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Magnetized Color-Flavor Locked Spheroidal Strange Quark Stars in γ-metric formalism

We investigate the mass-radius relationship of magnetized color-flavor locked (MCFL) spheroidal strange quark stars within the framework of the γ-metric formalism. The CFL phase, a superconducting state of quark matter, is characterized by the pairing of quarks of different colors and flavors, leading to a significant energy gap and increased stability. The Equation of State (EoS) of the magnetized color-flavor locked (MCFL) phase is self-consistently determined by using the solutions of the gap equations of paired quark matter in presence of strong magnetic field and taking into consideration the parallel and perpendicular pressures due to the field-induced breaking of spatial rotational symmetry. Due to the strong magnetic field, the total pressure becomes anisotropic, causing the deformation of magnetized strange quark star from a spherical shape to an oblate spheroid. This deformation is accounted in the presence of a deformed Schwarzschild metric known as the γ-metric. Our results indicate that the presence of strong magnetic field and the MCFL phase in parameterized γ-metric formalism significantly influence the quark star's maximum mass, radius and stability. We considered two different bag constant values of 65 MeV/fm^3 and 75 MeV/fm^3 and three different magnetic field values, 0, 6×10^{17} G and 10^{18} G. We found stable configurations of quark stars with masses $gtrsim$ $2M_{\odot}$. The maximum mass with bag constant of 65 MeV/fm^3 and with magnetic field of 10^{18} G turns out to be $2.17M_{\odot}$ with a corresponding equatorial radius of 15.44 km.

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