Bayesian inference on quark matter from observations of neutron stars

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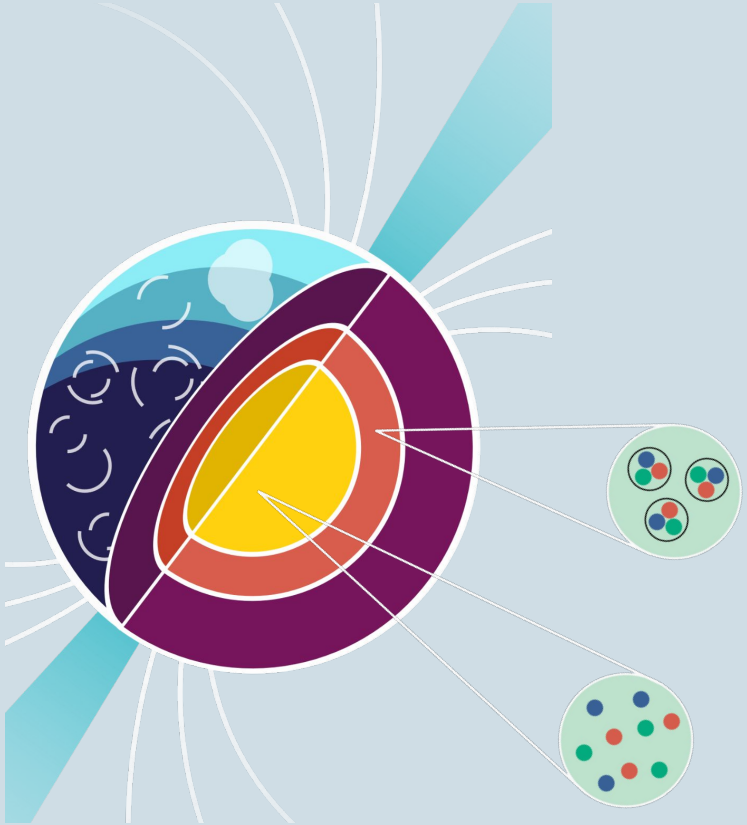
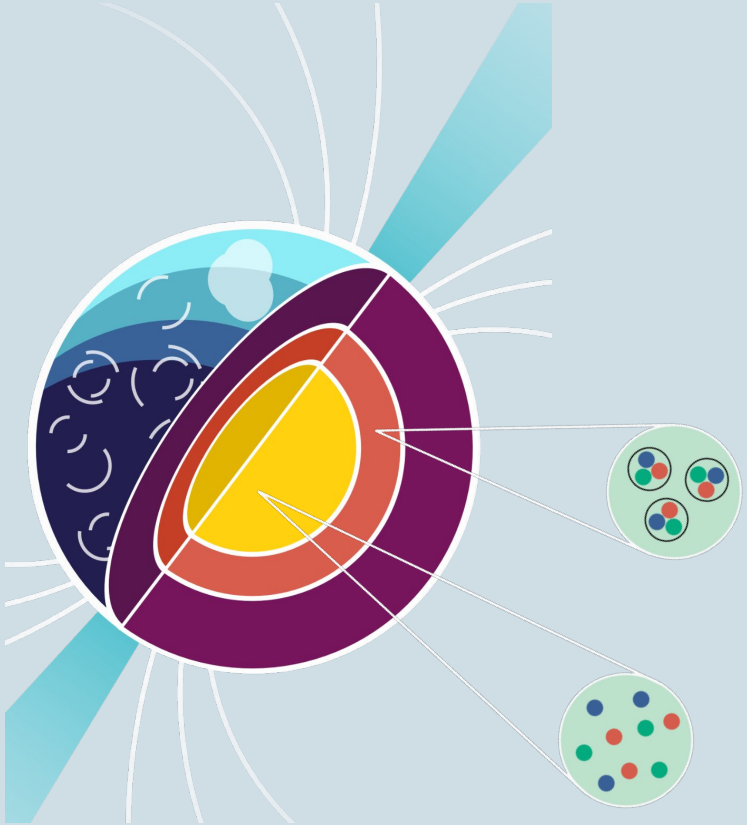
Collaborators: ***Jürgen Schaffner-Bielich, György Wolf***

