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Spontaneous Breaking of Restricted Weyl Symmetry in Pure R^2 Gravity

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Recent work has shown that pure R^2 gravity (i.e. R^2 gravity with no extra R term) has a symmetry that is larger than scale symmetry and smaller than full Weyl symmetry. This has been dubbed restricted Weyl symmetry as it involves a Weyl transformation where the conformal factor has a constraint. Most importantly, this symmetry is spontaneously broken when the vacuum (background spacetime) has a non-zero Ricci scalar. In this case, the theory can be shown to be equivalent to Einstein gravity with non-zero cosmological constant and a massless scalar field. The massless scalar field is identified as the Goldstone boson of the broken sector. In spontaneously broken theories, the original symmetry of the Lagrangian is realized as a shift symmetry of the Goldstone bosons. We show that this is the case also here. The unbroken R=0 sector is completely different and has no connection to Einstein gravity.

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