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A Discrepancy between Two Criteria of Stability for Hybrid Stars

PRATIK SACHDEVA, MARK ALFORD, Washington University in St. Louis — Neutron stars, along with other compact matter, are some of the most stable structures in the universe. Their stability can be disrupted, however, by radial oscillations, which may cause them to collapse into black holes. John Bardeen, in his Catalogue of Methods, detailed two methods by which we can determine the stability of compact stars for a given equation of state: direct calculation of the oscillation frequency with Chandrasekhar's equation or a qualitative examination of a mass-radius plot. These two methods were believed to agree until Glendenning et al. proposed the existence of a white dwarf with a strange quark core. We observed that Glendenning's white dwarf showed disagreement between Bardeen's methods. With this motivation, we examined the stability of a similar family of hybrid stars which contain a quark matter core surrounded by a nuclear matter envelope. The equations of state for such stars exhibit either a kink or discontinuity. By reproducing the calculations of these methods, we observed that Bardeen's methods do not agree for these stars as well. We believe that this discrepancy stems from the fact that Chandrasekhar's equation is incompatible with discontinuous equations of state and are working to resolve this incompatibility.

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