Fizički odsjek, PMF, Sveučilište u Zagrebu

Bijenička cesta 32

Seminar Fizičkog odsjeka

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From strange nuclei to strange atoms and stars

Experiments with low-energy kaons at the DAΦNE Collider in Italy

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The low-energy QCD, the theory describing the strong interaction, is still missing fundamental experimental results in order to achieve a breakthrough in its understanding. Among these experimental results, the low-energy kaon-nucleon/nuclei interaction studies are playing a key-role, with important consequences going from particle and nuclear physics to astrophysics. Combining the excellent quality kaon beam delivered by the DAΦNE collider in Frascati (Italy) with new experimental techniques, as fast and very precise X ray detectors, like the Silicon Drift Detectors, and with the high acceptance charged and neutral particles KLOE detector, we have performed unprecedented measurements in the low-energy strangeness sector in the framework of SIDDHARTA and AMADEUS Collaborations. The kaonic atoms, as kaonic hydrogen and kaonic deuterium, provide the isospin dependent kaon-nucleon scattering lengths from the measurement of X rays emitted in the de-excitation process to the fundamental 1s level of the initially excited formed atom. The most precise kaonic hydrogen measurement was performed by the SIDDHARTA collaboration, which realized, as well, the first exploratory measurement for kaonic deuterium ever. Presently, a major upgrade of the setup, SIDDHARTA-2 is being realized to perform in the near future a precise measurement of kaonic deuterium and of other exotic atoms. The kaonnuclei interactions are being measured by the AMADEUS collaboration for kaon momenta up to 100 MeV/c by using the KLOE detector implemented in the central region with a dedicated setup. Preliminary results for the interaction of negatively charged kaons with various type of nuclei will be shown, including an analyses of the still "mysterious" $\Lambda(1405)$. Future plans will be discussed. The experiments at the DAΦNE collider represents an opportunity which is unique in the world to, finally, unlock the secrets of the QCD in the strangeness sector and understand the role of strangeness in the Universe, from nuclei to the stars.