Beyond of the Poincaré Chern-Simons hypergravity, in (2+1) dimensions

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Introducción

We study the minimal coupling of Chern-Simons gravity based on the Maxwell symmetry with massless spin-5/2 gauge fields, in three dimensions. It is shown the simplest hyper-Maxwell superalgebra and its corresponding Chern-Simons gravity, which contains a massless spin-2 fields interacting with a massless Majorana spin-5/2 field. For certain combinations of osp(1/4) and sp(4) algebras, we find two different alternatives for hypersymmetric extensions of the Maxwell algebra, using the Inönü-Wigner contraction procedure. The hyper-Maxwell Chern-Simons actions was constructed for each case, which show interactions of non-propagating spin-4 fields with one or two spin-5/2 gauge fields.

Desarrollo

We present two hypersymmetric extensions of the Maxwell algebra, which are obtained through the IW contraction procedure. The hypersymmetric extensions of the Maxwell CS gravity theory, was constructed by introducing fermionic generators which transform in an spin-3/2 irreducible representation of the Lorentz group. The $\mathrm{sp}(4)$ algebra is spanned by generators, $\mathrm{sp}(4) = \mathrm{Span}\{T_a, T_{abc}\}$ *and* $\mathrm{osp}(1/4) = \mathrm{Span}\{T_a, T_{abc}, G_{\alpha a}\}$, where $sl(2/R) \subseteq \mathrm{sp}(4) \subseteq \mathrm{osp}(1/4)$.
The simplest hypersymmetric extension of the Maxwell CS gravity theory, is spanned by the set $\{J_a, P_a, Z_a, Q_{\alpha a}\}$, where in addition to the usual commutators of Maxwell's algebra, the (anti-) commutation relations are:

$$[J_a, Q_{\alpha b}] = \frac{1}{2}(\Gamma_a)^{\beta}_{\ \ldots\alpha} Q_{\beta b} + \epsilon_{abc} Q_{\alpha}^{\ \cdot\cdot c} \quad , \quad \{Q_{\alpha a}, Q_{\alpha\beta}\} = -\frac{4}{3}\eta_{ab} Z_c (C\Gamma^c)_{\alpha\beta} + \frac{5}{3}\epsilon_{abc} C_{\alpha\beta} Z^c + \frac{2}{3} Z_{(a|}\left(C\Gamma_{|b)}\right)_{\alpha\beta} \qquad (1)$$

The T_a span the sl (2, R) subalgebra and stand the spin-2 generators, T_{abc} and $G_{\alpha a}$ yields the spin-4 and spin-5/2 fields, respectively. The $G_{\alpha a}$ are Γ-traceless vector-spinor $(\Gamma^a G_a)_\alpha = 0$ and T_{abc} are traceless (η_{ab}Tabc = 0) and totally symmetric generators. The hyper-Maxwell algebras appear by considering the IW contractions (flat limit $l \to \infty$) of the: Case I: osp(1/4)⊗osp(1/4)⊗sp(4). This algebra, corresponds to a hyper-Maxwell algebra with spin-4 generators $\{J_{abc}, P_{abc,} Z_{abc}\}$, and its hypersymmetric extension is characterized by two fermionic generators $Q_{\alpha a}$ and $\Sigma_{\alpha a}$ (required to satisfy the Jacobi Identities). The novel hypergravity can be seen as a Maxwellian generalization of the hyper-Poincaré gravity in presence of spin-4 gauge fields. Case II: osp(1/4)⊗sp (4)⊗sp (4). This algebra, corresponds to a non-standard hyper-Maxwell (translational generators P_a are not expressed as bilinear expressions of fermionic generators $Q_{\alpha a}$), where P_{abc} and J_{abc} transform in a spin-3 irreducible representation of the Lorentz group. Using a Lie algebra expansion method, a generalization of hyper-Poincaré and hyper-AdS gravities can be found.

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Referencias

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