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Wilson Lines and Color-Neutral Operators in the Color Glass Condensate

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Abstract content
   (Max 300 words)
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In modern collider experiments such as the LHC or DESY, QCD reaction channels dominate the particle production. In the high energy limit, the number of gluons produced through these channels is so large, that these gluons dominate the initial conditions of heavy ion collisions and influence subsequent transitions of the produced hot dense matter into a Quark Gluon Plasma. These gluon dominated configurations are called the color glass condensate (CGC). The JIMWLK equation is a renormalization group equation that describes the energy evolution of observables in the CGC. In a collider experiment in the above described regime, the following stages occur: Due to confinement, a <i>color-neutral</i> configuration of partons, hereafter referred to as a <i>singlet</i>, scatters off a target eikonally; that is, each parton at a position <i>x</i> picks up a Wilson line U_x. The resulting color-rotated parton will then recombine into a color-neutral state, as is necessary by confinement. Since Wilson lines <i>U_x</i> are elements of the group SU(N_c), the interaction is governed by principles of group theory. I present a way of classifying all singlet states of an algebra of <i>m</i> quarks and <i>n</i> anti-quarks, where each gluon is mathematically equivalent to a dipole consisting of a quark and an anti-quark. I begin by considering all singlets of SU(N_c) over the algebra of <i>m</i> quarks and <i>m</i> anti-quarks, and then show that these give rise to the remaining (N_c-dependent) singlets of the algebra of <i>m</i> quarks and <i>n</i> anti-quarks via the Leibniz identity. I then discuss coincidence limits of the Wilson lines, giving interesting physical insights.

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