Referee Report for SciPost: 'The Geometry of Cosmological Correlators' by Paolo Benincasa and Gabriele Dian

The manuscript presents a novel and interesting perturbative characterization of cosmological correlators through weighted cosmological polytopes, providing insights into their geometric and analytic structures. The authors establish a correspondence between cosmological correlators and subdivisions of these polytopes, introduce novel contour integral representations, and derive factorization theorems and Steinmann-like relations. The mathematical characterization of weighted polytopes and their adjoint surfaces adds further mathematical depth to their work.

The work offers a significant advancement in the field of cosmological correlators by introducing a geometric framework that unifies various perturbative representations of correlators. The identification of weighted cosmological polytopes and their canonical forms is a noteworthy contribution with potential implications for both theoretical cosmology and mathematical physics. Additionally, the contour integral representations and novel vanishing conditions extend known results on Steinmann relations.

The introduction of weighted cosmological polytopes and their relation to cosmological correlators is interesting and original. The authors provide fresh mathematical tools and geometric interpretations that open new avenues for analyzing cosmological correlators and their singularity structures.The manuscript is clearly structured, with a detailed presentation of background material, definitions, and results. The inclusion of worked examples, such as the two-site line graph and two-site bubble graph, aids comprehension.

This paper is a high-quality and original contribution to the field, with significant theoretical and mathematical insights. It meets the standards of SciPost and should be published.