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Superconductivity of Confined Particles in a field-theory model

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In this work, a simple model of superconductivity of confined particles, which constitute low energy hadrons, such as quarks and gluons. Many models like these of superconductivity are already present in high energy physics, mainly in the study of color superconductivity. These models use in general a gluon propagator with specific electrical and magnetic effects, and after several approximations resulting in a differential gap equation, first obtained by Son. These gaps were frequency dependent and could reach results in the order of 100 MeV, as shown numerically by Wilczek and Schäfer. In this work we will adapt the color superconductivity model by changing the usual Gluon propagator, to a confining propagator, such as encountered in Gribov-Zwanziger and Refined Gribov-Zwanziger theories. An analysis of the differential gap equation and the gap function will compare how the effect of corrections originated from the new propagators modify the results in the literature. This will allow us to assess how nonperturbative confinement effects might affect the phenomenon of color superconductivity at intermediate densities. Two mass limits in the bosonic propagator must be reached: the high mass limit, reproducing the behavior of the “point like” approximation, making the gap function behave like a usual BCS superconductivity and the small mass, making the gap function behave similar to early results in color superconductivity .

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