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TECHNISCHE UNIVERSITÄT DARMSTADT

Master thesis in Experimental Nuclear Physics

Antiproton trapping at CERN for the GBAR and PUMA experiments

A Master thesis project is proposed at the Institute of Nuclear Physics (IKP) of TU Darmstadt.

Project description:
PUMA is a new CERN experiment aiming at using trapped antiprotons to probe the low-density tail of stable and radioactive nuclei. A key aspect of PUMA is the trapping of a large amount of antiprotons (a first objective is 1e7 while the final objective is 1e9) at the CERN/ELENA facility.

GBAR is a CERN experiment aiming at measuring the behaviour of antimatter (anti hydrogen atoms) in the gravitational field both earth. A key component of the experiment is the production of $\bar{H}^+$ ions (two positrons bound to an antiproton), the first step towards the production of H at rest. At GBAR, the formation of $\bar{H}^+$ ions is made by sending bunches of slow (3 keV) antiprotons though a cloud of positronium, short lived system composed of an electron and a positron.

Both experiments aim at an efficient antiproton trapping and accumulation. The accumulation and trapping will rely on sympathetic cooling by trapping the antiprotons together with electrons.

The Master project focuses on the accumulation and trapping of antiprotons at CERN. The Master thesis will take place mainly at CERN at the GBAR experiment. The candidate will learn to operate an existing trap belonging to the GBAR experiment. An electron gun will be designed, based on an existing design, built and installed inside the trap. At a first stage, electrons will be trapped. At a later stage, antiprotons will be injected inside the trap and the trapping and accumulation of antiprotons will be performed.

Candidate profile:
Only candidates holding a Bachelor degree in physics or engineering may apply.

Interested candidates should contact Prof. Alexandre Obertelli (spokesperson of PUMA), alexandre.obertelli@tu-darmstadt.de and Dr. Patrice Pérez (spokesperson of GBAR), patrice.perez@cern.ch.