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The present status of quantum field theory in curved spacetime

ROBERT WALD, University of Chicago

Quantum field theory in curved spacetime is the theory of quantum fields propagating in a classical curved spacetime, as described by general relativity. This theory has been applied to describe such important and interesting phenomena as particle creation by black holes and perturbations in the early universe associated with inflation. On account of the absence of Poincare symmetry and the lack of a preferred "vacuum state" or natural notion of "particles," some major conceptual issues arose as to how the theory is to be formulated. By the mid-1980's it was understood how to give a mathematically rigorous formulation of the theory of a free quantum field in curved spacetime by focusing attention on the algebraic relations satisfied by the field observables. However, only during the past decade has major progress been made in providing a mathematically satisfactory formulation of renormalization for interacting fields in curved spacetime. This talk will describe some of the recent developments and elucidate some of the insights that have thereby been attained regarding the nature of quantum field theory.