Abstract Submitted
for the APR20 Meeting of
The American Physical Society

**Fermion-mass and charge renormalization using the relativistic, time-dependent Dirac equation** ATHANASIOS PETRIDIS, TIMOTHY KUTNINK, Drake University — The time-dependent electromagnetically self-coupled Dirac equation is solved numerically by means of the staggered-leap-frog algorithm. The stability region of the method versus the interaction strength and the ratio of the spatial-grid size over the time-step is established. The expectation values of several dynamic operators are evaluated as functions of time. These include the fermion and electromagnetic energies and the fermion dynamic mass. There is a characteristic time-dependence leading to asymptotic constants of these expectation values. In the case of the fermion mass and charge this amounts to renormalization. The dependence of the expectation values on the spatial-grid size is evaluated and yields finite results due to the finiteness and continuity of the spinor. The contribution of positive and negative energy states to the asymptotic values and the gauge fields is analyzed. A statistical method, employing a canonical ensemble whose temperature is the inverse of the spatial-grid size, is used to remove the momentum-dependence. A result for each spatial-grid size value is obtained. The continuum limit is taken to calculate both the fermion mass and charge. The renormalization mass correction is 10% and the charge correction is about 30%.

Athanasios Petridis
Drake University

Date submitted: 07 Jan 2020

Electronic form version 1.4