

The variational method within the Hamiltonian formalism of quantum field theory is used to derive relativistic n-body wave equations for scalar particles and antiparticles. The equations are shown to have the Schrodinger non-relativistic limit. We also study the effect of virtual pairs for relativistic bound-state problems. The results show that the inclusion of virtual pairs has a large effect for the binding energy of the system at strong coupling. Applications to some particular cases are presented along with some numerical results.

I also briefly discuss many body systems consisting of fermions (particles like electrons) and antifermions (antiparticles like positrons). As an example, the discovery of positronium molecule, an exotic four-body system consisting of two electrons and two positrons (observed in 2007), will be presented.