Kaluza-Klein expansion of pure gravity on general spaces[1] EL-
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ogy of spacetime is a product space with compact internal factor, higher dimensional
gravity on the full spacetime has an equivalent lower dimensional formulation in-
volving infinite towers of lower dimensional fields, via the Kaluza-Klein mechanism.
For pure classical Einstein gravity, we derive the full lower dimensional action, which
suprisingly, has not appeared in the literature except in the special case of 5D with
an internal circle. In this action, scalar fields parametrize the space of Riemannian
metrics on the internal manifold, vector fields gauge the internal diffeomorphism
group, and symmetric tensors implement lower dimensional Einstein gravity plus
a tower of analogous fields transforming under the gauge group. Any particular
choice of scalars spontanously breaks the gauge group to the isometry group of the
corresponding internal metric, and for spatially homogeneous solutions, the reduced
scalar manifold is the moduli space of Ricci flat internal metrics. A final noteworthy
feature of this action is that there is generically no consistent truncation to massless
modes.

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