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A Chern-Simons Pandemic

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Triple Chern-Simons terms are a generic feature of stringy compactifications, where they are usually responsible for topological masses, or branes ending in branes. Another piece of common lore says that one should not expect exact global symmetries in quantum gravity, and in fact this is the case in every known stringy compactification. I will argue that these two seemingly disconnected observations are in fact related: Black holes can acquire charge under a seemingly exact global two-form symmetry, which can be broken by appropriate triple Chern-Simons terms. A significant amount of stringy examples leads us to conjecture that consistent theories of quantum gravity must always have these Chern-Simons terms. This in turn means that a number of seemingly consistent four-dimensional effective field theories, such as pure gravity or four-dimensional Maxwell+gravity+WGC particles, cannot be consistent theories of quantum gravity by themselves.

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