Dynamical coupled-channel approach to the $\pi^- p \to \eta n$ process

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A dynamical coupled-channel formalism [1], proven to be succesful in studying $\pi N \to \pi N$ reactions [2], is used to investigate the $\eta-$meson production on the proton induced by pions. The goal is to investigate the reaction mechanism and to extract the relevant nucleon resonances ($N^\star$) parameters from the cross-section data, in the total center-of-mass energy region from threshold up to $W \approx 2$ GeV.

The coupled-channel equations are derived from standard projection operator techniques. The non-resonant interactions are deduced from a unitary transformation method [3], applied on a set of phenomenological Lagrangians.

This approach includes intermediate πN, ηN, $\pi\Delta$, σN, and ρN channels and all 3 and 4 star resonances with $M \leq 2$ GeV, namely, $S_{11}(1535)$, $S_{11}(1650)$, $P_{11}(1440)$, $P_{11}(1710)$, $P_{13}(1720)$, $D_{13}(1520)$, $D_{13}(1700)$, $D_{15}(1675)$, and $F_{15}(1680)$.

Differential cross section data [4] for the reaction $\pi^- p \to \eta n$ has been fitted, leading to a reduced $\chi^2 = 1.96$.

We will present our results for differential and total cross sections compared to the data. The dominant ingredients of the reaction mechanism will be singled out. Predictions for the $\eta p \to \eta p$ total cross section, as well as for the ηN scattering length will be reported and discussed with respect to the findings by other authors.

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