

Study of strong interaction with strangeness – from kaonic hydrogen at DAΦNE to kaonic deuterium at J-PARC

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The study of the antikaon-nucleon system at very low energies plays a key role for the understanding of the strong interaction between hadrons in the strangeness sector. At the DAΦNE electron-positron collider of Laboratori Nazionali di Frascati kaonic hydrogen atoms were studied with up to now unreached precision with SIDDHARTA [1-3], taking advantage of the low-energy charged kaons from Φ -mesons decaying nearly at rest. The SIDDHARTA experiment used specially developed Silicon Drift Detectors (SDDs) for X-ray spectroscopy to determine the strong interaction induced

shift and width of the 1s level of kaonic hydrogen atoms. Shift and width are connected to the real and imaginary part of the scattering length, but only measurements of kaonic hydrogen and kaonic deuterium atoms will allow the determination of the isospin dependent scattering lengths a_0 and a_1 , essential for a further understanding of low-energy QCD.

Therefore, a proposal was put forward to J-PARC to measure the X-ray transition to the ground state of kaonic deuterium atoms, which are shifted in energy from its “pure” electromagnetic value due to strong interaction and also broadened due to kaon absorption on the nucleus. The existing K1.8BR spectrometer will be perfectly suited for this measurement, together with a newly developed X-ray detector system based on SDDs.

The state-of-the-art kaonic hydrogen atom X-ray measurement will be described as well as the future attempt to measure kaonic deuterium X-rays at J-PARC for the first time.

References

- [1] SIDDHARTA Collaboration, M. Bazzi et al., Phys. Lett. B 681, 310 (2009).
- [2] SIDDHARTA Collaboration, M. Bazzi et al., Phys. Lett. B 704, 113 (2011).
- [3] SIDDHARTA Collaboration, M. Bazzi et al., Phys. Lett. B 714, 40 (2012).

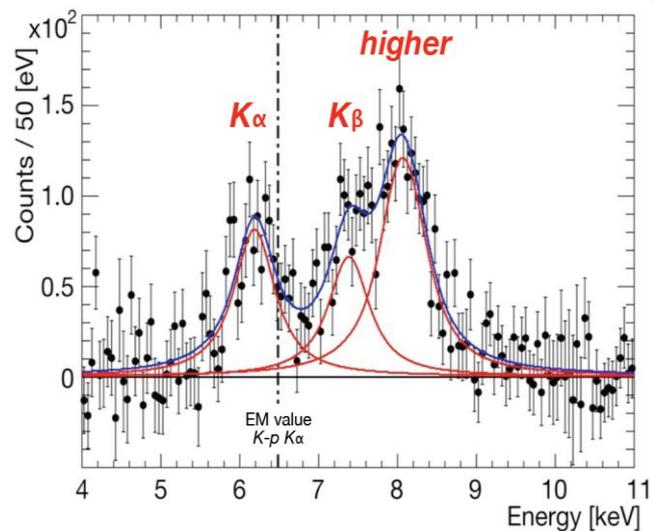


Fig.1 Kaonic hydrogen atom X-ray spectrum showing transitions to the ground state: $2p \rightarrow 1s$ (K_α), $3p \rightarrow 1s$ (K_β) and higher transitions from $n(>3)p$ -states $\rightarrow 1s$.