XQCD Conference, Trondheim - 27-29 July 2022





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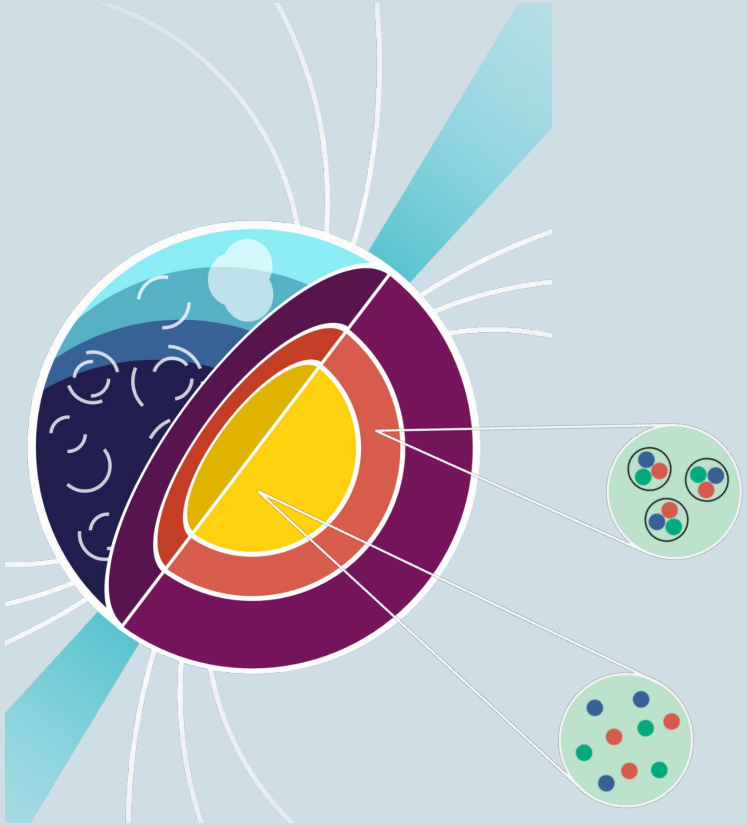
Hadronic model

(SFHo, DD2)

Quark model

Not set: m_σ, g_V



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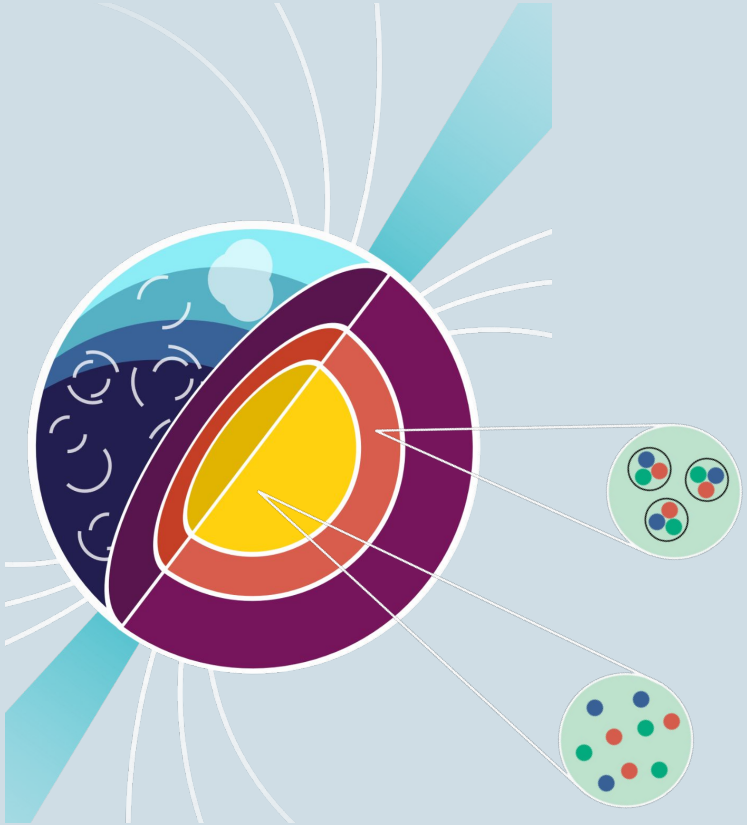
2 parameters: n, Γ



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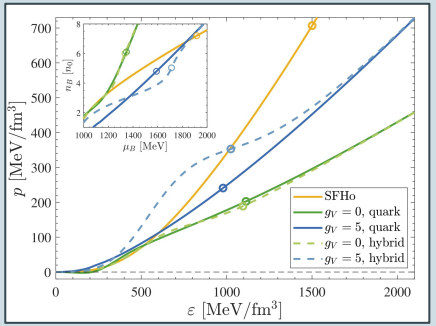

