S, P, D, F, G-waves KN phase shifts in a constituent quark model with a spin orbit interaction

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Abstract

In this work we have investigated KN elastic scattering, an important tool to understand high density regions of nuclei. Since the pioneer works of Bender and Dosch we know that the quark substructure of kaon and nucleon can't be neglected. However due to the complexity of non perturbative effect of QCD at the lower energy regions, QCD-inspired models are needed. Experimentally, elastic phase shifts are known up to $L = 4$ waves for I=0 and I=1 channels and the goal of the present work aims at calculating s, p, d, f, g-waves KN elastic phase shifts using the resonating group method approach (RGM) in a non relativistic quark constituent model. Our calculation essentially rely on three requirements which aim at reducing as much as possible the approximations. First, the same quark-quark interaction is used to build the K and N wave functions and to generate the dynamics of the KN interaction in order to ensure a better consistency between the dynamic inside the clusters and the dynamic between clusters; second, the quark-quark interaction must reproduce as well as possible the mesons spectra; third, the relative KN wave function is let completely free to take the form that dynamics wants without any presupposed parametrization. We obtain quite good results for S_{01}, P_{11}, D_{13}, D_{15} waves whereas the others are rather poorly reproduced. This difference between experimental data and calculations tells us that probably some physical ingredients are still missing in our approach as medium range mesons exchanges mechanism.