

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Soft Radiation Theorems at All Loop Order in Quantum Field Theory

By

Hualong Gervais

We study the emission of soft photons and soft gravitons coupling to high energy fixed angle scattering processes at first order in the electromagnetic coupling and in Newton's constant, respectively, but to all loop orders in a class of theories without soft divergences, including massive and massless Yukawa and scalar theories. We adapt a method introduced by del Duca for quantum electrodynamics to show that subleading corrections to the soft photon and soft graviton theorems are sensitive to the structure of nonleading external jets of collinear lines. Our techniques are based on a power counting analysis of loop integrals, an application of jet Ward identities, and hard-soft-collinear factorization. We also apply Grammer and Yennie's decomposition to isolate separately gauge invariant contributions to the soft expansion. These are interpreted as infrared sensitive matrix elements coupling to a field strength tensor in the case of photons, and to the linearized Riemann curvature tensor in the case of gravitons.

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Time: 3:00pm

Place: Math Tower, 6-125.

Program: Physics

Dissertation Advisor: George Sterman