Contribution ID: **11** Type: **not specified**

# Positronium in liver cancer diagnostics

*Friday, 5 December 2025 09:00 (30 minutes)*

The annihilation of positronium (Ps), a hydrogen-like, unstable atom composed of an electron (e-) and a positron (e+), has been successfully used in basic research to assess the nanostructure properties of organic and inorganic matter, metals, porous materials, and others. In the near future, it may also support oncology diagnostics.

The triplet bound state of positronium (*o*-Ps) can be used as a nanometer-scale porosimetric probe in biological matter, providing information on both the structure and physicochemistry of the medium. The structure and course of the metabolic processes that collectively influence the formation and annihilation of o-Ps are different in healthy tissues and in cancerous tissues. Consequently, analysis of the o-Ps annihilation process enables the differentiation of biological matter at different stages of disease.

Many years of research using Positron Annihilation Lifetime Spectroscopy (PALS) on tissues from various organs, including human liver, collected during resection of the organ or parts thereof, have led to the development of a research methodology enabling reliable tissue differentiation in terms of the presence of pathological changes and the effectiveness of therapy. It was possible to demonstrate the influence of both individual, patient-dependent factors and the impact of the adopted measurement procedure and data analysis methodology on the differentiation results. A key criterion for assessing the reliability of the *o*-Ps probe in oncological diagnostics was the reproducibility and repeatability of results. Systematizing data and standardizing measurement and analytical procedures led to the development of a relatively simple method for tissue differentiation based on mapping (INTI plot), which can support oncological diagnostics.

**Author:** Dr ZGARDZIŃSKA, Bożena (Institute of Physics, Maria Curie-Sklodowska University in Lublin)

**Co-author:** Ms YANKOVA, Katsiaryna (Institute of Physics, Maria Curie-Sklodowska University in Lublin)

**Presenter:** Dr ZGARDZIŃSKA, Bożena (Institute of Physics, Maria Curie-Sklodowska University in Lublin)

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