Was GW190814 a black hole – strange quark star system?

Domenico Logoteta

University of Pisa

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In collaboration with:

Ignazio Bombaci (University of Pisa)

Alessandro Drago (University of Ferrara)

Giuseppe Pagliara (University of Ferrara)

Isaac Vidaña (INFN Catania)

Outlook

- What about the GW190814 event?
- EOS of hadronic stars
- EOS of strange quark stars
- Conclusions

The GW190814 event

- Merging between a (22.2-24.3) $M_\odot$ BH and a compact object with mass around (2.50-2.67) $M_\odot$

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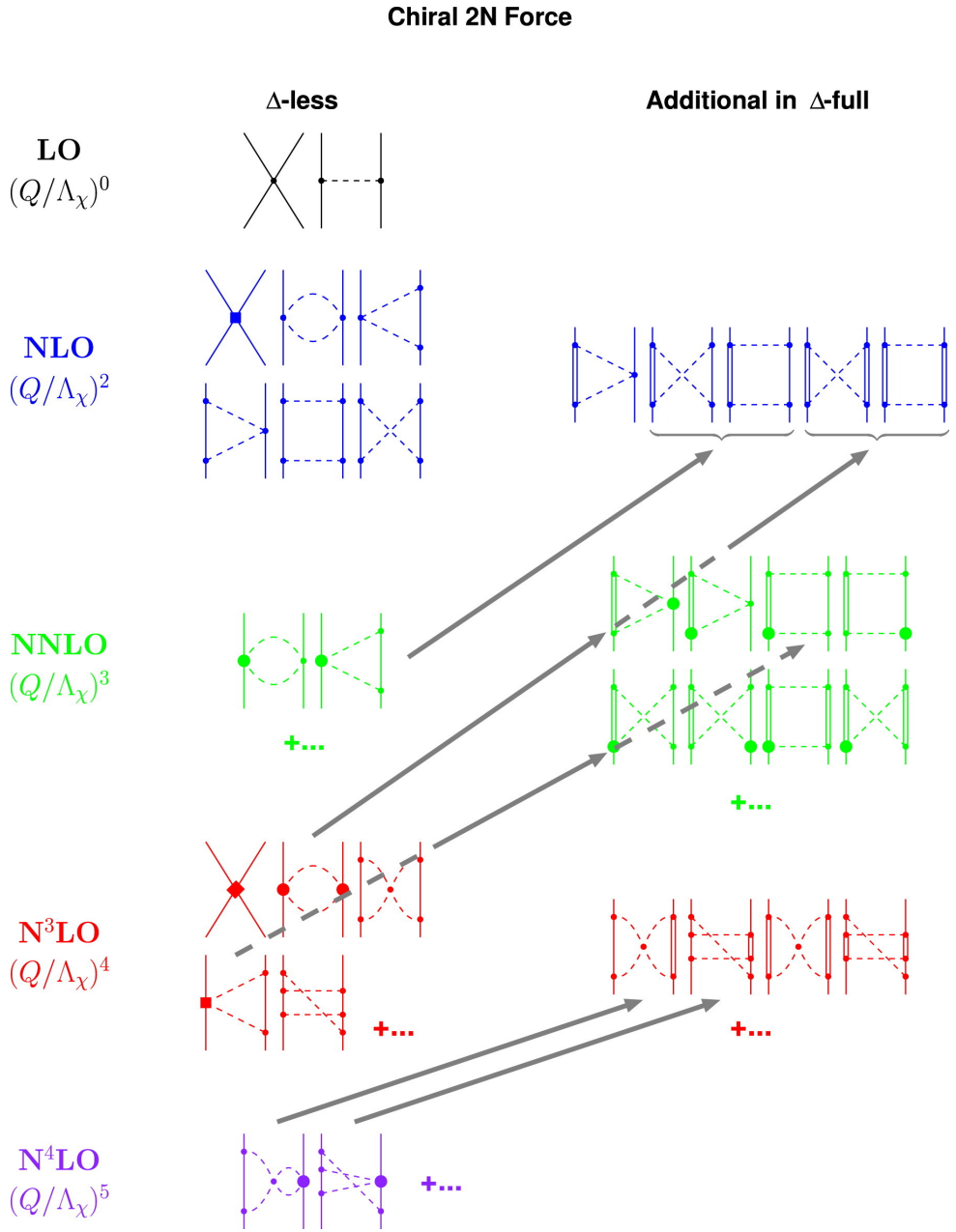
- Hadronic matter (NY): Microscopic BHF approach using ChEFT interactions, SFHo RMF model
- Quark matter: Phenomonological approach...see later

