

# The Tests of CP and CPT Asymmetry using J-PET Detector

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## Collaboration

J-PET collaboration

## Abstract content

### Abstract

Symmetries under the parity transformation (P), charge-conjugation (C) and time reversal (T) are of fundamental importance in nuclear and elementary particle physics. Studies of the observables violating the combined CP symmetry constitute precise tests of the Standard Model. However, CP violation was observed to date only for systems involving quarks, raising the importance of searches its manifestations e.g. in purely leptonic systems.

The  $3\gamma$  decay of spin-aligned ortho-positronium atoms (o-Ps) can be used to test CP invariance in such a purely leptonic system. The Jagiellonian Positron Emission Tomograph (J-PET) detection system [1] enables experimental tests of CP and CPT through measurement of the expectation values of angular correlation operators odd under these transformations and constructed from (i) spin vector of the ortho-positronium atom, (ii) co-planar momentum vectors of photons originating from the decay of positronium, and (iii) linear polarization direction of annihilation photons [2,3]. Precise experimental symmetry tests with J-PET are possible thanks to a dedicated reconstruction technique of  $3\gamma$  ortho-positronium decays [4] and a positronium production chamber including a highly porous aerogel target, whose setup allows for determining the ortho-positronium spin polarization without the use of external magnetic field [5].

References: [1] E. Czerwiński et al., Acta Phys. Polon. B10, 1961 (2017).

[2] P. Moskal et al., Acta Phys. Polon. B47, 509 (2016).

[3] D. Kamińska et al., Eur. Phys. J. C76, 445 (2016).

[4] A. Gajos et al., Nucl. Instrum. and Meth. A819, 54 (2016).

[5] M. Mohammed et al., Acta Phys. Polon. A130, 1486 (2017).

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