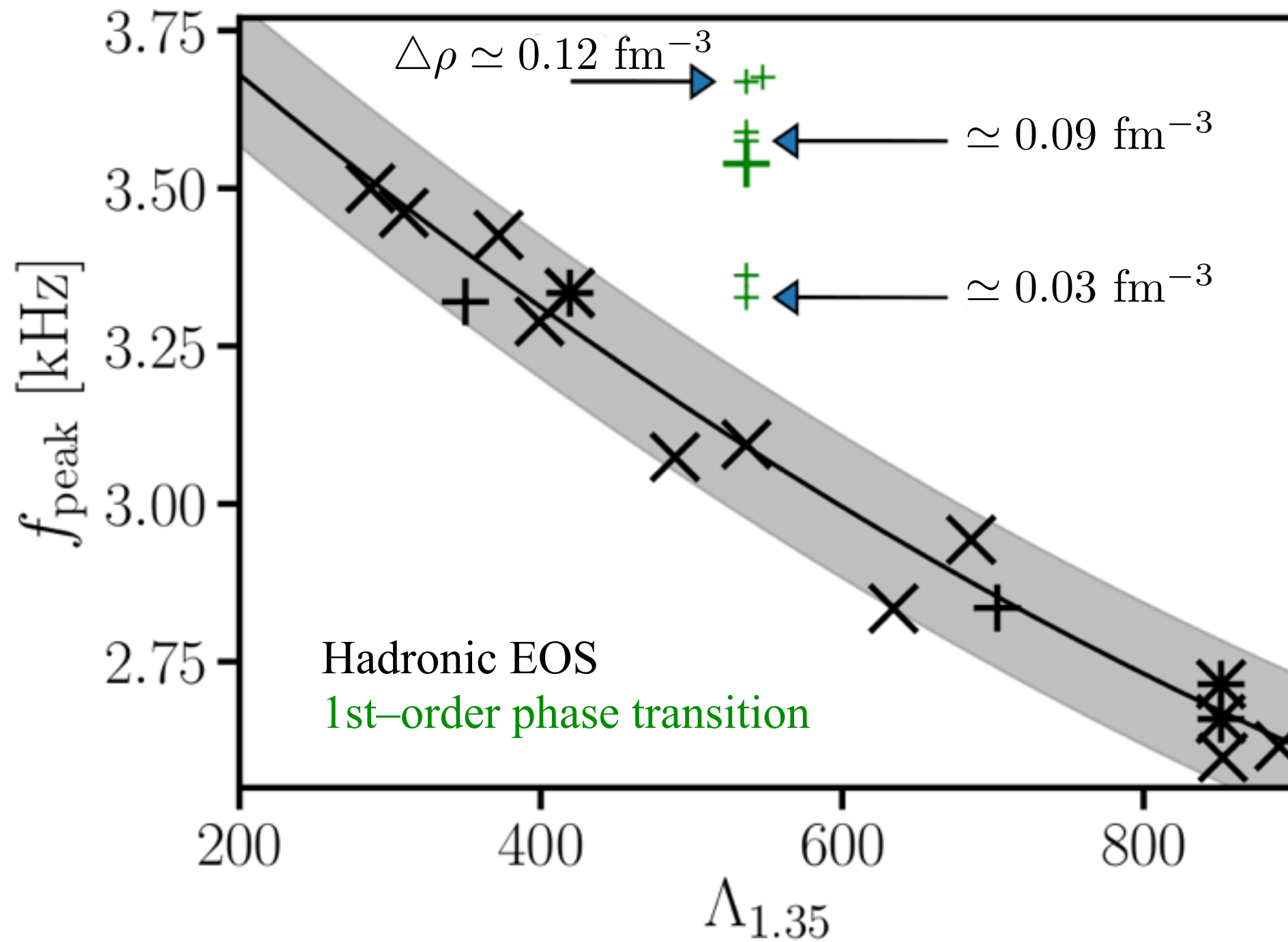
$1.35 \times 1.35 M_{\odot}$

1st-order phase transition



$$f_{\text{peak}} \neq (6.486 \times 10^{-7} \Lambda^2 - 2.231 \times 10^{-3} \Lambda + 4.1) \text{ Hz}$$





Observations of neutron star radii

Novel road to supernova explosions
of *very* massive stars $\gtrsim 40 - 50 M_{\odot}$

Remnants: *massive* neutron stars $\sim 2 M_{\odot}$

Signature for 1st-order phase transition: ν -burst

GW-signal from binary neutron star mergers

Wroclaw Supernova Project

Thanks for your attention

In collaboration with:

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