

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Spin and QCD Instanton & Stringy Pomeron

By

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The QCD vacuum is dominated by large instanton and anti-instanton fluctuations in the infrared, which are largely responsible for the spontaneous breaking of chiral symmetry and the anomalously large η' mass. We review some aspects of spin physics where QCD instantons play an important role. In particular, their large contributions in semi-inclusive deep-inelastic scattering and polarized proton on proton scattering. We also review their possible contribution in the P-odd pion azimuthal charge correlations in peripheral AA scattering at collider energies.

In the second part, we show that a single closed string exchange contribution to the eikonized dipole-dipole scattering amplitude yields a Regge behavior of the elastic amplitude; the corresponding slope and intercept are different from previous results obtained by a variational analysis of semi-classical surfaces. We provide a physical interpretation of the semi-classical worldsheets driving the Regge behavior for $(-t) > 0$ in terms of worldsheet instantons. The latter describe the Schwinger mechanism for string pair creation by an electric field, where the longitudinal electric field $E_L = \sigma \tau \tanh(\chi/2)$ at the origin of this non-perturbative mechanism is induced by the relative rapidity χ of the scattering dipoles. The overall dipole-dipole scattering amplitude in the soft pomeron kinematics is shown to be sensitive to the extrinsic curvature of the string for finite momentum transfer. The characteristics of the diffractive peak in the differential elastic pp scattering are affected by a small extrinsic curvature of the string.

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