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Optical model potential of 800 MeV/c K^+ meson for ^{12}C and ^{40}Ca by the method of inversion

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Abstract. The elastic scattering differential cross-sections of 800 MeV/c K^+ mesons from ^{12}C and ^{40}Ca have been analyzed using the Ericson's parametrization for the phase shift. It is found that the parameter values obtained by our analysis are significantly different from those obtained from the closed expression for K^+- nucleus amplitude derived by the strong absorption approximation. Next, using the phase shift obtained from the present analysis we calculate the K^+ optical model potentials for ^{12}C and ^{40}Ca by the method of inversion. The calculated potentials are compared with the recently determined phenomenological ones.

Keywords. K^+-nucleus scattering; diffraction model; optical potential by inversion.

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1. Introduction

The study of the scattering of K^+ mesons from nuclei in the momentum range of about 500–800 MeV/c (see refs [1–7]) has attracted a lot of attention over the past two decades. Reasons for the interest are well-known. In this momentum range, the K^+ meson is the weakest of all hadronic probes. It has a mean free path of about 5–6 fm in nuclear matter, and the K^+N scattering amplitude varies fairly smoothly. These characteristics imply that corrections to the first-order microscopic optical potential are small and the conventional '$t\rho$' model with the free K^+N amplitude (impulse approximation) should provide a satisfactory description of the experimental data. However, in practice it has been found that the '$t\rho$' model, even after incorporating some well-known corrections, does not provide a satisfactory theoretical framework for the description of K^+-nucleus scattering. This theoretical situation has prompted many authors to propose that the K^+N amplitude within the nuclear medium differs from the free one in a significant way, and to suggest ways to account for the medium effect in order to get a better agreement with the