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The Gravitational Energy-Momentum Pseudo-Tensor in Higher Order Theories of Gravity

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We discuss the generalization of gravitational energy-momentum pseudo-tensor to Extended Theories of Gravity, in particular to higher-order theories in curvature invariants. This result is achieved by imposing that the local variation of gravitational action of any order vanishes under rigid translations. We also prove that this tensor, in general, is not covariant but only affine, that is, it is a pseudo-tensor. The pseudo-tensor is calculated in the weak-field limit up to a first non-vanishing term of order h^2 , where h is the metric perturbation. The average value of the pseudo-tensor, over a suitable spacetime domain, is obtained. Finally, we calculate the emitted power, per unit solid angle, carried by a gravitational wave in a direction x for a fixed wave number k under a suitable gauge.

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