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Canonical superenergy tensors: a reappraisal

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In the framework of general relativity (GR) the gravitational field has no energy-momentum tensor. But it is very easy to attach to this field a "superenergy tensor". In the Lecture we present an universal and constructive definition of such a tensor. This definition uses locally Minkowskian structure of the spacetime in GR and canonical energy-momentum complex for matter and gravity in this theory. The obtained canonical superenergy tensor for gravity is very closely related to Appel's "energy of acceleration" in classical mechanics. Applied to matter tensor our procedure leads to superenergy tensor for matter. We have used in past the superenergy tensors, gravitation and matter, to analysis of the majority solutions to the Einstein equations which are interesting in astrophysics and cosmology. The obtained results were interesting (they were published). By slightly changing our constructive definition of the superenrgy tensors one can obtain the averaged relative energy-momentum tensors. These tensors have proper dimensions and they differ from the superenergy tensors only by a dimensional factor which needs fixing. We have given a proposal how to establish this factor.