

Covariant nucleon-nucleon contact Lagrangian up to order $O(q^4)$

Tuesday, 11 June 2019 16:30 (30 minutes)

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 $1/m_N$ 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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Session Classification: Parallel Session C

Track Classification: Advances in the modeling of baryon spectrum and structure