Seminář

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Microscopic model for K^- absorption on two nucleons in nuclear matter

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The study of interactions of mesons (antikaons K^-) with nucleons and nuclear medium at low and intermediate energies plays an important role in contemporary physics since it extends our knowledge of the basic laws and symmetries in nature. The theoretical description of the K^-N interaction is currently provided by chiral SU(3) meson-baryon coupled-channel interaction models which respect the dynamics and symmetries of QCD. The K^-N interaction near threshold is known to be attractive from analyses of kaonic atom data and the existence of the $I = 0$ $\pi\Sigma$ resonance λ (1405). This fact stimulated theoretical and experimental search for K^- bound states in few-body as well as many-body nuclear systems.
The K^--nuclear optical potential based on the K^-N amplitudes derived form a chiral model yields narrow K^- widths in nuclei from ^{12}C up to ^{208}Pb which would be favorable for experimental observation. However, such single-nucleon K^- optical potential is not able to fit the kaonic atom data unless supplemented by a purely phenomenological term representing the K^- absorption on two and more nucleons. The K^- multi-nucleon absorption has a crucial impact on the K^- widths in the medium and cannot be neglected.
We have developed a microscopic model describing the K^- absorption on two nucleons in nuclear matter employing the K^-N scattering amplitudes derived from the state-of-the-art chiral meson-baryon interaction models. The model enables us to study the depth of the K^-NN optical potential at various nuclear matter densities, the respective contributions from different K^-NN absorption channels to the total K^- potential as well as the total K^- optical potential (K^-N + K^-NN) using one particular chiral amplitude model. We confronted the K^-N and K^-NN absorption fractions calculated within our model with corresponding data from old bubble chamber experiments as well as the recent data on the K^-NN absorption fractions from AMADEUS experiment. Our results seem to be in a very good agreement with available experimental data and our model is suitable for further applications in the K^- bound states calculations.

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