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ASTROPHYSICS

Özel replies

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In their comment[1] on my theoretical interpretation[2] of the observations of EXO 0748–676, Alford *et al.* suggest variants of quark-matter equations of state that produce stars consistent with my results. They do not challenge either the method that I propose or my conclusion that the data require a stiff equation of state[2].

Given the large uncertainties in the phenomenological description of quark matter used in predicting the properties of quark and hybrid stars, it is not surprising that models that meet the new constraints can be readily constructed. It is only through quantitative and uncoupled measurements of the masses and radii of neutron stars, such as the one that I propose[2], that the properties of matter at high densities will be constrained.

There are other methods related to the cooling of young neutron stars, pulsar glitches and quasiperiodic variability that offer the possibility of providing astrophysical constraints on the equation of state of the neutron-star matter. It is important to realize, however, that some of these methods rely on the two most uncertain properties of astrophysical objects, namely their distances and ages. Others lead to only qualitative inferences because of their strong dependence on models. In both cases, comparison of predictions with observations indicates that quark stars cannot be ruled out, but neither are they favoured[3–6].

Unlike these other methods, the one that I present results in a direct measurement of stellar masses and radii, with quantifiable uncertainties. In the case of EXO 0748–676, it leads to the firm conclusion that soft equations of state are ruled out, as Alford *et al.* concur.

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