Subtractive renormalization of the NN interaction from chiral effective theory up to next-to-next-to-leading order II: S-waves[1] DANIEL PHILLIPS, CHIEH JEN YANG, CHARLOTTE ELSTER, Ohio University — We develop a subtractive renormalization scheme to evaluate the 1S0 and 3S1-3D1 NN scattering phase shifts up to next-to-next-to-leading order (NNLO) in the chiral effective theory. We show that for the 1S0 channel, the phase shift can be obtained by performing two subtractions on the Lippmann-Schwinger equation and using the knowledge of the scattering length and the 1S0 phase shift at a particular energy. For the triplet channel, the renormalization can be achieved by 2 subtractions—which use knowledge of the 3S1 scattering length and the 3S1-3D1 generalized scattering length—and then making a fit to one additional piece of NN scattering data. This method allows us to use arbitrarily high cutoffs in the Lippmann-Schwinger equation. Our results show that use of an energy-dependent short-distance potential in the 1S0 channel creates scattering resonances at certain cutoffs—in conflict with NN data. This facilitates an analysis of the cutoff at which an the non-perturbative treatment of higher-order pieces of the ChiET potential becomes questionable.

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