In this paper the authors apply a recently developed covariant formulation of supersymmetric theories [1] to 4-dimensional $\mathcal{N} = 1$ supergravity. The authors start from the construction of $\mathcal{N} = 1$ conformal supergravity with auxiliary fields of chiral multiplets, and then obtain $\mathcal{N} = 1$ Poincaré supergravity by imposing gauge-fixing conditions.

With the covariant formulation [1] the authors construct covariant superconformal transformations among the chiral multiplets of the superconformal theory. One of the key ingredients here is a superconformal Kähler manifold on which the chiral multiplets are defined. The use of the Kähler manifold enables the authors to make geometric treatments on the covariant construction of the supersymmetirc algebra. The super-Poincaré theory is obtained by imposing gauge-fixing conditions for symmetries of the superconformal algebra that are not part of the Poincaré subalgebra, such as dilatation, chiral, and special conformal symmetries. In practice the results seem technical for non-experts but the main idea is simple as stated above. It is also intriguing to notice that the authors make full use of projective properties of the Kähler manifold in deriving the gauge-fixing conditions.

Explicit tensor calculi of $\mathcal{N} = 1$ conformal and Poincaré supergravities in 4 dimensions were systematically exploited many years ago [2] but the formulations then were not covariant or geometric either. In this sense this paper provides a modern approach to an everlasting physical subject of 4-dim $\mathcal{N} = 1$ supergravity.

References

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