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## Exercises on Elementary Particle Physics II

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### 1. *No-Scale Supergravity*

Take  $\mathcal{N} = 1$  supergravity with three chiral superfields  $S$ ,  $T$  and  $C$ . The Kähler potential (with  $M_P = 1$ ) is

$$K = -\log(S + S^*) - 3\log(T + T^* - C^*C). \quad (1)$$

The superpotential is

$$W = C^3 + a \exp(-\alpha S) + b, \quad (2)$$

where  $a$  and  $b$  are arbitrary complex numbers and  $\alpha > 0$ . These additional terms will enable us to fix  $\langle S \rangle$ .

- (a) Find the auxiliary fields for  $S$ ,  $T$  and  $C$  and check that SUSY is broken.
- (b) Calculate the scalar potential.
- (c) What is the value of the vacuum energy? Are there flat directions (where  $E_{\text{vac}}$  is independent of the vev of a field)?
- (d) What is the gravitino mass?