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Kaonic Atom X-Ray Spectrocopy with the SIDDHARTA-2 Experiment

Kaonic atoms are ideally suited candidates to study the low-energy regime of QCD including strangeness, without the need to extrapolate to zero relative energy as for scattering experiments. The theoretical models describing the low-energy antikaon-nucleon interaction show significant differences, and experimental input is crucial to constrain them. The SIDDHARTA-2 experiment, located at the DAΦNE collider at LNF in Italy, can provide this input via X-ray spectroscopy of light kaonic atoms, in particular by measuring the $2p \rightarrow 1s$ transition in kaonic deuterium. A combination of the results from kaonic hydrogen measured by SIDDHARTA in 2009 and kaonic deuterium will enable the extraction of the isospin-dependent antikaon-nucleon scattering lengths a_0 and a_1 for the first time, which are vital parameters for constraining the models. By employing newly developed X-ray detectors in the form of Silicon Drift Detectors as well as sophisticated methods for background suppression, SIDDHARTA-2 is equipped to perform the challenging K^-d measurement. During its commissioning in 2021, a first successful run with kaonic helium-4 was performed, and the K^4He $2p$ level shift ϵ_{2p} and width Γ_{2p} were extracted and found to be $\epsilon_{2p} = (0.2 \pm 2.5_{stat.} \pm 2.0_{syst.})$ eV and $\Gamma_{2p} = (8 \pm 10)$ eV. The experimental apparatus will be presented and the results from the first data taking campaigns will be discussed.

Scientific topic

Symmetries and Interactions

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