

## 7. DEPARTMENT OF COSMIC RAY PHYSICS

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### Overview

The Department of Cosmic Ray Physics in Łódź is involved in basic research in the high-energy Cosmic Ray field. Cosmic Rays are energetic particles from outside the Solar System. Most of the studies of Cosmic Rays address fundamental problems:

- the nature of the physical and astrophysical processes responsible for the high energies of the particles
- an estimation of the astrophysical conditions at the acceleration sites and/or the search for sources of Cosmic Rays,
- properties of high-energy particle interactions at very high energies.

Some Cosmic Ray studies might have practical (commercial) implications, e.g.

-“cosmic weather” forecasting - predictions of geomagnetic disturbances related to Solar activity changes (due to large Solar Flares/Coronal Mass Ejection events); these are important for large electricity networks, gas pipelines, radio-wave connections, space missions and satellite experiments.

Presentation of Cosmic Ray registration to high school students has become a popular way to introduce particle physics detectors and elementary particle detection techniques to young people. We organize in Łódź and Poznań workshops on particle physics for high school students. This is a part of the European activity: EPPOG's Masterclass – Hands on CERN.

Energetic Cosmic Ray particles produce cascades of particles in the atmosphere, called Extensive Air Showers (EAS). Registering EAS and their properties is the main way of experimentally study's very high energy Cosmic Rays. Locally in Łódź we concentrate on methodological studies of the detection of neutrons correlated with EAS and the interpretation of this phenomenon. We have also performed two series of neutron background measurements in the deep underground Gran Sasso Laboratory in Italy (within the ILIAS-TA Project).

In 2004, we began the Roland Maze Project, a network of EAS detectors placed on the roofs of high schools in Łódź. The pilot project is to equip 10 high schools, each with four 1m<sup>2</sup> detectors and GPS. The network is connected off-line using internet infrastructure and precise time registration. Students of the high schools in Łódź are involved in the construction of the array.

International collaborations are very important: the Department is a member of the KASCADE-Grande Collaboration – the large classical experiment for very high energy EAS, extended to EAS radio emission detection as part of LOPES Collaboration. We also became a member of the JEM-EUSO satellite experiment collaboration. We collaborate in EAS data interpretation, detection techniques and basic Cosmic Ray studies with University Paris-VII, Institute for Nuclear Research of the Russian Academy of Sciences and JINR Dubna.

In the area of high-energy particle physics the Department participates in the ZEUS experiment at DESY (Hamburg, Germany), and in the WASA@COSY Collaboration in Juelich, Germany.

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