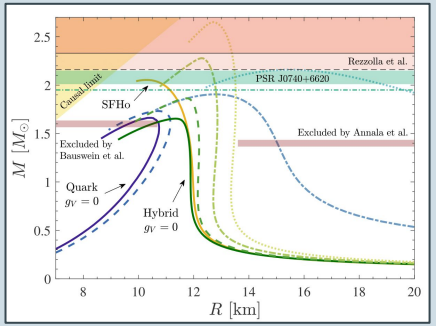

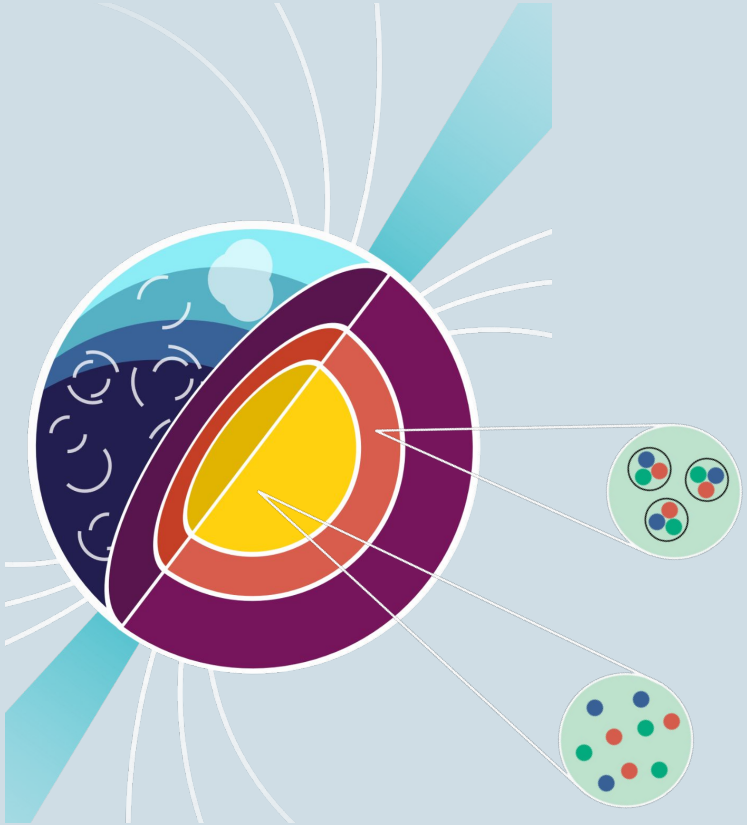

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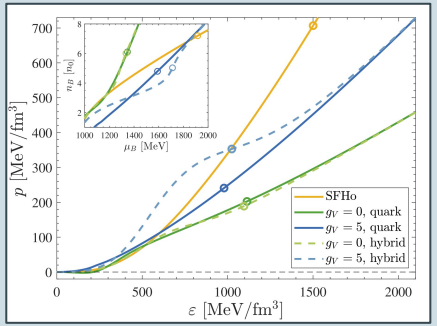
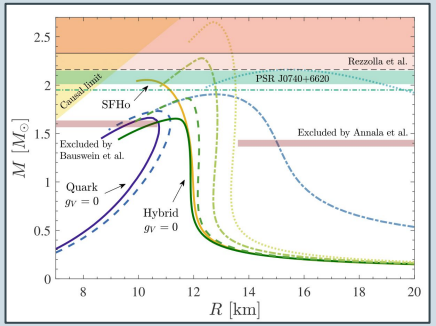
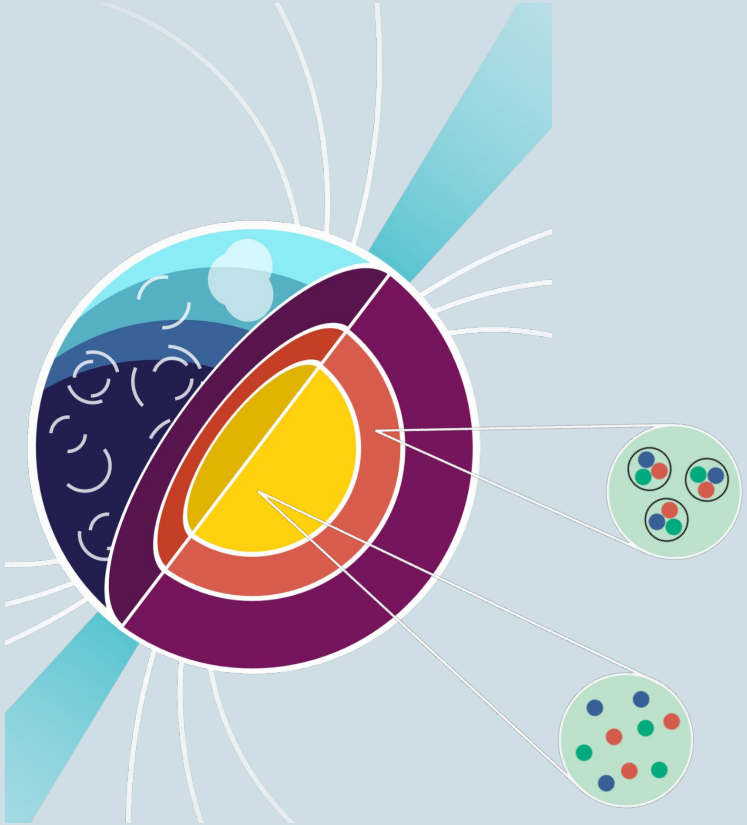




