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# The magnetic polarizabilities of $\pi$ and $\rho$ mesons in $SU(3)$ lattice gauge theory

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The study of the internal structure of hadrons in external electromagnetic fields is important and relevant in the context of the current experiments in JLAB, COMPASS and future experiments PANDA, CBM (FAIR). The COMPASS experiment have measured electrical polarizability. In non-central heavy ions colisions the magnetic field value in the moment of collision can reach up to $15m_\pi^2$ $0.27GeV^2$. Such a strong magnetic field can modify the properties of strongly interacting matter. We calculate the correlators of pseudoscalar and vector currents in external strong abelian magnetic in $SU(3)$ pure lattice gauge theory. From the correlation functions we obtain the ground state energies of neutral and charged mesons. The energy of the $\rho^0$ meson with zero spin projection on the axis of the field decreases, while the energies with non-zero spins increase with the field value. The energy of $\pi^0$ meson decrease as a function of magnetic field. The mass of charged $\pi^\pm$ mesons increases with the field. At small magnetic fields the behaviour of energies of charged $\rho$ mesons agree with Landau level picture, while at high fields the terms with higher powers in magnetic field come into play. There are no evidences in favour of charged vector meson condensation or tachyonic mode existence at large magnetic fields. The magnetic polarizabilities of neutral and charged mesons were found for the lattice volumes $18^4$ and $20^4$ fitting the ground state energies. The g-factor of $\rho^\pm$ is found from its' ground state energies with various spins. After chiral extrapolation we obtain the value $g = 2.4 \pm 0.2$ [2] for the lattice volume $18^4$ and lattice spacing $a = 0.115fm$. This value is compatible with experimental determination [4] and theoretical value from relativistic quark model[3]. Researching QCD in the external electromagnetic field plays an important role in understanding the structure of hadrons.

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