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Covariant nucleon-nucleon contact Lagrangian up to order O(q⁴)

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We adopt a covariant version of the naive dimensional analysis and construct the two-nucleon contact Lagrangian constrained by Lorentz, parity, charge conjugation, and Hermitian conjugation symmetries.We show that at $O(q^0)$, $O(q^2)$, and $O(q^4)$, where q denotes a generic small momentum, there are 4, 13, and 23 terms, respectively.We find that by performing $1/mN$ expansions, the covariant Lagrangian reduces to the conventional nonrelativistic one, which includes 2, 7, and 15 terms at each corresponding order. We also do some preliminary studies on nucleon-nucleon contact potentials.

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