Astrophysical data

Pulsars, NICER,
GW170817, EM follow-up



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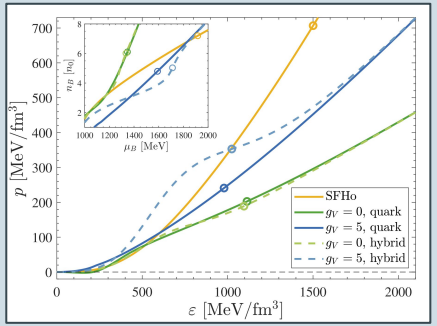

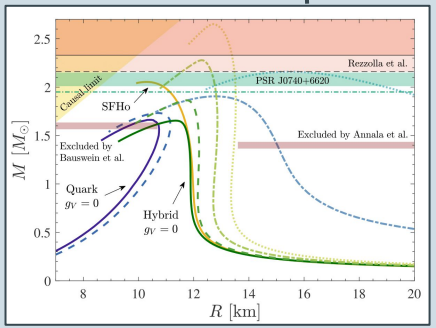

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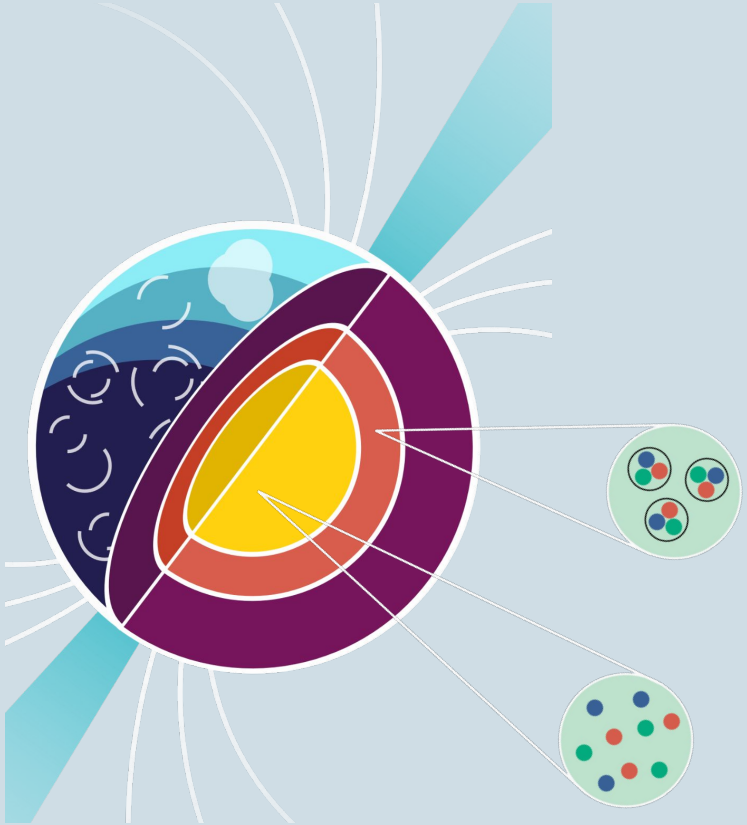

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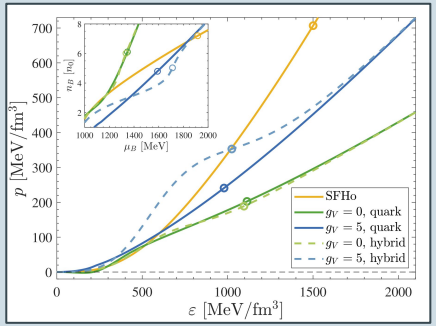

