πNN system at low energy

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With the advent of chiral perturbation theory, the low-energy effective field theory of QCD, high accuracy calculations for hadronic reactions with a controlled error estimation have become possible. We review the recent developments in the reaction $NN \to NN\pi$ in chiral EFT. We demonstrate that the counting scheme that acknowledges the large momentum transfer between the initial and the final nucleons (see Ref. [1]) allows for a consistent description of s- [2] and p-wave [3] pion production and even charge symmetry breaking effects in $pn \to d\pi^0$ [4]. The status of the theory for pion production allowed us to calculate the related corrections to the pion-deuteron scattering length due to the dispersive and the Delta-isobar contributions [5,6]. Those are necessary for a high accuracy calculation of the pion-deuteron scattering length with the goal to extract the low-energy S-wave πN scattering parameters [7].

[1] C. Hanhart, Phys. Rept. **397**, 155 (2004).

[2] V. Lensky *et al.*, Eur. Phys. J. A **27**, 37 (2006).

[3] V. Baru *et al.* Phys. Rev. C **80**, 044003 (2009).

[4] see Talk by Arseniy Filin; A. Filin *et al.* Phys. Lett. B **681**, 423 (2009).

[5] V. Lensky *et al.* Phys. Lett. B **648**, 46 (2007).

[6] V. Baru *et al.* Phys. Lett. B **659**, 184 (2008).

[7] see Talk by Martin Hoferichter; V. Baru *et al.* arXiv:1003.4444 [nucl-th].

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