大阪公立大学
Osaka Metropolitan University

第 146 回 生物科学フロンティアセミナー
第 57 回 ケミカルバイオロジー研究所セミナー

The first positronium imaging of the human brain with the J-PET scanner

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日時：令和 7 年 5 月 30 日（金）午後 2 時 30 分より
場所：中百舌鳥キャンパス A13 棟 3 階 323 室

事前参加申し込みは不要です。
会場まで直接お越しください。

Jagiellonian-PET (J-PET) is a novel, cost-effective positron emission tomography technology based on plastic scintillators [1,2]. The J-PET system constructed at the Jagiellonian University is the first multi-photon PET scanner [3] capable of measuring momentum vectors and the orientation of polarization planes of photons originating from positronium decays [4]. *Positronium imaging* is a newly invented method for imaging the properties of positronium in living organisms [5,6,7,8]. *Quantum Entanglement Imaging* is a method enabling the imaging the degree of the entanglement of annihilation photons [9].
We will present the first-ever images of the properties of positronium in humans [8], the first multi-photon images from the decays of positronium atoms into three photons [3], and the first observation of non-maximal entanglement of photons from positronium annihilation in matter [9]. We will discuss the status of the development of (i) *positronium imaging* and (ii) degree of *quantum entanglement imaging* as possible diagnostic biomarkers of tissue pathology [10] and biomarkers of hypoxia [11]. We will also discuss the possibility of developing a method for studies of material properties by the measurement of the degree of quantum entanglement of annihilation photons.

References

[1] P. Moskal, E. Ł. Stępień, *PET Clinics* **15**, 439 (2020), [2] P. Moskal *et al.*, *Phys. Med. Biol.* **66**, 175015 (2021), [3] P. Moskal *et al.*, *Nature Communication* **12**, 5658 (2021), [4] P. Moskal *et al.*, *Nature Communication* **15**, 79 (2024), [5] P. Moskal, *Positronium Imaging*, IEEE NSS MIC 2018, 10.1109/NSSMIC.2018.8824622, [6] P. Moskal, E. Ł. Stępień *et al.*, *Nature Reviews Physics* **1**, 527 (2019), [7] P. Moskal *et al.*, *Science Advances* **7**, eabh4394 (2021), [8] P. Moskal, *et al.*, *Science Advances* **10**, eadp2890 (2024), [9] P. Moskal et al., *Science Advances* **11**, eads3046 (2025), [10] P. Moskal, *et al. EJNMMI Phys.* **10**, 22 (2023), [11] P. Moskal, E. Ł. Stepień, *Bio-Algorithms and Med-Systems* **17**, 311 (2021).

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