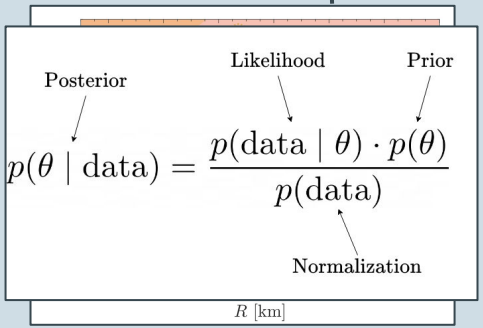

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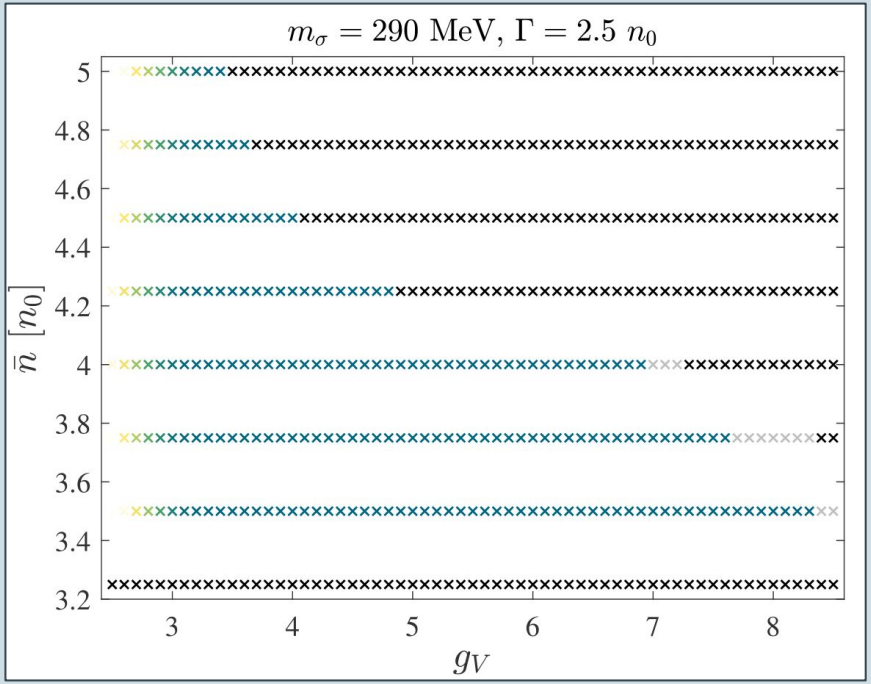
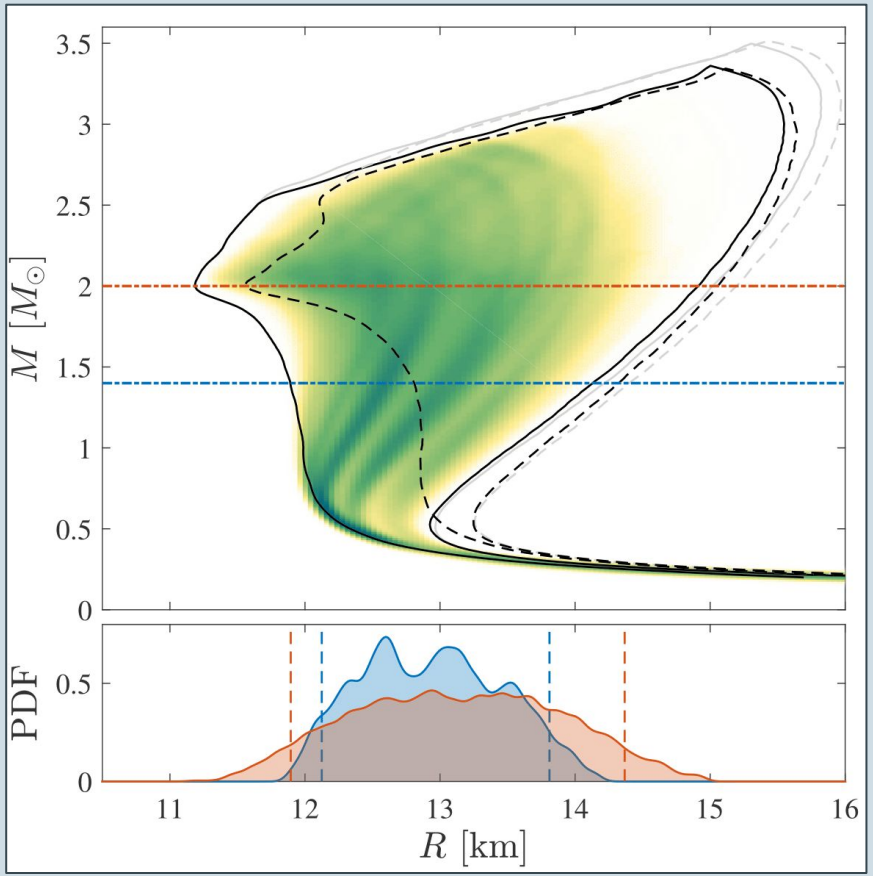
Bayesian analysis





