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Test of discrete symmetries with spin observables at J-PET

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The Jagiellonian PET (J-PET) detector is the only device which enables estimation of positronium spin axis together with determination of polarization of photons from positronium annihilation on the event-by-event basis. This allows to test angular correlations in the annihilations of the lightest leptonic bound system and explore a new class of discrete symmetry odd operators that were not investigated before. Such measurement is equivalent to a search for possible violation of combined charge, parity, and time-reversal symmetries as yet another approach for a test of New Physic. Positronium, a bound state of electron and positron, as the lightest matter-antimatter system and at the same time an eigenstate of the C and P operators is an unique probe in such endeavor. 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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