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Renormalization of the energy-momentum tensor on the lattice

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We construct an energy-momentum tensor on the lattice which satisfies the appropriate Ward Identities and has the right trace anomaly in the continuum limit. These relations come forth when the length of the box in the temporal direction is finite, and they take a particularly simple form if the coordinate and the periodicity axes are not aligned. We implement the method for the SU(3) Yang-Mills theory and, by carrying out numerical simulations, the renormalization constants of the traceless components of the tensor are determined with a precision of roughly half a percent for values of the bare coupling constant in the range $0 < g^2 < 1$. The renormalization constants of the energy momentum tensor provide also a new method to measure the thermodynamic features of a Quantum Field Theory: numerical results are presented for the Equation of State.

Author: PEPE, Michele (INFN)**Presenter:** PEPE, Michele (INFN)**Session Classification:** Non-Perturbative Field Theory and String Theory**Track Classification:** Non-Perturbative Field Theory and String Theory