NN chiral forces



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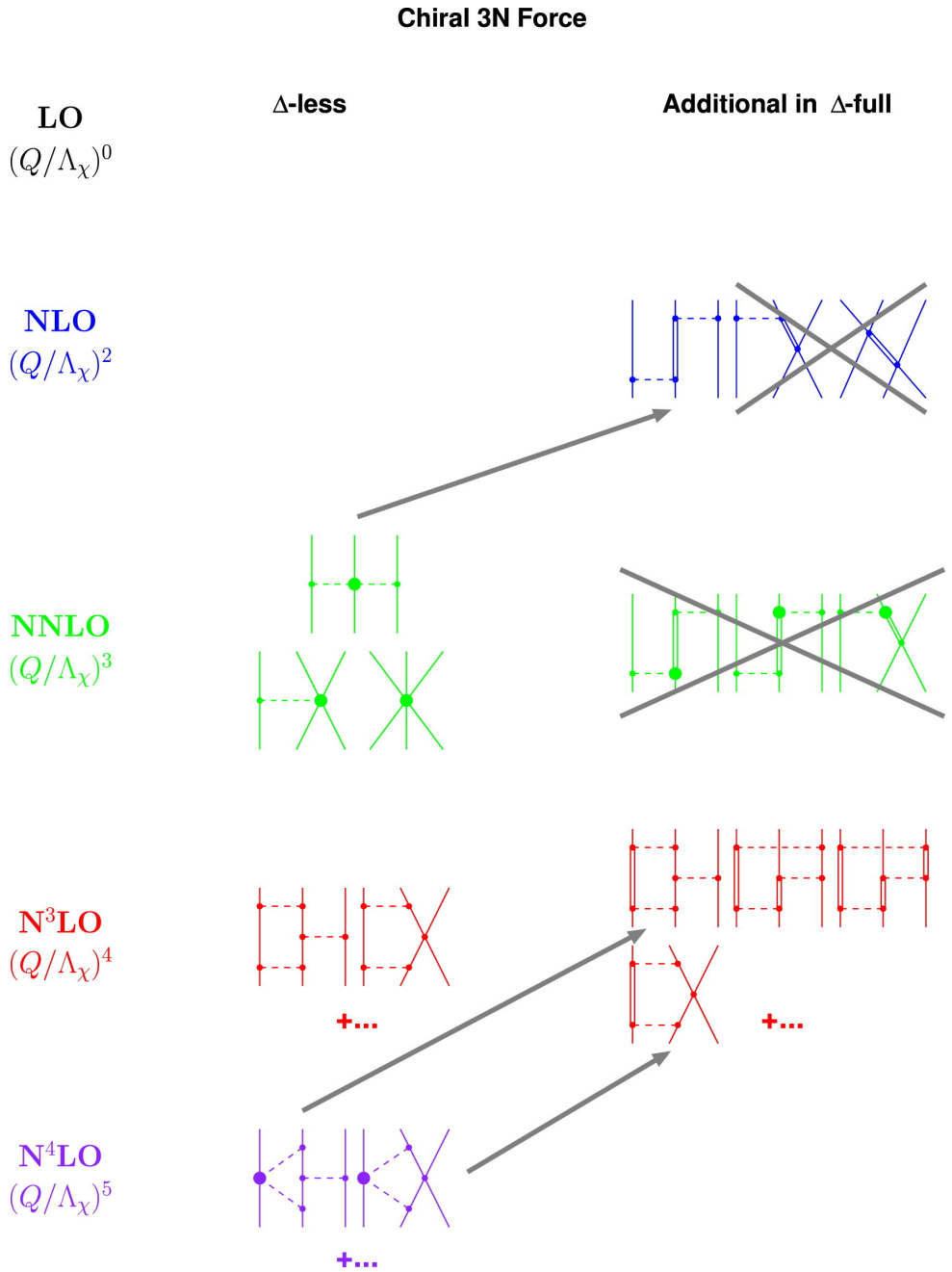
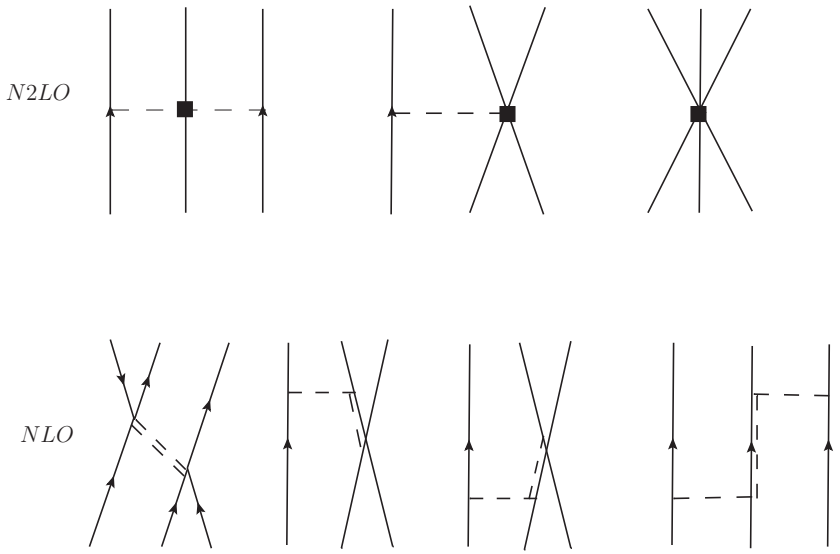


