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# Quantum Field Theory on Curved Spacetimes

Concepts and Mathematical Foundations

Reihe: Lecture Notes in Physics

After some decades of work a satisfactory theory of quantum gravity is still not available; moreover, there are indications that the original field theoretical approach may be better suited than originally expected. There, to first approximation, one is left with the problem of quantum field theory on Lorentzian manifolds. Surprisingly, this seemingly modest approach leads to far reaching conceptual and mathematical problems and to spectacular predictions, the most famous one being the Hawking radiation of black holes. Ingredients of this approach are the formulation of quantum physics in terms of  $C^*$ -algebras, the geometry of Lorentzian manifolds, in particular their causal structure, and linear hyperbolic differential equations where the well-posedness of the Cauchy problem plays a distinguished role, as well as more recently the insights from suitable concepts such as microlocal analysis. This primer is an outgrowth of a compact course given by the editors and contributing authors to an audience of advanced graduate students and young researchers in the field, and assumes working knowledge of differential geometry and functional analysis on the part of the reader.

2009, X, 160 p. 30 illus.

## Gedrucktes Buch

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Springer-Verlag GmbH, Handelsregistersitz: Berlin-Charlottenburg, HR B 91022. Geschäftsführung: Haank, Mos, Hendriks

