

Quantum Technologies within INFN: status and perspectives



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Type: **Invited talk** "successful initiative within INFN"

Quantum Information Transfer in Positronium Annihilation

We are forming a network of labs under the QUITPA (Quantum Information Transfer in Positronium Annihilation) acronym, to study quantum information transfer in positronium (P_s : bound state $e^+ e^-$) decay. The pioneering study of correlation between the quantum numbers of P_s and theory-predicted entanglement of the polarization of its annihilation γ s will be performed.

Present groups:

- Antimatter, Uni-Trento-TIFPA: e^+/P_s physics
- J-PET, Jagiellonian Uni-Cracow: γ detectors
- INFN-PD: γ detectors
- Quantum, Uni-Vienna, quantum theory

The experiment requires:

- a cold P_s beam on $23S$ long lived level with laser-selected magnetic quantum number
- determine the polarization of P_s 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 P_s magnetic quantum number. Impact on different fields (QI, Astrophysics, Med., CPT) are discussed.

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