NNΛ force from ChPT



- Up to N2LO just 1 LEC $\Rightarrow$ fixed to $U_\Lambda(k=0) = (-28,\ -30)$ MeV

- Following Petschauer (2013)
- Baryonic three-body forces from chiral effective field theory
- Nonvanishing leading order contributions at order NLO and N2LO
- Same strategy used for nuclear matter
- Effective NΛ interaction from bare NNΛ force
- Low energy constants estimated from decuplet saturation

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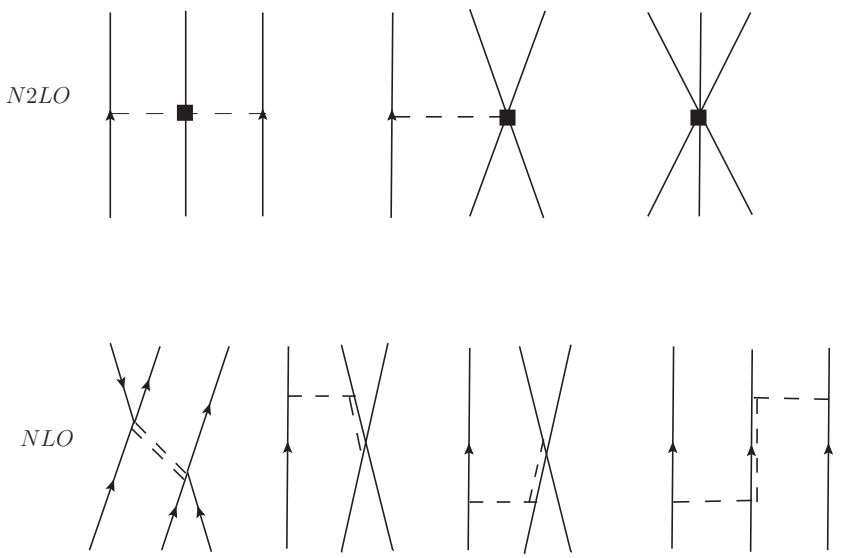

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- Separation energies of heavy hypernuclei improve!

