

Overview of pion-nucleus interaction at low energies

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Abstract This overview deals with several key issues in the interaction of low energy pions with nuclei, where progress has been made in recent years as part of a broader study of the modification of hadronic interactions in the nuclear medium. We note in this context that low energy pions are among the best-penetrating probes into nuclei.

Most of the experimental basis for this work is the extensive and precise data on strong interaction effects in pionic atoms across the periodic table, supplemented by experimental results on deeply bound pionic atom states. The renewed interest in the field was prompted by the latter and also by a possible link of the s-wave ‘anomalous repulsion’ to partial restoration of chiral symmetry in nuclear matter.

In this presentation we show the global picture of the pion-nucleus interaction at low energies and the connections to the corresponding pion-nucleon interaction. Correlations and ambiguities between the various components are discussed and the role played in data analysis by the neutron density distribution in nuclei is demonstrated, a role that was not fully recognized in earlier works. Comparisons are made with neutron densities obtained from other sources in general and from antiprotonic atoms in particular and it is shown that a fully consistent picture is possible.

With the help of a recent dedicated experiment on elastic scattering of 21 MeV pions by several nuclei the various elements of the pion-nucleus interaction are tested and the validity of the above picture is established across threshold.

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