

Exercises for the Lecture
Supersymmetry
Summer Semester 2016
Sheet 9

Exercise 1: Basic Supergravity

- a) Determine the explicit expression of the spin-connection in terms of the vielbein using torsion freeness.
- b) Determine the expression of the curvature $R_{\mu\nu}{}^{mn}$ in terms of the spin-connection.

Exercise 2: On-shell closure of local SUSY

Check the on-shell closure of the local SUSY algebra on the vielbein.

Exercise 3: No-scale Supergravity

- a) Show that generically a supersymmetric minimum of supergravity coupled to scalars has a negative vacuum energy.
- b) Explain why a non-vanishing gravitino mass $m_{3/2} \neq 0$ is a signal for supersymmetry breaking.

Consider supergravity coupled to a single chiral superfield with Kähler potential

$$K = -3 \log(\Phi + \bar{\Phi})$$

and constant superpotential W . This is called a no-scale model.

- c) Show that the scalar potential vanishes identically.
- d) Show that $m_{3/2}$ and the auxiliary field F of Φ are non-zero.
- e) Interpret this type of vacuum.

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