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**Very-low Momentum Nucleon-Nucleon Interaction Based upon Chiral Perturbation Theory** RUPRECHT MACHLEIDT, University of Idaho, LUIGI CORAGGIO, University of Naples, DAVID ENTEM, University of Salamanca — Recently, several groups have constructed low-momentuum nucleon-nucleon (NN) interactions that have become known as $V_{\mathrm{low-k}}$. One starts from a conventional high-momentum NN potential and applies renormalization group techniques that preserve the (half)-on-shell T-matrix to obtain a new potential that is charcterized by a low-momentum cutoff, typically around 2 fm$^{-1}$. The general justification for this proceedure comes from low-energy effective field theory (EFT). This fact suggests that there may be a more efficient way to construct a $V_{\mathrm{low-k}}$. Namely, instead of taking the detour through a high-momentum NN potential, one may as well construct a low-momentum potential from scratch—and this is what our contribution is about. We use chiral perturbation theory at next-to-next-to-next-to-leading order (N3LO) and apply a sharp cutoff at 2.1 fm$^{-1}$. This potential reproduces the NN phase shifts up to about 300 MeV lab energy and the deuteron properties. While the $V_{\mathrm{low-k}}$ constructed in the past allow only for a rather cumbersome numerical representation, our low-momentum potential is given in analytic form. Moreover, the low-energy constants are explicitly known such that the chiral three-nucleon forces consistent with our NN potential can be properly defined.

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