

# Dark Matter and rare decay searches of the ortho-Positronium with the J-PET detector

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The J-PET is a high-acceptance multi-purpose detector optimized for the detection of photons from positron-electron annihilation and can be used in a broad scope of interdisciplinary investigation. The Positronium system, a bound state of an electron and a positron, is suitable for testing the predictions of quantum electrodynamics (QED). In particular, the Ps triple state, the ortho-Positronium (o-Ps), which mainly decays to three photons, is a well-suited system to perform searches of new physics.

We propose to study the lifetime of the o-Ps state in search of a new type of matter, the so-called Alice or Mirror Matter (MM), a suitable candidate for Dark Matter. By performing a high-precision measurement of the o-Ps lifetime, the accuracy of the present QED calculations can be tested. A discrepancy with the expectation from theory could indicate the presence of Physics Beyond the SM, i.e. a signal for MM. Furthermore, profiting from the triggerless acquisition mode of the J-PET detector, we will search for decays of the o-Ps into  $4\gamma$  and  $5\gamma$ , the former C-violating decay and the latter never observed. The large acceptance and high angular resolution of the J-PET detector will push the present limits in these forbidden and rare decays.

## Collaboration

J-PET

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