Precision calculation of the $\pi^- d$ scattering length

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We present a high-accuracy calculation of the $\pi^- d$ scattering length using chiral perturbation theory up to order $(M_\pi/m_\mathrm{p})^{7/2}$ [1]. In particular, we focus on the consistent treatment of isospin-violating corrections and three-body dynamics. The resulting value of $a_{\pi^- d}$ has a theoretical uncertainty of a few per cent. We apply the result to extract the isoscalar and isovector pion–nucleon scattering lengths from a combined analysis of recent pionic deuterium and pionic hydrogen data. Via the Goldberger–Miyazawa–Oehme sum rule, this allows to infer the charged-pion–nucleon coupling constant $g_c^2/4\pi$.

[1] V. Baru, C. Hanhart, M. Hoferichter, B. Kubis, A. Nogga and D. R. Phillips, arXiv:1003.4444 [nucl-th].

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