

PhD student position with scholarship

in the NCN project Sonata Bis 10 2020/38/E/ST2/00112

Faculty of Physics, Astronomy and Applied Computer Science, Jagiellonian University of Kraków, Poland

Searches for Mirror Matter as Dark Matter candidate in decays of the ortho-Positronium and precision QED test



The aim of the project is to search for Dark Matter (DM) candidates in the Positronium system. Positronium is a bound state of an electron and a positron, suitable for testing the predictions of quantum electrodynamics (QED). Present positronium experiments search for invisible decays of its triplet state, the ortho-Positronium (o-Ps), which mainly decays to three photons. These invisible decays are sensitive to new physics scenarios, e.g. mirror matter. Mirror matter would interact with normal particles mainly through gravity, thus becoming possible DM candidates. Additionally, the measurement of the branching ratio of the charge conjugation violating decay o-PS to 4 gammas and QED allowed o-Ps to 5 gamma decay, will test the QED theoretical expectations at high order. The project leader is Dr. Elena Perez del Rio.

The minimum requirements for the candidate are:

- The student must hold a master's degree in the field of Natural Sciences, Engineering, Computer Science, Mathematics, or related field of science, he/she will need to have basic knowledge of programming languages as well as be familiar with data analysis, statistics, Unix operating systems, and Particle Physics.
- Status of Ph.D. student in a polish institution or the prospect to become one.
- Good knowledge of English (spoken and written).

The successful applicant is expected to perform the following tasks:

- Evaluation of the lifetime of the o-Ps decays and estimation of branching ratios for different reactions.
- Data acquisition. Detector calibration. Identification and selection of the data. Simulation of the positronium decays and background sources.
- Background reduction and discrimination. Development and implementation of Machine Learning based algorithms for background rejection.
- Interpretation of results, preparation of scientific articles, presentation of results at conferences and scientific meetings.

We offer experience, team work and an excellent research environment in the field of Dark Matter searches performed by a state-of-the-art detector, the [JPET \(Jagiellonian PET\) Tomograph](#), . In addition, the successful candidate will receive a **scholarship of 4000 zł/month for the time of work in the project**.

The interested candidates should send the following documents:

A short application with a cover letter. A scientific CV with a list of publications and a description of previous scientific work and other experiences/achievements. At least one letter of recommendation.

Please include in your offer: "I hereby give consent for my personal data included in my application to be processed for the purposes of the recruitment process under the Personal Data Protection Act as of 29 August 1997, consolidated text: Journal of Laws 2016, item 922 as amended."

All documents should be sent via email to elena.rio@uj.edu.pl **no later than 15th of December 2021** with the Subject SONATA BIS Scholarship.

The candidates will be evaluated by a committee chaired by the leader of the project. Selected candidates will be called for an interview before the 23rd of December. The candidates will be informed of the result of the selection via email by January 7th.