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Higher Order Corrections to Positronium Energy Levels

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Positronium spectroscopy is of continuing interest as a high-precision test of our understanding of binding in QFT. Positronium represents the purest example of binding in QFT as the constituents are structureless and their interactions are dominated by QED with only negligible contributions from strong and weak effects. Positronium differs from other Coulombic bound systems such as hydrogen or muonium in having maximal recoil (the constituent mass ratio m/M is one) and being subject to real and virtual annihilation into photons. Spectroscopic studies of low-lying states ($n = 1$ hyperfine splitting, $n = 2$ fine structure, and the $2S - 1S$ interval) have reached a precision of order $1MHz$, and ongoing experimental efforts give the promise of improved results. Theoretical calculations of positronium energies at order $m\alpha^6 \sim 18.7MHz$ are complete, but only partial results are known at order $m\alpha^7 \sim 0.14MHz$. I will report on the status of the positronium energy calculations, give some details of the methods employed, and present the latest results for order $m\alpha^7$ contributions.

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