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Octet baryon masses in covariant baryon chiral perturbation theory up to O(p^4)

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We report on a recent study of the ground-state octet baryon masses and sigma terms in the covariant baryon chiral perturbation theory (ChPT) with the extended-on-mass-shell (EOMS) renormalization scheme up to next-to-next-to-next-to-leading order (N3LO). To take into account lattice QCD artifacts, the finite-volume corrections (FVCs) and finite lattice spacing discretization effects are carefully examined.

We performed a simultaneous fit of all the publicly available n_f = 2+1 lattice QCD data from the PACS-CS, LHPC, HSC, QCDSF-UKQCD and NPLQCD collaborations and found that the N3LO EOMS BChPT can describe the data reasonably well with chi^2/d.o.f. = 1.0. Our study showed that the various lattice simulations are consistent with each other. Although the finite lattice spacing discretization effects up to O(a^2) can be safely ignored, but the finite volume corrections cannot even for configurations with M_phi L>4. As an application, we predicted the octet baryon sigma terms using the Feynman-Hellmann theorem. In particular, the pion- and strangeness-nucleon sigma terms are found to be sigma_{pi N} = 55(1)(4) MeV and sigma_{sN} = 27(27)(4) MeV, respectively.

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