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# Discriminating hadronic and quark stars through gravitational waves of the P1 pulsation mode

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We investigate non-radial oscillations of hadronic and pure self-bound quark stars with maximum masses above the mass of the recently observed pulsar PSR J1614-2230 with M ≈ 2MΘ. For quark stars we include the effect of strong interactions and color superconductivity. We look for features in the pulsation modes that allow a clear differentiation between hadronic and quark stars. The equations of non-radial oscillations are integrated within the Cowling approximation in order to determine the frequency of the fundamental mode and of the first and second pressure modes. For the hadronic equation of state we employ different parametrizations of a relativistic mean-field model with nucleons and electrons, and for self-bound quark stars we use the MIT bag model. We find that the frequency of the fundamental mode is typically 1 − 3 kHz for both hadronic and quark stars. For hadronic stars the fundamental mode grows roughly linearly with the square root of the average density in approximate accordance with fitting formulae previously found in the literature. For quark stars the fundamental frequency has an approximate parabolic dependence with the gravitational redshift z although it varies very little for a wide range of z. For these stars we find that strong interactions and color superconductivity have an appreciable effect on the fundamental frequency. The first and second pressure modes have a very different behavior for hadronic and quark stars. For hadronic stars the frequencies are smaller than ~ 8 kHz and for quarks stars they are larger than ~ 8 kHz and diverge at small masses. This may allow an observational differentiation of both kinds of stars if the mass is below ~ 2MΘ. The observation of the p1-mode frequency of a nascent neutron star, together with the determination of its mass or gravitational redshift, may allow to determine whether a compact object is a hadronic or a self-bound quark star.

**Author:** VÁSQUEZ FLORES, César Oswaldo (Federal University of ABC, Santo André, Brazil)

**Co-author:** LUGONES, German (Federal University of ABC, Santo André, Brazil)

**Presenter:** VÁSQUEZ FLORES, César Oswaldo (Federal University of ABC, Santo André, Brazil)

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