

Positron emission tomography imaging harnessing polarization correlations

Friday, 5 December 2025 09:30 (30 minutes)

Conventional Positron Emission Tomography (PET) imaging is based on measurement of energy and coincidence time of back-to-back photons from positron annihilation. The annihilation quanta posses yet another correlation - the orthogonality of their initial polarizations. We developed a demonstrator based on single-layer Compton polarimeters to study the potential of this additional information to enhance PET. We present the imaging tests done with two Ge-68 rod sources of 45 MBq each, and with NEMA NU-4 phantom with a Ga-68 solution of 400 MBq initial activity. To assess the performance we compare the images reconstructed using polarization-correlated Compton events with single-pixel gamma identification, as a reference. We observed the spatial resolutions of from 4.3 ± 0.3 mm to 6.3 ± 0.3 mm, in the former case, and 2.5 ± 0.3 mm in the latter. We also show that $\sim 10\%$ sensitivity increase can be obtained by combining all events.

Authors: Prof. MAKEK, Mihael (Department of Physics, Faculty of Science, University of Zagreb); KOŽULJEVIĆ, Ana Marija (Institute for Medical Research and Occupational Health); BOKULIC, tomislav (Department of physics, Faculty of Science, University of Zagreb); GROŠEV, Darko (University Hospital Centre Zagreb); Dr PARASHARI, Siddharth (Instituto de Física Corpuscular (IFIC)); PAVELIĆ, Luka (Institute for Medical Research and Occupational Health); ŽUVIĆ, Marijan (University Hospital Centre Zagreb)

Presenter: Prof. MAKEK, Mihael (Department of Physics, Faculty of Science, University of Zagreb)

Session Classification: Exotic atoms: fundamental aspects, applications and advances in radiation detectors