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Superconducting baryon crystal induced via the chiral anomaly

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Determining the phase structure of nuclear and quark matter in external magnetic fields is not only of theoretical interest but also experimentally motivated by the large magnetic fields found in heavy-ion collisions and compact star physics. By including the effects of the chiral anomaly within Chiral Perturbation theory at zero-temperature and non-zero baryon chemical potential, it can be shown that neutral pions form an inhomogeneous phase dubbed the "Chiral Soliton Lattice" (CSL) above a certain critical magnetic field. Above a second, even higher critical field, the CSL becomes unstable to fluctuations of charged pions implying they condense.

I will point out the similarity of this second critical field to the upper critical magnetic field in conventional type-II superconductors. By applying similar methods originally used by Abrikosov, I will construct an inhomogeneous, superconducting baryon crystal phase existing above this point which is preferred in the chiral limit. An update will be given on current progress of results outside the massless pion approximation.

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