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## Superadditivity at Large Charge

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The weak gravity conjecture has been invoked to conjecture that the dimensions of charged operators in a CFT should obey a superadditivity relation (sometimes referred to as convexity). In this work, we study superadditivity of the operator spectrum in theories expanded about the semi-classical saddle point that dominates correlators of large charge operators. In particular, we construct bottom-up effective field theories with the goal of violating the conjecture. We indeed find such an EFT, though are forced in the process to introduce a dilaton field. This demonstrates that while the superadditivity conjecture cannot be proven using bottom-up arguments alone, a conjecture-violating theory would require the very tall order of an infinitely tuned potential.

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