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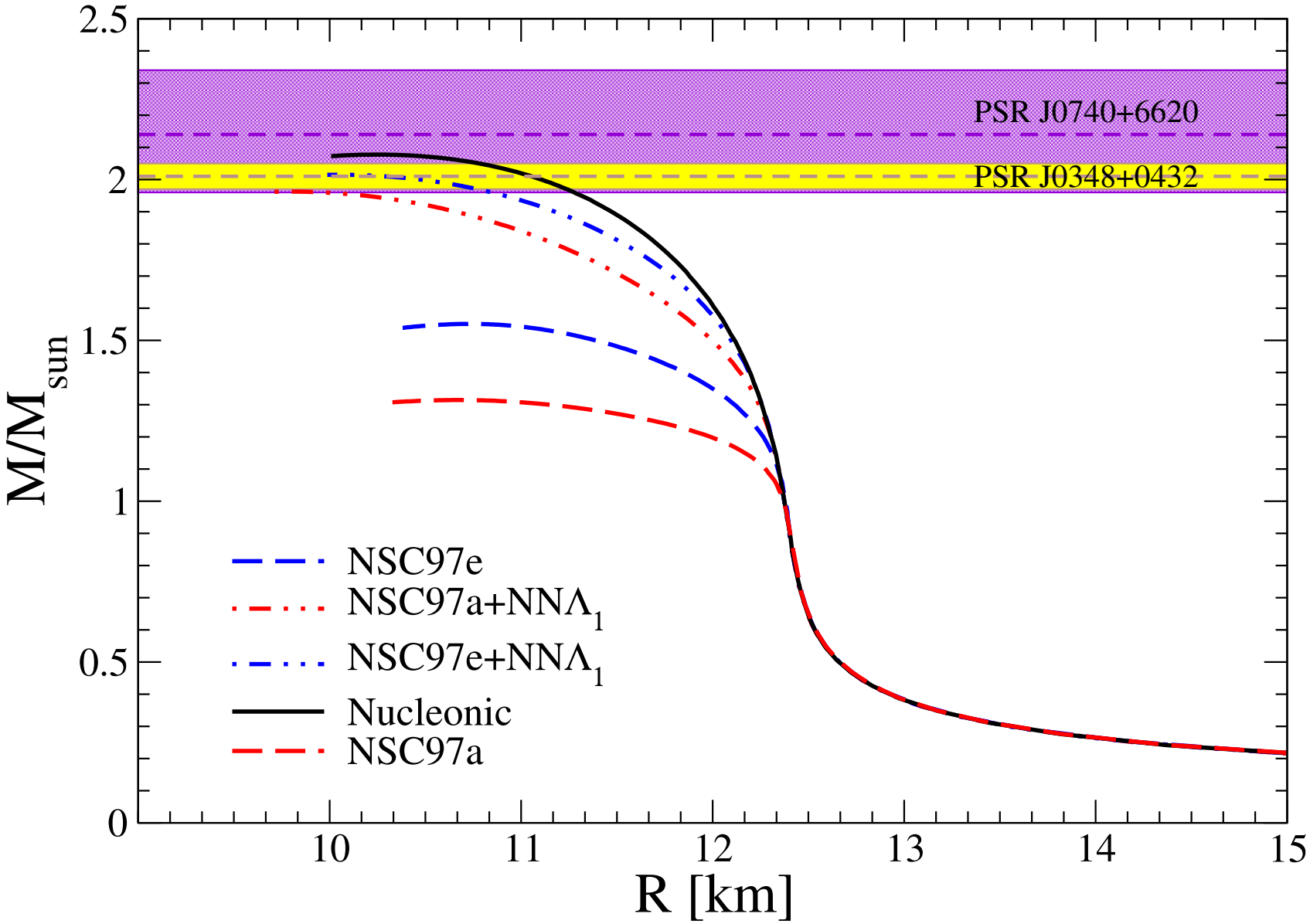
Neutron stars structure including Λ-hyperon



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- EOS $\Rightarrow$ MIT bag model + NP correction + SC.

- External parameter: B (Bag constant) $\Rightarrow$ "vacuum" pressure $\Rightarrow$ phenomenological description of confinement
- External parameter: Δ (quark Gap) $\Rightarrow$ quark pairing
- B, Δ $\Rightarrow$ adjusted to satisfy the Witten hypothesis on the absolute stability of SQM

- SQM absolute stability (Witten hypothesis)

