# Hadron properties under strong magnetic fields in the NJL model

**N. N. Scoccola**
scoccola@tandar.cnea.gov.ar
Tandar Lab -CNEA– Buenos Aires, Argentina

We study the magnetic field dependence of the masses of pions, diquarks and nucleons in the context of the Nambu-Jona-Lasinio (NJL) model. Eigenvalue equations associated with charged particles are obtained using the Ritus formalism. In this way we fully take into account the existence of non-vanishing Schwinger phases. Our results are compared with those available in the literature obtained using Lattice QCD and/or Chiral Perturbation Theory.

# Motivation

The interest in understanding the behavior of strongly interacting matter in the presence of intense magnetic fields is motivated by the fact that it has been suggested that values of B ~ $10^{19}$ G (~ 0.1 $GeV^2$), or even larger, might exist in the interior of magnetars or during the early stages of non-central relativistic heavy ion collisions.

# Approach

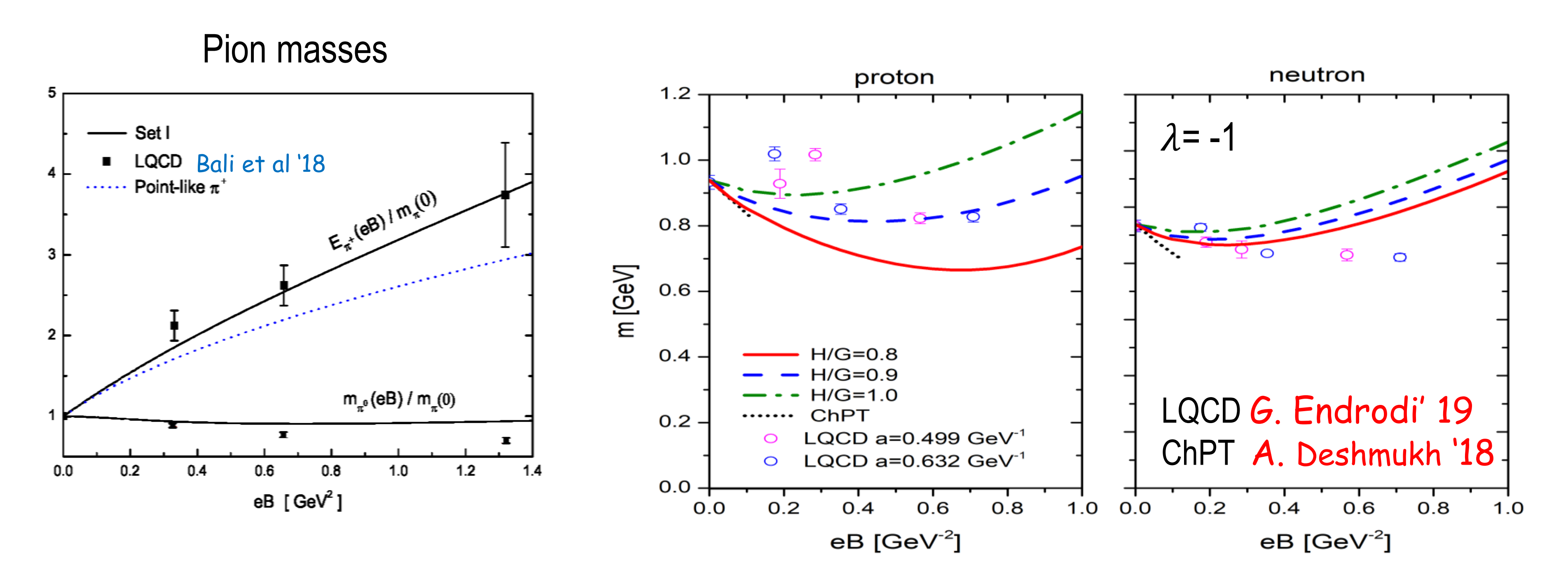
We consider a NJL model that includes color pairing interactions in the presence of constant and uniform magnetic field. We use the Landau gauge. Polarization functions associated with charged particles are diagonalized using the Ritus eigenfunction method. To regularize the divergent mean field action and the meson and diquark polarization functions we use the Magnetic Field Independent Regularization scheme.

For the nucleons we consider the Fadeev equation that accounts for the quark exchange between their diquark and quark components. In this context we use the static approximation for the exchanged quark propagator. Resulting equations are diagonalized by expanding in a Ritus basis in the case of the proton and in a Fourier basis in the case of the neutron.

# Main results

We find that $m_{\pi^0}$ decreases slightly with B, $E_{\pi^\pm}$ displays an strong increase (always above that of point-like pion). For the diquark it is below that of a point-like diquark at low B and above for eB > ~ 0.4 GeV$^2$

For the nucleons, we find that both $m_n$ and $m_p$ first decrease with B. At about 0.2-0.6 GeV$^2$ (depending somehow on the ratio of the color pairing to scalar coupling constants H/G) they start to increase quite strongly as B does.




Based on : Coppola, Gomez Dumm & NNS, Phys.Lett. B782 (2018) 155 , Coppola, Gomez Dumm, Noguera & NNS, Phys.Rev. D100 (2019) 054014 and work in preparation.