

## Nucleon self-energy including two-loop contributions

The nucleon self-energy is calculated in  $SU(2)$  covariant chiral perturbation theory to study the pion mass dependence of the nucleon mass up to chiral order  $O(q^6)$ , i.e., including two-loop diagrams.

The contributions of the diagrams are expressed by a small set of (scalar) master integrals, which are evaluated by means of the chiral expansion in  $d$  dimensions, using the strategy of regions to differentiate between the infrared singular and regular part.

The extended on-mass-shell renormalization scheme is applied, making the renormalized expressions consistent with the power counting.

In addition, the renormalization is discussed in the off-shell case, taking the nucleon mass in the chiral limit as renormalized nucleon mass.

For the final result not to rely on the chiral ( $1/m$ ) expansion, the master integrals are computed numerically.

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