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SCET gravity with fermionic matter

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Soft-collinear gravity describes the interactions of collinear and soft gravitons with matter and themselves to all orders in the soft-collinear power expansion. It is constructed based on the underlying diffeomorphism invariance and can describe scalar and integer-spin tensorial representations.

In this talk, I present the extension of this framework to include internal gauge symmetries consistently, at the example of the local Lorentz symmetry required to implement half-integer spin representations in curved space-times.

The treatment of the additional gauge symmetry is closely related to the standard SCET construction, but the employed Wilson lines must be modified to respect the emergent gauge symmetry of SCET gravity. With these additional Wilson lines, the effective Lagrangian can be constructed to all orders in the power-counting parameter.

The resulting Lagrangian shares the same emergent gauge symmetry as SCET gravity, and can be expressed in terms of a covariant derivative and multipole-expanded interactions featuring the Riemann tensor. The covariant derivative generalises in a natural fashion to the fermionic fields, as the total angular momentum (featuring both the orbital and spin part) arises as a gauge charge.

This concludes the Lagrangian construction of SCET gravity, which can now describe fields of arbitrary spin and internal gauge symmetry in a gravitational setting.

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