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Fermion Mass Renormalization Using Time-dependent Relativistic Quantum Mechanics TIMOTHY KUTNINK, AMELIA SANTRACH, SARAH HOCKET, 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 refcecting 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, as the self-interacting spinors are no longer mass-eigenfunctions. 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. Statistical regularization is proposed to remove the grid-size dependence.

Athanasios Petridis
Drake University

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