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Landau damping in a strong magnetic field: Dissociation of quarkonia

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We have investigated the properties of quarkonia in a hot QCD medium in the presence of strong magnetic field, which may be produced in the non-central events at RHIC and LHC and then studied its quasi-free dissociation due to the Landau-damping mechanism. Using the Schwinger propagator in the lowest Landau level, we have calculated the real and imaginary parts of the retarded gluon self-energy in a strong magnetic field using the real-time formalism. The aforesaid self-energy computes the resummed retarded and symmetric propagators whose static limits embody the effects of the medium into the real and imaginary part of both short- and long-distance components of $Q\bar{Q}$ interaction in vacuum. In strong magnetic field, the large-distance interaction is affected more than the shot-distance interaction, as a result, the real part of potential becomes more attractive. On the other hand, due to the dimensional reduction, the magnitude of imaginary part becomes smaller compared to a thermal medium in absence of strong magnetic field. We have found that the average radii of the quarkonia get reduced and become more strongly bound in presence of the strong magnetic field. However, further increase of the magnetic field results in the decrease of binding energies. In the presence of strong magnetic field, the decay width of the resonances becomes smaller and the dependence on magnetic field becomes less steep than the dependence on temperature. Having discussed the properties of quarkonia, we have estimated the magnetic field beyond which
the resonances go to the continuum due to Landau damping, where we found that ψ' and χ_c in a hot QCD medium are dissociated relatively at larger magnetic fields, $eB = 4\ m_\pi^2$ and $5\ m_\pi^2$, compared to the dissociation by the color screening mechanism only. However, the J/ψ is dissociated at very large magnetic field.

Content type

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