QUARK MODEL STUDY OF THE TRITON BOUND STATE

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Constituent quark models have been successfully applied to the study of low-energy hadron phenomenology. The description of hadrons in terms of quark degrees of freedom provides a unified framework to study simultaneously the hadronic spectra and baryon-baryon interactions. Quark-model based baryon-baryon potentials present distinctive features with respect to baryonic interactions, mainly attributed to the relevant role played by the Pauli principle, that, for example, gives an explanation of the repulsive core of the nuclear force.

Our objective in this contribution is the study of complex systems, such as the triton bound state, analyzing the role played by the non-localities arising from the quark substructure. For this purpose we will make use of baryon-baryon potentials derived from the quark model introduced in ref. [1]. The potential model allows to understand the NN data [1,2,3] and the baryon spectra [4].

The three-body system is solved performing a five channel Faddeev calculation including $^1S_0(NN)$-$^5D_0(N\Delta)$ and $^3S_1(NN)$-$^3D_1(NN)$ partial waves. Firstly, we will use local baryon-baryon potentials obtained through the Born-Oppenheimer approximation. A second calculation will be based on an almost phase-equivalent non-local baryon-baryon potential derived from the resonanting group method. Technically, we obtain separable expansions of the original potentials with the EST [5] technique, that simplify a lot the three-body calculation.

The obtained triton binding energy is 7.572 MeV for the local interaction and 7.715 MeV for the non-local one. In both cases, the results are of comparable quality to those obtained with phenomenological potentials such as Paris, Bonn or Nijmegen. Although both models underbind the triton, our calculation shows that the non-localities coming from the quark model go into the right direction, providing some of the missing binding for the triton.

[1] F. Fernández, A. Valcarce, U. Straub, and A. Faessler, J. Phys G **19**, 2013 (1993)

[2] D. R. Entem, F. Fernández, and A. Valcarce, Phys. Rev. C **62**, 034002 (2000)

[3] A. Valcarce, A. Buchmann, F. Fernández, and A. Faessler, Phys. Rev C **50**, 2246 (1994)

[4] A. Valcarce, P. González, F. Fernández, and V. Vento, Phys. Lett. B **367**, 35 (1996)

[5] D. J. Ernst, C.M. Shakin, and R.M. Thaler, Phys.Rev. C **8**, 507 (1973)