



KOÇ UNIVERSITY

Science – Math Seminar

Speaker: Dr. M. Cem Guclu, Department of Physics, Istanbul Technical University

Date: Thursday, March 02, 2006

Time: 16:45 (Tea and cookies will be served at 16:30)

Place: Science building, Room Z42

Title: Physics of Ultra-Peripheral Nuclear Collisions

Abstract:

The strong electromagnetic field of heavy ions can produce different kind of two-photon reactions at relativistic heavy ion colliders. Recently the STAR collaboration has presented results on electron-positron pair productions on ultra-relativistic peripheral collisions. The authors compare the experimental data with QED and equivalent photon approximation

(EPA).

We have calculated electron-positron pair cross sections with mutual coulomb excitation in relativistic heavy-ion collisions. We have used gold - gold collisions at a center of mass energies of 200 GeV. We solved the electron-positron pair production exactly by calculating the second order Feynman diagrams. We also used the probability of mutual nuclear excitation with breakup. Within the kinematic acceptance region, we find that cross sections agree well with the experimental results. This shows that lowest order quantum electrodynamics can explain the kinematic distributions.

The cross sections of peripheral electron-positron pair production is very large and this pairs might possibly mask the leptonic signals originating from the quark- plasma phase. Electromagnetic production from the vacuum of single and multiple lepton pairs is a major contribution to this physical background and therefore must be understood in detail.

On the other hand, when heavy-ions collide at relativistic velocities, the Lorentz contracted electromagnetic fields in the space time region near the collision are sufficiently intense to produce large numbers of electron-positron pairs, muon-pairs, vector bosons and possibly the yet-unconfirmed Higgs bosons. All these processes occur at

nearly
atomic distance scales. The phenomena involved are pervasive,
impinging upon atomic, nuclear, and particle physics.

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-Math seminars.