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Studying meson-nucleus interactions - the long way to first indications for the existence of η' mesic states

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Pionic and kaonic atoms are well known systems bound by the electromagnetic interaction between charged mesons and nuclei. Systems of a neutral meson bound to a nucleus only by the strong interaction have not been observed so far. The talk describes the long way to the first indication of η'⊗11C mesic states. In a series of photoproduction experiments the interaction between the η' meson
and nuclei has been studied. The real part of the η' nucleus potential has been extracted from the measurement of excitation functions and momentum distributions of η' mesons produced off various nuclei. The imaginary part of the η'-nucleus potential has been deduced from the measurement of transparency ratios. These measurements revealed a strong η'-nucleus attraction and a relatively weak imaginary potential, favourable conditions for the existence of meson-nucleus bound states. In a dedicated experiment using the 12C(p,d) reaction at the WASA@FRS setup at GSI the excitation energy spectrum of 11C has been investigated near the η' production threshold. Thereby the decay of possibly formed η'⊗11C mesic states has been tagged via the η'NN →Np decay channel. In coincidence with protons from this decay channel the 11C excitation energy spectrum shows structures in the bound state region which may be interpreted as the searched for η'⊗11C mesic states. The talk will give an overview over the steadily improved experiments with photon and proton beams which finally led to the result we dreamed of when starting this series of experiments many years ago.

Collaboration

CBELSA/TAPS, eta-PRiME Collaboration, Super_FRS Experiment Collaboration

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