Is the χPT Heavy Fermion Formalism Applicable to Meson Production in NN Collisions?

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Abstract

We consider the application of heavy fermion formalism (HFF) based χPT to meson production in nucleon-nucleon collisions. We demonstrate that (i) for tree and one loop diagrams, the corrections to the nucleon propagator constitute infinite series of correction terms which are of the same momentum power order, (ii) for irreducible diagram of any chiral order there exists an infinite sequence of n-loop diagrams, $n = 1, 2, ...$ of chiral order $2n + 1$ all having the same characteristic momentum power as the lowest chiral order tree diagram. Consequently, the basic principle of one-to-one correspondence between loop and small momentum expansion is badly destroyed in the HFF χPT. The primary production amplitude for meson production in NN collisions becomes a sum over infinite sequences of loop diagrams, and therefore excluding the possibility that finite chiral order HFF based χPT calculations can explain the production process.