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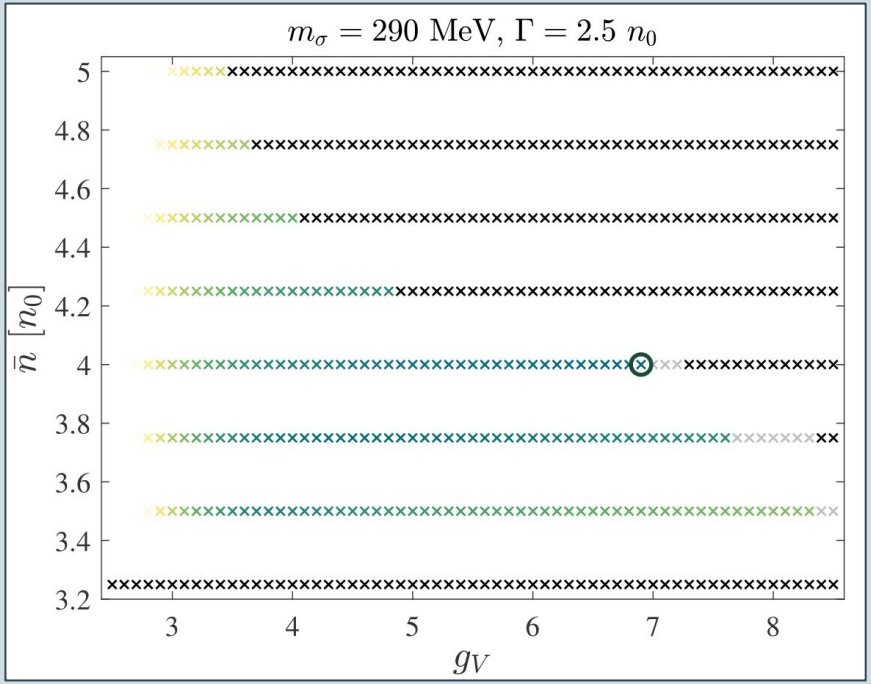

