Abstract Submitted
for the PSF09 Meeting of
The American Physical Society

The breakdown of one-dimensional fermionic and bosonic vaccua in strong fields[1] M. WARE, T. CHENG, Q. SU, R. GROBE, Intense Laser Physics Theory Unit, Illinois State University — We compare the creation rates for particle-antiparticle pairs produced by a supercritical force field for fermionic and bosonic model systems. The rates obtained from the Dirac and Klein-Gordon equations can be computed directly from the quantum mechanical transmission coefficients describing the scattering of an incoming particle with the supercritical potential barrier. We provide a unified framework that shows that the bosonic rates can exceed the fermionic ones, as one could expect from the Pauli exclusion principle for the fermion system. This imbalance for small but supercritical forces is associated with the occurrence of negative bosonic transmission coefficients of arbitrary size for the Klein-Gordon system, while the Dirac coefficient is positive and bound by unity. We confirm the transmission coefficients with time-dependent scattering simulations. For large forces, however, the fermionic and bosonic pair creation rates are surprisingly close to each other. The predicted pair-creation rates also match the slopes of the time-dependent particle probabilities obtained from large-scale ab initio numerical simulations based on quantum field theory.

[1]Supported by the NSF and Research Corporation.

Rainer Grobe
Intense Laser Physics Theory Unit, Illinois State University

Date submitted: 15 Oct 2009 Electronic form version 1.4