



Ecole Doctorale 534 MIPEGE

*Modélisation et Instrumentation en Physique, Energies,
Géosciences et Environnement*

Université Paris-Sud 11

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Subject for PhD and internship

Laboratory : Institut de Physique Nucléaire d'Orsay

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Title : HADES experiments with a pion beam (Darmstadt, Germany)

Subject description :

The HADES detector (High Acceptance Dielectron Spectrometer), located at GSI, near Darmstadt in Germany is devoted to the measurement of a rare process: the production of dielectrons (e^+, e^-) in nuclear reactions with incident energies in the 1-3 GeV/nucleon range. The main interest of this channel is to bring undistorted information on properties of hadrons in the nuclear matter, as produced in heavy-ion reactions. A comprehensive understanding of all the elementary processes producing dielectrons is however not yet achieved and is interesting in itself, due to the connection with the electromagnetic structure of hadrons. Therefore, the HADES collaboration also developed a program of measurements of elementary reactions, in which the IPN team is deeply involved. Proton-proton and neutron-proton reactions have been already measured. They serve as reference to the data obtained in heavy-ion reactions, and due to the possibility to select exclusive processes, allow to test

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the models in a very efficient way. A new step is now foreseen: experiments using the GSI pion beam, with energies ranging between 0.7 and 1.6 GeV.

The subject of the PhD will be the study of the reactions induced by a pion on a proton target, including all steps from the preparation to the analysis and publication of the results. Tests to check the quality of the beam and to operate the dedicated in-beam detectors will first be achieved. Then, the student will participate actively to the realization of the experiment and he will be responsible for the analysis of some of the exit channels. The dielectron production will be used in first place to study the electromagnetic structure of baryonic resonances (excited states of nucleons), in connection with the Heavy Ion HADES program. The two-pion and eta meson production channels are also very interesting. They are connected to specific baryonic resonances and can solve open issues about the decay branching ratios or even the existence of these states.

An internship is also proposed: the HADES collaboration will run in April-May 2012 an experiment to study the dielectron production in the system Au+Au with an incident energy 1.25 GeV/nucleon. The work will consist in the participation to the data taking and/or to the early stages of the analysis, such as calibrations and data quality assessment using the information of all sub-detectors.

National or international collaborations :

The HADES collaboration brings 80 persons from different European countries together. We have a close collaboration with the Cracow (Poland) and GSI (Darmstadt, Germany) teams and make frequent stays in these laboratories.

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