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Test of new operators of discrete symmetries with J-PET

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Search for possible violation of combined charge, parity, and time-reversal symmetries is yet another approach for a test of New Physics, therefore a bound state of electron and positron (positronium) as the lightest matter-antimatter system and at the same time aneigenstate of the C and P operators is an unique probe in such endeavour. The test is performed by measurement of angular correlations in the annihilations of the lightest leptonic bound system. The J-PET detector is the only device which enables determination of polarization of photons from positronium annihilation together with estimation of positronuium spin axis on the event-by-event basis. This allows exploration of a new class of discrete symmetry odd operators that were not investigated before. With first measurements demonstrating such capabilities we are able to reach the precision of CP and CPT tests at permill level. In the talk we will describe experimental techniques and new results of discrete symmetries tests in the decays of positronium in a whole available phase-space.

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