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★**Quantum gravitation.**
The Feynman path integral approach.
Springer-Verlag, Berlin, 2009. *xviii*+342 *pp*. $109.00. *ISBN* 978-3-540-85292-6

This book represents a clear exposition of quantum gravity from the point of view of the Feynman path integral approach. This work covers all the important aspects of the subject and points the reader in the direction of open problems in the field of quantum theory of gravity.

In the first part of the book the author describes the covariant approach to quantum gravity. Through the description of the wave equation for spin-two fields and their Feynman propagator, the author introduces the Einstein action. By utilizing a perturbative approach, he leads the reader to discover the divergencies that arise from the quantization of the gravitational action, which brings the reader, ultimately, to the perturbative nonrenormalizability of quantum gravity.

The second chapter of the book is mainly focused on the construction of the Feynman path integral approach for a theory of quantum gravity, discussing, in particular, the issue of the path integral measure and gauge fixing. In this part of the book, the author emphasizes the close relation between the description of functional integrals in quantum gravity and in Yang-Mills theories. In fact, in the next chapter, the author describes other gauge theories that are perturbatively nonrenormalizable, in particular the nonlinear sigma model.

The book continues with a detailed account of the Hamiltonian formulation of quantum gravity, with particular emphasis on Hamiltonian constraints and the Wheeler-DeWitt wave equation. Although this approach is particularly interesting, it is plagued by operator-ordering problems and the lack of general covariance which is due to the choice of a preferred time coordinate.

A substantial part of the book is devoted to the development of lattice methods in quantum gravity. The description is very detailed and all the formal tools and the fundamentals ideas of this approach are rendered extremely clear by the author. An extensive overview of the application of lattice methods in nonperturbative quantum gravity is also present. The book ends with a discussion of open problems in quantum gravity and quantum cosmology such as quantum effects in the early stages of the Universe.

The book is very well written, and all the material is presented in a detailed fashion with all the key points and ideas clearly described. This book will be a great reference tool for researchers working in the field of quantum gravity as well as for graduate students, with basic knowledge of classical gravitational theory and quantum field theory, who wish to learn about quantum gravity and lattice methods.

Reviewed by *Guglielmo Fucci*