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Precision tests for T-symmetry violation in Positronium decay using the J-PET detector

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Time reversal symmetry (T) violation has been one of the most intriguing aspects of the tests on discrete symmetries. So far, T-violation has not been observed in purely leptonic systems [1, 2, 3]. According to the standard model predictions, photon-photon interaction or weak interaction can mimic the symmetry violation at the level of 10^{−9} (photon-photon interaction) and 10^{−13} (weak interactions) respectively, posing as a physical restriction to these tests [4-6].
The Jagiellonian Positron Emission Tomograph (J-PET) developed at Jagiellonian University in Krakow, Poland, is one of its kind, based on organic scintillators [7, 8, 10]. J-PET is an axially symmetric and high acceptance scanner that can be used as a multi-purpose detector system. It is well suited to pursue tests of discrete symmetries in decays of positronium in addition to medical imaging [9, 10, 12, 14]. J-PET enables the measurement of the momentum vector ki and the polarization vector \epsilon_{j} of annihilation photons [11, 13, 14]. Measurement of polarization of annihilation photons is a unique feature of the J-PET detector which allows the study of T-violation by determining the expectation values of the time reversal symmetry odd operator [14],

(\epsilon_{j} \cdot k_{i}), (for j ≠ i) [14].

J-PET collaboration aims to improve the sensitivity for the tests of the time reversal symmetry with respect to the previous experiments in the leptonic sector beyond the present established level of 10^{-3} [2]. At the turn of 2017 and 2018, a three month data-taking campaign with the positronium produced in the porous polymer was conducted. The results of the analyzed data will be presented.

References

[1] V.A. Kostelecky and N. Russell, January 2018 update to Reviews of Modern Physics 83, 11(2011)
[2] T. Yamazaki, T. Namba, S. Asai, T. Kobayashi, Phys. Rev. Lett. 104, 083401 (2010)
[3] P.A. Vetter, S.J. Freedman, Phys. Rev. Lett. 91, 263401 (2003)
[4] M. S. Sozzi, Discrete Symmetries and CP Violation. From Experiment to Theory,
Oxford University Press (2008)
[5] W. Bernreyther et. al., Z. Phys. C 41, 143 (1988)
[6] B. K. Arbic et. al., Phys. Rev. A 37, 3189 (1988)
[7] P. Moskal et al., Phys. Med. Biol. 61 (2016)
[8] P. Moskal et al., Nucl. Instr. and Meth. A 764 (2014) 317-321
[9] D. Kamiska et al. Eur. Phys. J. C 76, 445 (2016)
[10] P. Moskal et al., Phys. Med. Biol. 64 (2019) 055017
[11] B. C. Hiesmayr and P. Moskal, Scientific Reports 7, 15349 (2017)
[12] A. Gajos et al., Nucl. Instrum. Methods A 819, 54 (2016)
[13] P. Moskal et al., Eur. Phys. J. C 78, 970 (2018)
[14] P. Moskal et al., Acta Phys. Polon. B 47, 509 (2016)

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