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Beta functions of $(3 + 1)$ -dimensional projectable Horava gravity

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We derive the full set of beta functions for the marginal essential couplings of projectable Horava gravity in $(3 + 1)$ -dimensional spacetime. To this end we compute the divergent part of the one-loop effective action in static background with arbitrary spatial metric. The computation is done in several steps: reduction of the problem to three dimensions, extraction of an operator square root from the spatial part of the fluctuation operator, and evaluation of its trace using the method of universal functional traces. This provides us with the renormalization of couplings in the potential part of the action which we combine with the results for the kinetic part obtained previously. The calculation uses symbolic computer algebra and is performed in four different gauges yielding identical results for the essential beta functions. We additionally check the calculation by evaluating the effective action on a special background with spherical spatial slices using an alternative method of spectral summation. We conclude with a preliminary discussion of the properties of the beta functions and the resulting renormalization group flow, identifying several candidate asymptotically free fixed points.

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