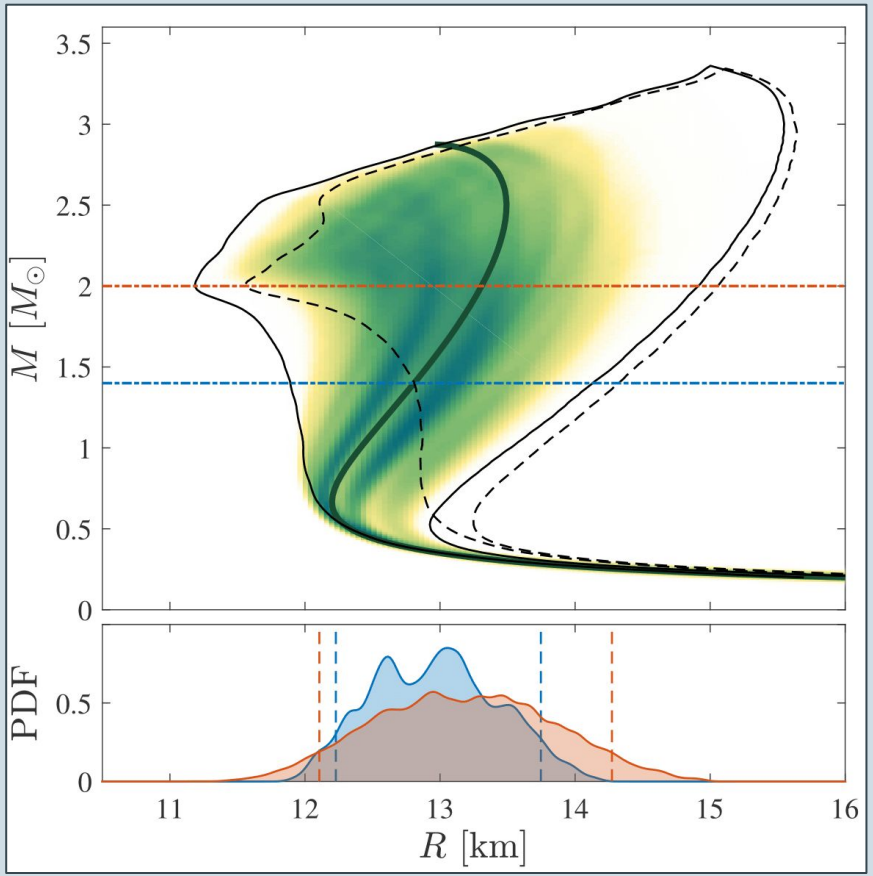

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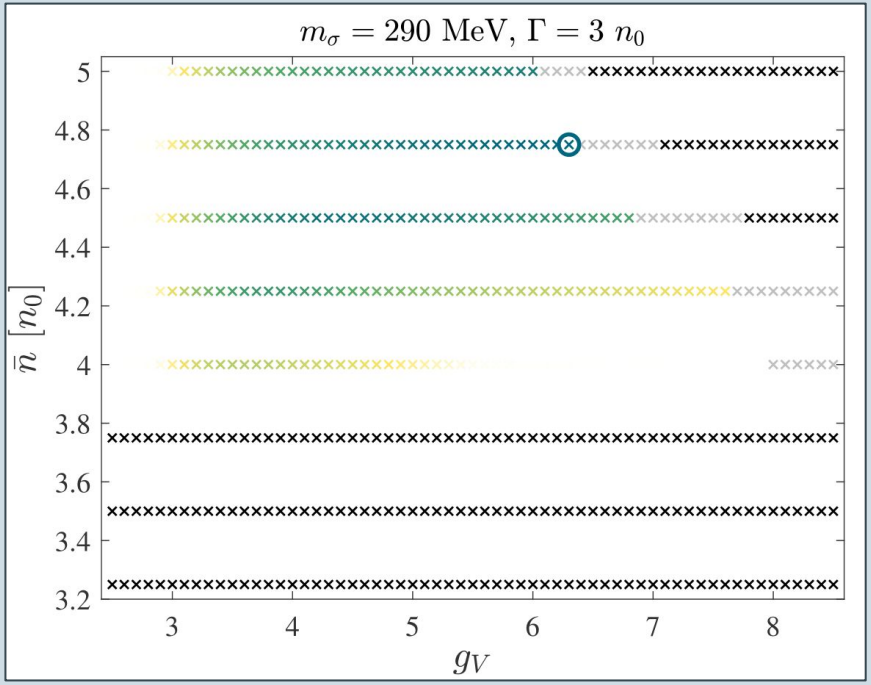

