Abstract Submitted
for the DNP17 Meeting of
The American Physical Society

Relativistic time-dependent Fermion-mass renormalization using statistical regularization. TIMOTHY KUTNINK, CHRISTIAN MCMURRAY, AMELIA SANTRACH, SARAH HOCKETT, SCOTT BARCUS, ATHANASIOS PETRIDIS, Drake University — The time-dependent electromagnetically self-coupled Dirac equation is solved numerically by means of the staggered-leap-frog algorithm with reflecting boundary conditions. The stability region of the method versus the interaction strength and the spatial-grid size over time-step ratio is established. The expectation values of several dynamic operators are then evaluated as functions of time. These include the fermion and electromagnetic energies and the fermion dynamic mass. There is a characteristic, non-exponential, oscillatory dependence leading to asymptotic constants of these expectation values. In the case of the fermion mass this amounts to renormalization. The dependence of the expectation values on the spatial-grid size is evaluated in detail. Furthermore, the contribution of positive and negative energy states to the asymptotic values and the gauge fields is analyzed. Statistical regularization, employing a canonical ensemble whose temperature is the inverse of the grid size, is used to remove the grid-size and momentum-dependence and produce a finite result in the continuum limit.

Timothy Kutnink
Drake University

Date submitted: 29 Jun 2017 Electronic form version 1.4