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The Nonrelativistic Limit of Dirac-Fock Equations

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The Dirac-Fock equations are an approximate model for bounds states of relativistic atoms and molecules. In this set of coupled nonlinear elliptic equations there is a big parameter, the light speed. When this speed is very large, we show that the solutions of the Dirac-Fock problem converge in some sense towards the solutions of the Hartree-Fock equations, a much better model in (nonrelativistic) quantum mechanics.

In this talk the phenomenon which is behind this convergence will be first showed in the (much simpler) linear case. We will describe in detail the strange mechanism that produces convergence of eigenvalues (and somehow of eigenfunctions) of a not semi-bounded and first order operator towards those of a semi-bounded and second order one. Then we will go to the nonlinear case, and see the implications of this convergence for the definition of a notion of ground-state for the Dirac-Fock equations.