$$\left(\frac{E}{A}\right)_{^{56}Fe} < \left(\frac{E}{A}\right)_{uds}$$

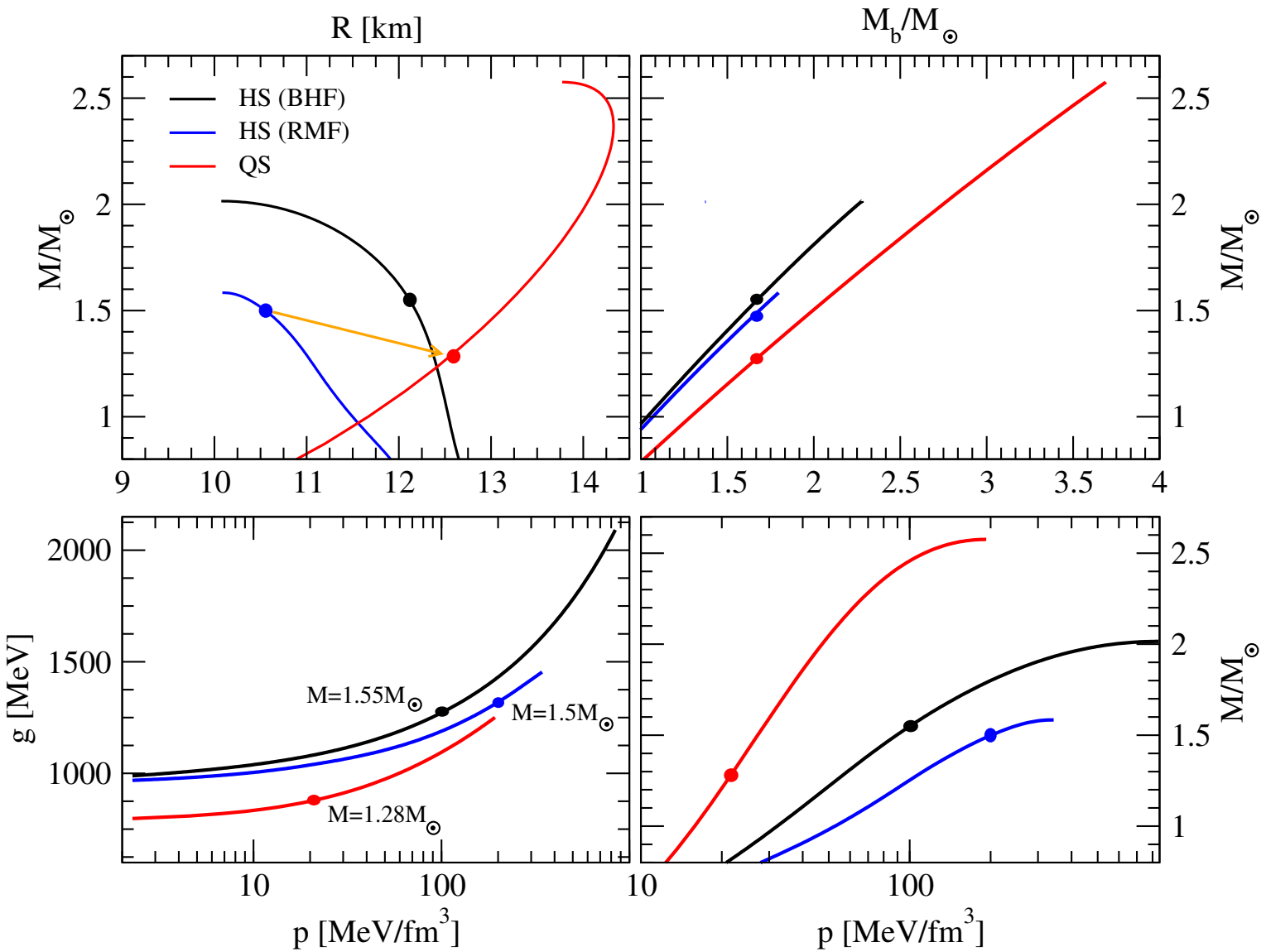
- Stability of ordinaty nuclei:

$$\left(\frac{E}{A}\right)_{ud} < \left(\frac{E}{A}\right)_{uds}$$

- We studied the conversion process:

$$HS \rightarrow QS$$

Conversion mechanism



I. Bombaci, A. Drago, D. Logoteta, G. Pagliara, I. Vidaña and I. Bombaci
Phys. Rev. Lett. 126, 162702

Conclusions

- Was GW190814 a black hole – strange quark star system?
- Lightest component: BH? $\rightarrow$ difficult to explain by stellar evolution...
- Lightest component: ordinary NS? $\rightarrow$ difficult to reconcile with low density nuclear physics
- Lightest component: SS? $\rightarrow$ plausible scenario but need to be confimed by: numerical simulations (ongoing) and if nature is nothing against SS (and we are very lucky) future observations.