The η-Helium states and η-π^0 mixing

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A K-matrix formalism is developed to relate the amplitudes for the three reactions $pd \to {}^3$Heη [1], π^- ^{3}H$\to$ ^{3}Heη [2], and $pd \to {}^3$Hπ^+[3]. Free parameters are fitted to the available experimental data and an extrapolation below the η^3He threshold is made to see the origin of the η^3He threshold enhancement. The best fit η^3He scattering length $A_{\eta,\eta} = 4.24(29) + i0.72(81)$ fm, indicates the existence of a virtual, and not a quasi-bound, state. The K-matrix permits a discussion of the η-π mixing. A mixing parameter of 0.010(5), *i.e.* a mixing angle $\theta = 0.6(3)^o$, is extracted from a best fit to the recent $pd \to$ ^{3}Heπ^0 reaction data [3].

An attempt is made to describe the elastic amplitude in terms of the η^3He optical potential. The latter is obtained from the single nucleon $N\eta$, $N\pi$, $N\gamma$ and the double nucleon $d\eta$, $pn\eta$ data. New Brookhaven results on (π, η) reactions are included. As a result one obtains both ρ and ρ^2 terms in the potential. An extrapolation to heavier nuclei is made.

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[2] J.C.Peng *et al.*, Phys. Rev.Lett. **63**, 2353 (1989).

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