

Search for Kaonic Nuclei at DAΦNE2: The AMADEUS Project

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We will describe a new series of experiments planned at Laboratori Nazionali di Frascati dell INFN, using an upgrade of the DAΦNE machine, to search for the existence of antikaon-mediated bound nuclear states. This search deals with one of the most important, yet unsolved, problems in hadron physics: how the hadron masses and hadron interactions change in the nuclear medium and what is the structure of cold dense hadronic matter. Deeply bound antikaon nuclear states ($\bar{K}$ -nuclear clusters) offer the ideal conditions for investigating the way in which the spontaneous and explicit chiral symmetry breaking pattern of low-energy QCD changes in the nuclear environment.

An overview of the status of the search for antikaon nuclear clusters will be given, starting with the work done at KEK, which showed a first experimental evidence for the existence of $\bar{K}$ -nuclear clusters. Also hints are seen at DAΦNE with FINUDA and at GSI with FOPI.

The experimental setup to perform the AMADEUS project will be sketched, using the existing KLOE detector at DAΦNE and modifying it by adding in the inner region, around the beam pipe, a target and tracker system. The AMADEUS scientific program consists of precision spectroscopy studies, starting with light kaonic nuclei - ^3He and ^4He - to form the most basic antikaon nuclear clusters: “strange dibaryon” (ppK^- , pnK^-) and “tribaryon” ($ppnK^-$, $pnnK^-$) states, as function of their baryon number and isospin. Measurements with medium heavy nuclear targets are planned as well. The detailed structure information can be extracted from a Dalitz-plot analysis of three-body decays of kaonic nuclei, as was pointed out recently by Kienle, Akaishi and Yamazaki, being one of the most interesting feature to be performed with the AMADEUS setup. Finally, these data will clearly proof or disproof the existence of antikaon-mediated bound nuclear systems, a question still under debate.

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