

Gell-Mann-Oakes-Renner relation in external magnetic fields at zero temperature

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We present results of chiral condensates, masses and decay constants of neutral pseudo scalar mesons in (2+1)-flavor QCD in the presence of external magnetic fields at zero temperature. We discuss the validity of Gell-Mann-Oakes-Renner relation in a wide region of magnetic field strength eB up to around 3.5 GeV^2 . The simulations were performed on $32^3 \times 96$ lattices using the Highly Improved Staggered Quarks (HISQ) action with a single lattice cutoff $a=0.117 \text{ fm}$ and $m_\pi \approx 220 \text{ MeV}$. Sixteen values of eB along the z direction up to around 3.5 GeV^2 have been applied in the simulation.

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