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Colour particle states behaviour in the QCD vacuum

To study the properties of colour particle states behaviour in the QCD vacuum we calculate the density matrix of the system colour particle - stochasticQCD vacuum, considered as environment, and averaged over degrees of freedom of the environment.As a result the density matrix of colour particle is depended on the Wilson loop which depends on spanned area RT. In the stochastic vacuum Wilson loop decays exponentially with RT at large distances and we obtain evident form of density matrix of colour particle moving in the stochastic QCD vacuum. Learning density matrix we obtain characteristics of colour particle: purity (closeness of a quantum state to a pure one), von Neiman entropy, information, fidelity (measure of quantum motion stability). The quantities are calculated for different initial colour states: superposition, pure, mixed, separable, nonseparable (entangled), multiparticle. In the case of of stochastic (not coherent) QCD vacuum (only correlators of the second order are important) in confinement region (Wilson loop decays exponentially) we have decoherence of pure colour states into a mixed white states, while purity decays exponentially (decay rate = string tension).For multiparticles (pure separable, mixed separable and nonsepaparable (entangled) states) when RT ->∞ we obtain diagonalization of density matrix, decreasing of purity and increasing of vonNeumann entropy.

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