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Report of Contributions

Contribution ID : **1** Type : **not specified**

Matching Singlet Axial-Vector and Topological Currents from (S)MOM to MS to Four Loops

The singlet axial-vector and topological current operators play central roles in determining the quark and gluon spin contributions to the proton spin. As a consequence of the Adler–Bell–Jackiw anomaly, the axial-vector current J_A^μ acquires a non-trivial renormalization starting at two loops in perturbation theory, which is closely related to the renormalization of the topological current. The determination of the renormalization constant for J_A^μ at high orders is complicated by the notorious difficulty of treating γ_5 in dimensional regularization. Employing an newly proposed efficient variant of Larin's renormalization condition for J_A^μ in dimensionally regularized QCD, we compute the finite matching coefficients from (S)MOM to $\overline{\mathrm{MS}}$ schemes up to unprecedented (3)4 loops. These results provide essential theoretical input for accurately converting (S)MOM-renormalized currents computed in lattice QCD to their $\overline{\mathrm{MS}}$-renormalized counterparts.

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Contribution ID : **2** Type : **not specified**

LaMET-Agent: Agentic Workflow for Large-Momentum Effective Theory Analysis

Extracting light-cone parton distributions from lattice QCD within Large-Momentum Effective Theory (LaMET) requires a multi-stage data-reduction pipeline: fitting Euclidean correlators for hadronic matrix elements, renormalizing the resulting matrix elements, extending and Fourier-transforming them to momentum space, matching to light-cone distributions in perturbation theory, and extrapolating to the continuum, infinite-volume, and physical-mass limits. Several of these stages are procedurally fixed once a scheme is chosen, but others require a physicist to judge fit windows, ansatz choices, and model-averaging strategies from the data itself, which makes the full pipeline slow to execute and difficult to reproduce across practitioners. We present \lamet, an open-source large language model (LLM) agent framework that formalizes this pipeline as a declarative, job-based manifest and exposes each analysis stage as a registry of typed numerical tools. A tool-calling LLM loop drives the stages that require strategy selection, guided by stage-local “skill” prompts that encode the underlying physics heuristics, while stages that are procedurally fixed run as deterministic tool pipelines. We describe the resulting architecture, validate the agent-in-the-loop correlator-fitting stage on synthetic two-point-function data, and outline its application to an end-to-end pion quasi-parton-distribution-function (quasi-PDF) workflow in the Coulomb-gauge formulation of LaMET. This paper documents the design and first release, \lamet\ v1.0, of the framework.

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