Quantum Information Transfer in Positronium Annihilation

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We are forming a network of labs under the QUITPA (Quantum Information Transfer in Positronium Annihilation) acronym, to study quantum information transfer in positronium (Ps: bound state e+ e-) decay.

The pioneering study of correlation between the quantum numbers of Ps and theory-predicted entanglement of the polarization of its annihilation $γ$s will be performed.

Present groups:

-Antimatter, Uni-Trento-TIFPA: e+/Ps physics

-J-PET, Jagiellonian Uni-Cracow: $γ$ detectors

-INFN-PD: $γ$ detectors

-Quantum, Uni-Vienna, quantum theory

The experiment requires:

-a cold Ps beam on 23S long lived level with laser-selected magnetic quantum number

-determine the polarization of Ps annihilation $γ$s via detection of primary and scattered Compton $γ$s

-compare the measurements with theory predictions.

Details about the project are given enlightening issues as the detector design and the selection of the Ps magnetic quantum number. Impact on different fields (QI, Astrophysics, Med., CPT) are discussed.