

# Positronium molecule

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Positronium is the simplest known atom. Its properties can be calculated with almost arbitrary precision using quantum electrodynamics (QED), limited only by technical challenges. Confrontation of theoretical and experimental results for the spectrum and lifetimes will be briefly reviewed.

Recently, also the three-body positronium ion, consisting of two electrons and one positron, has been subject of precise measurements [1]. Theoretical description of its decay, including radiative and relativistic effects, will be reviewed [2].

The most recent discovery is the di-positronium molecule, consisting of two electrons and two positrons [3]. The molecule is sufficiently strongly bound to have a spectrum of several excited states. This is in contrast to the three-body ion, which has no discrete excited states. The emerging spectroscopy of di-positronium will reveal details of its structure. Theoretical prediction for the dipole excitation interval, including relativistic corrections, will be presented [4]. Lifetime, decay channels, and branching ratios of the P-state will also be described.

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[1] F. Fleischer *et al.*, Phys. Rev. Lett. **96** (2006) 063401.

[2] M. Puchalski and A. Czarnecki, Phys. Rev. Lett. **99** (2007) 203401.

[3] D. B. Cassidy and A. P. Mills, Jr., Nature **449** (2007) 195.

[4] M. Puchalski and A. Czarnecki, to be published.