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Requirements for a Manifestly Covariant Quantum Field Theory

STUART WALKER, None — Quantum field theory has shown much success in defining manifestly covariant fields in Minkowski space-time. The general procedure for construction of QFT in terms of annihilation and creation operators acting through a simplectic form is outlined. It is demonstrated that this methodology fails to define a general covariant vector field in a space-time spanning a Riemannian manifold with Lorentz metric (M,g_{uv}); therefore, no appropriate outer product can be defined to produce a general 2^{nd} rank tensor (i.e. stress-energy tensor). The QFT defined in flat space-time is expanded to include curvilinear coordinates. The manifestly covariant QFT in curved space-time is used to redefine the equations of motion in terms of the classical field theory. The resulting theory has the benefit of requiring an S-matrix defining unitarily equivalent quantum theories while providing an exact formulation for the quantized equations of motion in a gravitational field. The physical implications of this construction are discussed including the anisomorphic nature of the simplectic vector space in curvilinear coordinates. An example involving plane wave expansion is discussed.

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None

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