Pérez Martínez, A.; **Pérez Rojas, H.**; **Mosquera Cuesta, H. J.**; **Boligan, M.**; **Orsaria, M. G.**
Quark stars and quantum-magnetically induced collapse. (English) Zbl 1081.85002
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Quark matter is expected to exist in the interior of compact stellar objects as neutron stars or even the more exotic strange stars, based on the Bodmer-Witten conjecture. Bare strange quark stars and (normal) strange quark-matter stars, those possessing a baryon (electron-supported) crust, are hypothesized as good candidates to explain the properties of a set of peculiar stellar sources such as the enigmatic X-ray source RX JI856.5-3754, some pulsars such as PSR B1828-11 and PSR B1642-03, and the anomalous X-ray pulsars and soft γ-ray repeaters.

One of the main physical models to treat the equation of state of both strange (made up of the flavors u, d, s) and non-strange (consisting of the flavors u and d only) matter, and to study the structure and stability of stars constituted of this matter, is the MIT bag model. In this model, quarks are described by a degenerate Fermi gas confined to a region of space having a vacuum energy density B_{bag} (the Bag constant). But although strong magnetic fields are known to exists in the interior of compact stars, notwithstanding, up to now only a few attempts were made to analyze the behavior of quark matter permeated by a magnetic field.

Thus in the present paper the MIT bag model is modified by including the electromagnetic interaction between the quarks. For the sake of simplicity, the case of non-strange quarks is considered. The energy-momentum tensor of the matter is rewritten. As result, an anisotropic Bag pressure is found which depends on the direction of the magnetic field. Further, a structural instability is obtained, which is related to the anisotropic pressure of the magnetized matter.

To study the instability of degenerate quark gases in presence of ultra-strong magnetic fields, two approaches are usually used: first, the interaction of the quark field with the magnetic field is taken into account via the charges, second, the quarks are considered to have an anomalous magnetic moment. It is shown that within the second approach somewhat more stable quark gases are described. These systems are even more stable than related neutron gas models taking into account also anomalous magnetic moments (NG-AMM).

Besides, in agreement with the NG-AMM model, it is found that in the extremely degenerate non-strange quark matter the pressure component perpendicular to the magnetic field vanishes (collapse) when the magnetic field grows, and the parallel pressure component grows with the field strength. It is told that an opposite behavior is possible only in classical systems where the parallel pressure component may be smaller than the perpendicular one at instability.

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MSC:

85A15 Galactic and stellar structure
65Z05 Applications to the sciences
83C75 Space-time singularities, cosmic censorship, etc.

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