Structural properties of strongly magnetized degenerate neutron star

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The structural properties of strongly magnetized neutron star (NS) are investigated by following Landau magnetization approach for quantized, degenerate electrons. A new magnetization M expression known as Nodar-- Rozina magnetization co-efficient is formulated in the presence of super strong magnetic field B. It is shown that the susceptibility is positive square root function of B, hence the associated permeability (μ) will be greater than 1. Next, the conceptual issue regarding the impact of magnetization M on Maxwellquantum magneto hydrodynamic (QMHD) equations is addressed, the obtained modified QMHD model is followed to investigate the dispersive properties of low frequency waves in weakly ionized plasma, consisting of degenerate neutrons, electrons and ions in the atmosphere of degenerate NS. The dispersion relation of a new type of magneto sonic waves propagating perpendicular to the B field is obtained in the presence of quantized magnetic pressure, with Alfven speed being reduced by the factor μ. It is shown that magnetar flares may excite new type of Alfvén waves propagating along the B field, Alfven frequency is found to have only decreasing trend with the increase of μ, to depict that the surface-crust of NS are magnetized enough to contain a quantum 'ordered superconducting fluid. Moreover, the Alfven speed, calculated here, is found to be function of neutron mass density in contrast to the usual electron ion plasma case. We suggest an experimental search for Alfven-like waves in superconductors.

References

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