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Towards Charge conjugation symmetry test in Electromagnetic Interaction using J-PET

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Charge conjugation symmetry (C symmetry) still remains a fundamental symmetry in the realm of physics. It is well-known to be maximally violated in weak interactions. However, its validity is yet to be tested in Electromagnetic (EM) and Strong interactions. With the aim to test this symmetry in EM interactions, the forbidden decay channel of the triplet Positronium state - the ortho-Positronium (oPs) shall be explored. The C symmetry forbids this state from decay into anything other than an odd number of photons; henceforth a search for four-photon decay extends the feasibility of testing the C symmetry in EM interaction using a J-PET detector. Furthermore, the bosonic nature of photons hints at a distinct configuration in the event of a C-symmetry violation. Known for its outstanding timing ($\sim$ 250 ps) and angular ($\sim$1 $^{\circ}$) resolutions, J-PET offers a viable and substantial platform to perform this symmetry test. J-PET series of detectors has previously established its credibility in the tests of discrete symmetries, further supporting the feasibility of the aforementioned test. In this presentation, the motivation behind the study, the theoretical assumptions, and recent advancements in the test of C symmetry using J-PET shall be discussed.

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