



Contribution ID: 1

Type: talk

Neutral pion matter in strong magnetic fields

Wednesday, 28 June 2017 15:35 (25 minutes)

The ground state of QCD in sufficiently strong external magnetic fields and at moderate baryon chemical potential is a chiral soliton lattice (CSL) of neutral pions. This is a model-independent result based on low-energy effective field theory, and the magnetic fields and baryon densities required may occur in the cores of neutron stars. The spectrum of excitations above the CSL ground state contains a soft, nonrelativistic mode that gives an anomalous contribution to pressure, scaling with temperature and magnetic field as $T^{5/2} B^{3/2}$. Finally, I will argue that in stronger but still achievable magnetic fields, the neutral pion CSL background may catalyze Bose-Einstein condensation of charged pions.

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