The Study of $\Sigma\pi$ Invariant Mass Spectrum of the In-flight Kaon Interaction on the Deuteron Target

Jafar Esmaili*, Hamed Abdellahi

Department of Physics, Shahrekord University, Shahrekord, 115 Iran

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Abstract

In this article, using the coupled-channel procedure, $\Sigma\pi$ invariant mass spectra $(M_{\Sigma\pi})$ of the in-flight kaon interaction on the deuteron target is investigated. In the calculation of the interaction cross-section, two processes as the one- and two-interaction processes are considered. The one-interaction process dominates at low values momenta of the incident kaon $(P_{Lab} < 400\ MeV/c)$ whereas the two-interaction contribution is not negligible at high values $(P_{Lab} \sim GeV/c)$ and both processes should be considered in the total cross-section amplitude. By using χ^2 analysis and considering the $\Sigma^*(1385)$ population, the $\bar{K}N$ sub-threshold theoretical invariant mass spectra are fitted to Braun's data that the mass and width of $\Lambda(1405)$ are respectively extracted as $M = 1432 MeV/c^2$ and $\Gamma = 20 MeV$. Although the present result is in fairly good agreement with the results of the chiral $SU(3)$ models, it is not consistent with the current value of the Particle Data Group.

Keywords: $\Lambda(1405)$, $K^- - d$ interaction, kaonic nuclei

* Corresponding Author: jafar.esmaili@gmail.com

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