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The static quark potential in Maximal Abelian gauge with perturbation theory

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A popular idea, originally proposed by ‘t Hooft, explains confinement in analogy to superconductivity in electromagnetism. Instead of the condensation of electrons, in QCD magnetic monopoles would condense leading to the confinement of the chromoelectric force. Since there are no elementary particles that could act as magnetic monopoles, the gluons themselves take on this role, which can be made explicit in certain gauges. An essential feature of these gauges is the discrimination between diagonal gluons, belonging to the center of the gauge group, and off-diagonal gluons. The most actively studied gauge is called the Maximal Abelian gauge, which minimizes the off-diagonal gluons globally. There is abundant lattice data showing both the existance of magnetic monopoles in this gauge and how they seem to be solely responsible for the linear part of the static quark potential. An interesting feature of these results is that the linear behavior of the monopole contribution seems to extend even to short distances, where the potential becomes perturbative. In order to investigate this, we have calculated the potential and its Abelian projection in Maximal Abelian gauge up to two-loop order in perturbation theory.

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