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Two fermion relativistic bound states

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Abstract

We consider the relativistic quantum mechanics of a two interacting fermions system. We first present a covariant formulation of the kinematics of the problem and give a short outline of the classical results. We then quantize the system with a general interaction potential and deduce the explicit equations in a spherical basis. The case of the Coulomb interaction is studied in detail by numerical methods, solving the eigenvalue problem for $j = 0$, $j = 1$, $j = 2$ and determining the spectral curves for a varying ratio of the mass of the interacting particles. Details of the computations, together with a perturbative approach in the mass ratio and an extended description of the ground states of para- and orthopositronium, are given in the appendices.

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