Positronium in Basis Light-front Quantization

Xingbo Zhao

*Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou China, 730000**

(Dated: June 28, 2016)

In this talk I report our recent progress on solving the positronium system in Basis Light-front Quantization (BLFQ). BLFQ is a nonperturbative method based on light-front quantization and Hamiltonian formalism. In BLFQ, bound-state problems are treated as eigenvalue problems for the associated Hamiltonian. The resulting eigenvalues give the mass spectrum of the bound states and the eigenvectors are the light-front amplitudes encoding the bound-state structure. In this work we solve the positronium system in the $|e^+e^-\rangle$ and $|e^+e^-\gamma\rangle$ two Fock sectors. We adopt a basis-state dependent renormalization scheme, where different basis states in the $|e^+e^-\rangle$ sector receive renormalization constants of different magnitude, depending on their respective phase space for fluctuating to the higher Fock sector. These renormalization constants are inferred from a series of parallel computation of a physical electron system "embedded" in the basis space of the corresponding positronium system. I will present the resulting positronium mass spectrum and compare with those obtained in nonrelativistic quantum mechanics and those from a previous work in BLFQ but restricted in the $|e^+e^-\rangle$ sector. I will also compare the light-front amplitudes for the low-lying states with that of a physical electron and those from the previous work.

* xbzhao@impcas.ac.cn