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The gravitational energy-momentum pseudo-tensor in higher-order theories of gravity

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We derive the gravitational energy momentum tensor for a general Lagrangian of any order and prove that this tensor, in general, is not covariant but only affine, then it is a pseudo-tensor. Furthermore, the pseudo-tensor is calculated in the weak field limit up to a first non-vanishing term of second order in the metric perturbations. The average value of the pseudo-tensor over a suitable spacetime domain is obtained. Finally we calculate the power per unit solid angle carried by a gravitational wave. These results are useful in view of searching for further modes of gravitational radiation beyond the standard two modes of General Relativity and to deal with non-local theories of gravity. The general aim of the approach is to deal with theories of any order under the same standard.

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