

P42 | **Study the linear polarization of the positron and positronium by using the J-PET detector**

Muhsin Mohammed<sup>1,10,\*</sup>, Aleksander Gajos<sup>1</sup>, Daria Kaminska<sup>1</sup>, Dominika Alfs<sup>1</sup>, Piotr Bialas<sup>1</sup>, Catalina Curceanu<sup>3</sup>, Eryk Czerwinski<sup>1</sup>, Andrzej Danel<sup>4</sup>, Kamil Dulski<sup>1</sup>, Bartosz Glowacz<sup>1</sup>, Marek Gorgol<sup>5</sup>, Beatrix Hiesmayr<sup>6</sup>, Bozena Jasinska<sup>5</sup>, Krzysztof Kacprzak<sup>1</sup>, Andrzej Kochanowski<sup>7</sup>, Grzegorz Korcyl<sup>1</sup>, Pawel Kowalski<sup>8</sup>, Tomasz Kozik<sup>1</sup>, Wojciech Krzemien<sup>9</sup>, Ewelina Kubicz<sup>1</sup>, Mateusz Kucharek<sup>4</sup>, Monika Pawlik-Niedzwiecka<sup>1</sup>, Szymon Niedzwiecki<sup>1</sup>, Marek Palka<sup>1</sup>, Lech Raczynski<sup>8</sup>, Zbigniew Rudy<sup>1</sup>, Oleksandr Rundel<sup>1</sup>, Neha G. Sharma<sup>1</sup>, Michal Silarski<sup>1</sup>, Tomasz Uchacz<sup>7</sup>, Anna Wieczorek<sup>1,2</sup>, Wojciech Wislicki<sup>8</sup>, Bozena Zgardzinska<sup>5</sup>, Marcin Zielinski<sup>1</sup>, Pawel Moskal<sup>1</sup>

<sup>1</sup> *Faculty of Physics, Astronomy and Applied Computer Science, Jagiellonian University, 30-348 Krakow, Poland*

<sup>2</sup> *Institute of Metallurgy and Materials Science of Polish Academy of Sciences, 30-059 Krakow, Poland*

<sup>3</sup> *INFN, Laboratori Nazionali di Frascati, 00044 Frascati, Italy.*

<sup>4</sup> *Institute of Chemistry and Physics, University of Agriculture, 30-149 Krakow, Poland*

<sup>5</sup> *Institute of Physics, Maria Curie-Sklodowska University, 20-031 Lublin, Poland.*

<sup>6</sup> *Faculty of Physics, University of Vienna, 1090 Vienna, Austria*

<sup>7</sup> *Faculty of Chemistry, Jagiellonian University, 30-060 Krakow, Poland*

<sup>8</sup> *Department of Complex System, National Centre for Nuclear Research, 05-400 Otwock-Swierk, Poland*

<sup>9</sup> *High Energy Physics Division, National Centre for Nuclear Research, 05-400 Otwock-Swierk, Poland*

<sup>10</sup> *Department of Physics, College of Education for Pure Sciences, University of Mosul, Mosul, Iraq*

\* email: muhsin.m@doctoral.uj.edu.pl

A method for measuring the linear polarization of positron and ortho positronium (o-Ps) atom is proposed which is based on the determination of the angular distribution of the normal to the decay plane with respect to the o-Ps spin orientation. In the case of the linear polarization we can determine it on the event by event basis as a direction of the positron motion. The unique geometry and properties of the J-PET enables to design the positron source such that the linear polarization of produced o-Ps can be determined. Due to the parity violation in the beta decay the emitted positrons are longitudinally polarized with the polarization vector equal to  $p = v/c$ , where  $v$  denotes the positron velocity,  $c$  is the speed of light. The J-PET is a novel tomography device using plastic polymer instead of conventional crystal. It can be used to study the Ps polarization, we can also study the degree of the o-Ps polarization which may be monitoring based on the measurements of the angular distribution between the normal to the  $3\gamma$  decay plane and the o-Ps spin direction.