

Report on Scipost_202505_00020v1

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Title: The Sky Remembers everything: Celestial amplitude, Shadow and OPE in quadratic EFT of gravity

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Report

- The authors are discussing scattering amplitudes involving scalars. Yet there is no mention of how the scalars couple to gravity. Presumably this is just minimal coupling. However, it would help to explicitly spell out the all the interactions of this scalar, perhaps around eq(3.1).
- What is γ in (2.10)? It is never defined. It seems to be the same or closely related to $\Delta = \sum_{i=1}^4 \Delta_i$.
- It would be helpful to distinguish between the full amplitude $\mathbb{M}_{Born}^{EFT}$ and its eikonal limit. Eq(3.6) seems to suggest that this is the full amplitude while eq(3.8) seems to suggest that it is just its eikonal limit.
- A related point that should be clarified is whether the authors consider the Mellin transform of the eikonal limit of the amplitude or of the full amplitude. I suspect that it is the former. This is an important point since it is unclear whether the eikonal limit commutes with the Mellin transform. While the authors do not need to address the issue of whether or not the integral commutes with the limit in this paper, it helps to explicitly mention the order of operations.
- It might be useful to explicitly state what δ_1 and δ_2 are near eq(3.10)?
- How is $\mathbf{q}_\perp$ related to t in eq(3.12), eq(3.13)?
- Typo beneath eq(3.23). $\mathcal{M}_{eik}^{(1,2)}$ have never been used.
- Below eq(3.26), the authors say, "in the large ω limit". How can this approximation be justified inside the integral where ω is integrated from $(0, \infty)$?

- The OPE coefficients in (4.27) appear to depend on γ . If this is indeed related to Δ , it seems that the OPE coefficient depends on 4 conformal dimensions. Since the OPE only involves 3 operators, it is unclear what OPE coefficient this corresponds.