

Partial Wave Analysis of Nucleon Nucleon scattering below pion production threshold with chiral interactions

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We undertake a simultaneous partial wave analysis (PWA) to proton-proton and neutron-proton scattering data from 1950 to 2013 below pion production threshold up to LAB energies of 350MeV. We represent the interaction as a sum of delta-shells in conformation space below a cut radius $r_c = 3\text{fm}$ and a charge dependent one pion exchange (OPE) potential above r_c together with electromagnetic effects. With a total of 46 fitting parameters we obtain $\chi^2/\text{d.o.f} \sim 1$ [1]. We also explore the role of chiral two pion exchange (χ TPE) interactions at intermediate and long distances. The inclusion of the next-to-leading order terms allows to reduce the number of fitting parameters to 33 by lowering the cut radius to $r_c = 1.8$ fm with a similar $\chi^2/\text{d.o.f}$. Fig. 1 compares the low angular momentum phaseshifts obtained in the two PWA. Special attention is payed to estimate the errors of the phenomenological interactions as well as the derived effects on the phaseshifts and scattering amplitudes.

[1] R. Navarro Pérez, J. Amaro, and E. Ruiz Arriola (2013), arXiv:1304.0895 [nucl-th]

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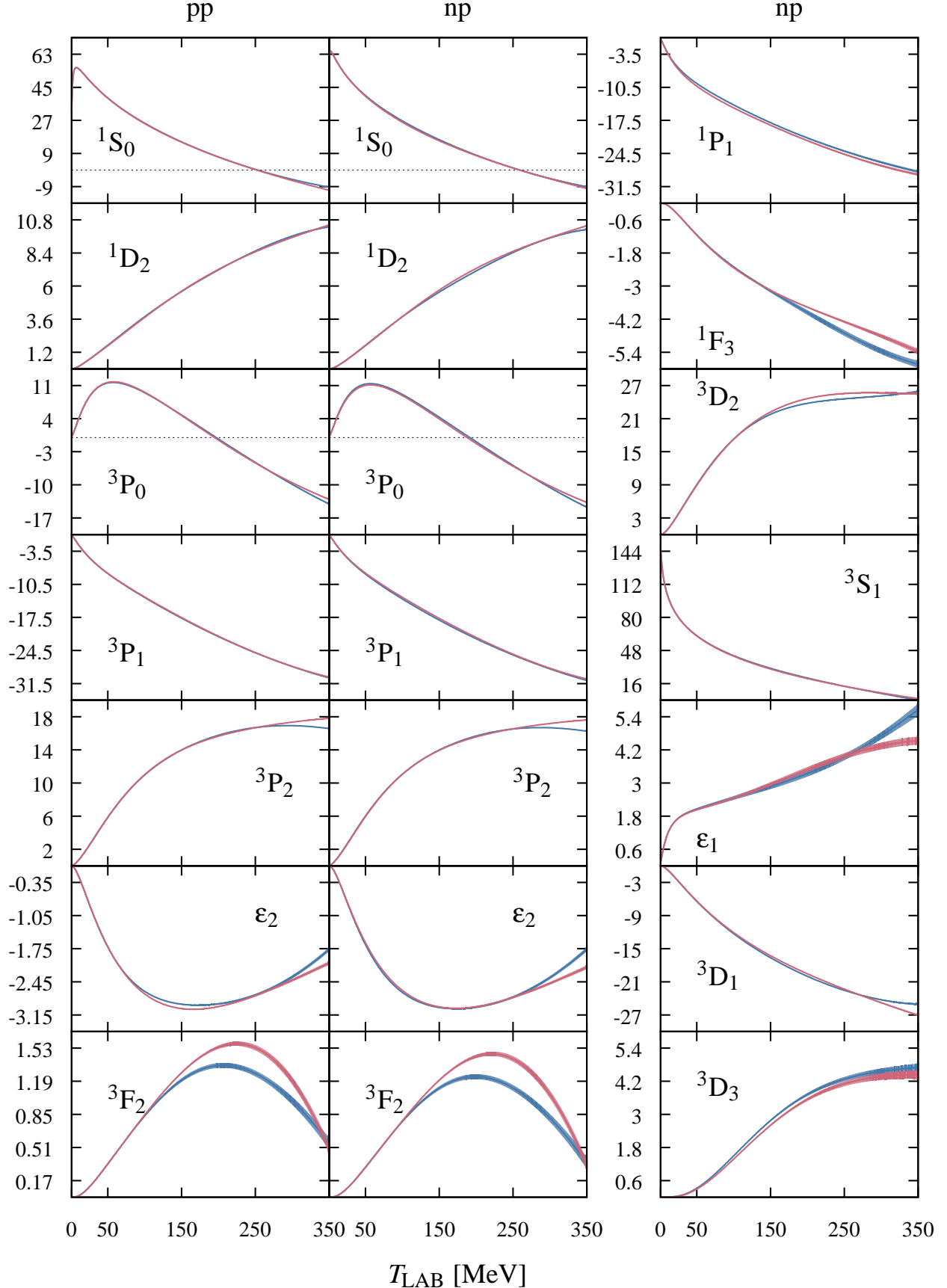


Figure 1: np and pp phaseshifts of the PWA using OPE with $r_c = 3\text{fm}$ (blue band) and χTPE with $r_c = 1.8\text{fm}$ (red band). The errors are propagated from the the scattering data's statistical uncertainty via the usual covariance matrix of the fitting parameters.