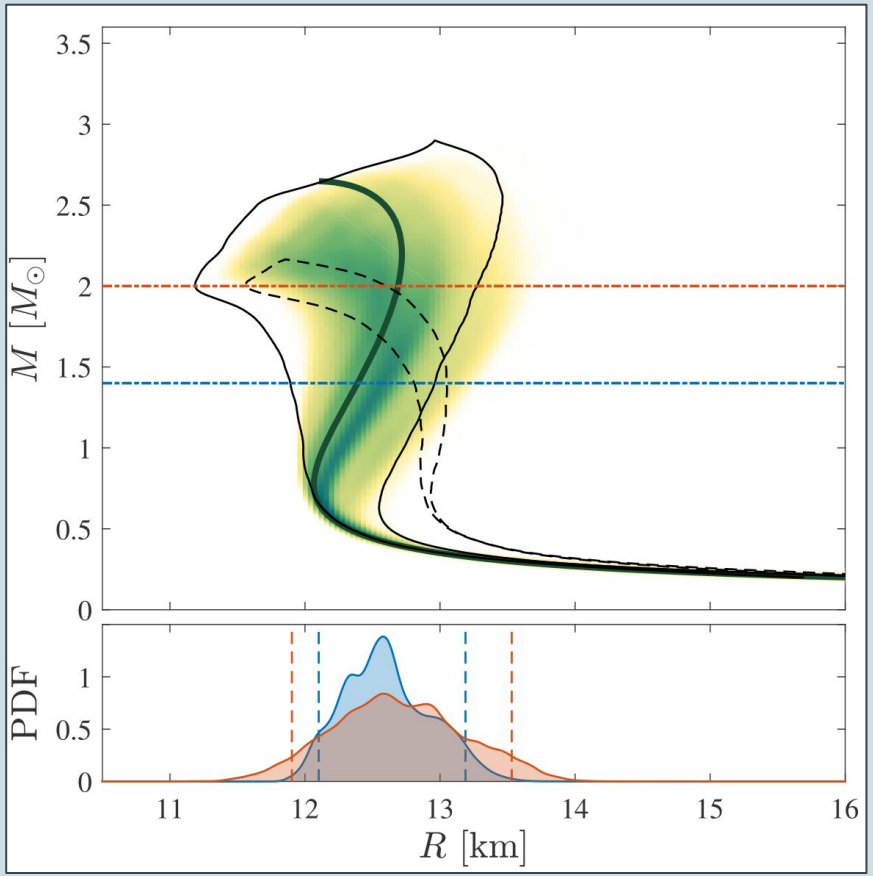

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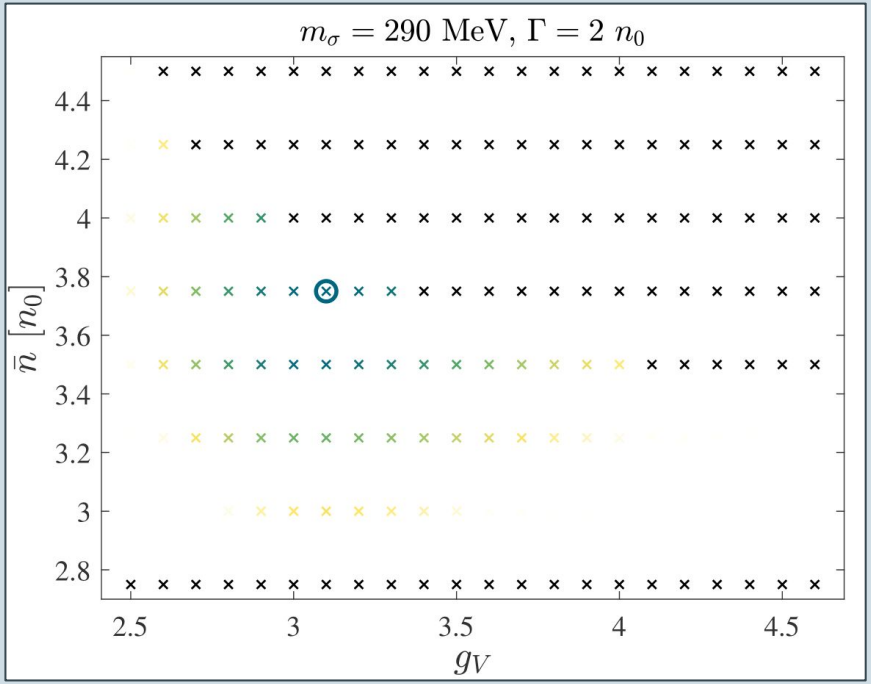

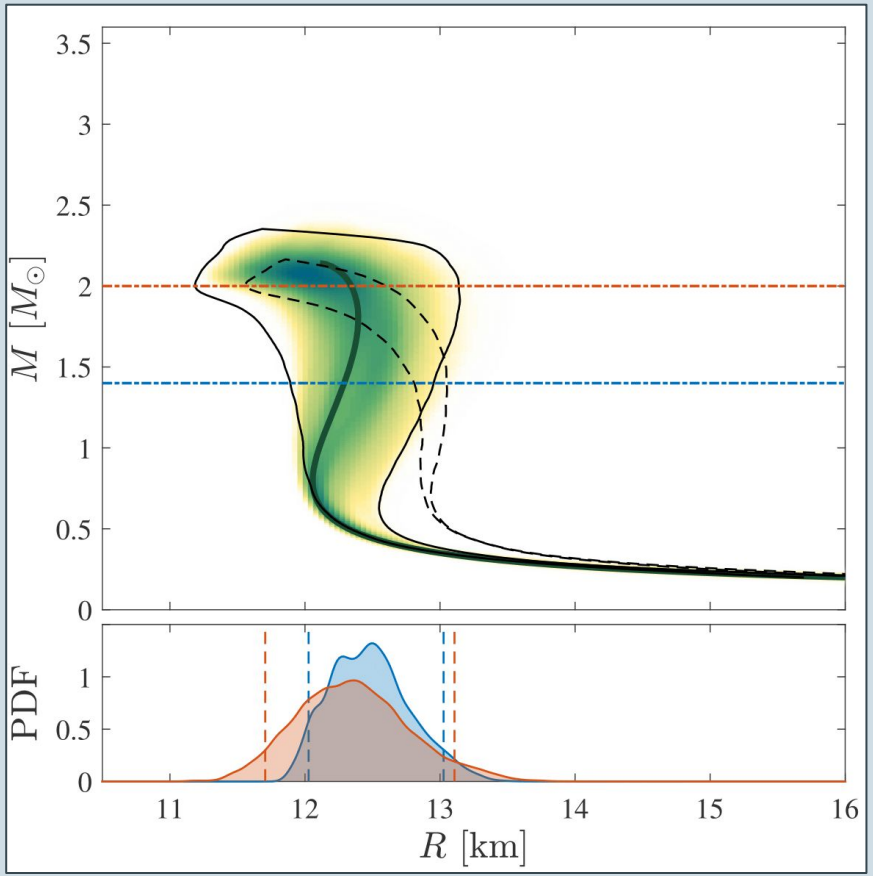

Phys. Rev. D 105, 103014

PHYSICAL REVIEW D
covering particles, fields, gravitation, and cosmology

Neutron star properties with careful parametrization in the vector and axial-vector meson extended linear sigma model

Péter Kovács, János Takátsy, Jürgen Schaffner-Bielich, and György Wolf
Phys. Rev. D **105**, 103014 – Published 16 May 2022

ABSTRACT

The existence of quark matter inside the cores of heavy neutron stars is a possibility which can be probed with modern astrophysical observations. We use a vector and axial-vector meson extended quark-meson model to describe quark matter in the core of neutron stars. We discover that an additional parameter constraint is necessary in the quark model to ensure chiral restoration at high densities. By investigating hybrid star sequences with various parameter sets, we show that low sigma meson masses are needed to fulfill the upper radius constraints and that the maximum mass of stable hybrid stars is only slightly dependent on the parameters of the crossover-type phase transition. Using this observation and results from recent astrophysical measurements, a constraint of $2.5 < g_V < 4.3$ is set for the constituent quark–vector meson coupling. The effect of a nonzero bag constant is also investigated, and we observe that its effect is small for values adopted in previous works.

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