

Subleading corrections to the special Galileon

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Galileon theories

Subleading contributions to the low-energy EFT of a 3-brane in $5d$ (real Galileon) or $6d$ (complex Galileon) Minkowski space

[see for example K. Hinterbichler et al. [arXiv:1008.1305](https://arxiv.org/abs/1008.1305)]

Spontaneously broken Poincaré symmetry



Invariance under shift $\phi \rightarrow \phi + c + v_\mu x^\mu$



Low-energy theorems for scattering amplitudes:

$$\mathcal{A}_n \sim p_i^2 \quad \text{as } p_i \rightarrow 0$$

The special Galileon

⇒ When decoupled from leading DBI, real quartic Galileon has “special” shift symmetry

$$\phi \rightarrow \phi + s_{\mu\nu} x^\mu x^\nu$$

and enhanced low-energy theorems

$$\mathcal{A}_n \sim p_i^3 \quad \text{as} \quad p_i \rightarrow 0$$

The question

Are there **higher-derivative corrections** that preserve the special Galileon symmetry?

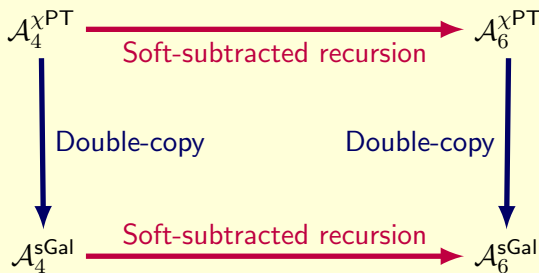
- Soft-subtracted recursion relations [C. Cheung arXiv:1509.03309]:
 - Recursively construct S-matrix from a generic ansatz for a set of fundamental amplitudes
 - If result has spurious poles, a theory cannot exist
 - If result has no spurious pole, it is positive evidence for the existence of the theory.
- The BCJ double-copy
[Z. Bern et al. arXiv:1004.0476, F. Cachazo et al. arXiv:1412.3479]

$$\mathcal{A}_n^{\text{sGal}} = \mathcal{A}_n^{\text{XPT}} \times \mathcal{A}_n^{\text{XPT}}$$

Higher-derivative corrections of special Galileon

$$\mathcal{A}_4^{\text{sGal}}(1, 2, 3, 4) = \frac{c_1}{\Lambda^6} stu + \frac{c_2}{\Lambda^{10}} (s^5 + t^5 + u^5) + \frac{c_3}{\Lambda^{12}} s^2 t^2 u^2 + \mathcal{O}(1/\Lambda^{14})$$

We calculate higher derivative corrections to the special Galileon using two independent methods:



The results match for all orders where recursion is valid.

Higher-derivative corrections of special Galileon

- We also find 5-point contributions to the S-matrix that preserve the Galilean symmetry
- These contributions cannot be obtained from a double-copy construction

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THANK YOU!