

# Decay Rates of Positronium Species

*Saturday, 18 February 2023 10:00 (15 minutes)*

It has been known for many years that an electron and its antiparticle, the positron, may together form a metastable hydrogen-like atom, known as positronium or Ps. In 1946, Wheeler speculated that two Ps atoms may combine to form the positronium molecule ( $\text{Ps}_2$ ) stable with respect to auto-dissociation. In 2007, the existence of  $\text{Ps}_2$  was confirmed experimentally by David Cassidy and Allen Mills at the University of California.

I will present a determination of the radiation-less and two photon decay rates of  $\text{Ps}_2$ . We employ a simple technique to compute the amplitudes and write the products of spinors in terms of gamma matrices, which reduces the computational time and provides more insights into the physics of a reaction. After testing the method with the well known problem of para-positronium (p-Ps) and positronium ion ( $\text{Ps}^{-1}$ ), I will present decay rate calculation of  $\text{Ps}_2 \rightarrow e^- e^+$  and  $\text{Ps}_2 \rightarrow \gamma\gamma$ , and demonstrate that the previously published results are incorrect.

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