Physics meets philosophy at the Planck scale

The greatest challenge in fundamental physics is how quantum mechanics and general relativity can be reconciled in a theory of 'quantum gravity'. The project suggests a profound revision of our notions of space, time, and matter, and so has become a key topic of debate and collaboration between physicists and philosophers. This timely volume collects classic and original contributions from leading experts in both fields for a provocative discussion of all the issues.

This volume contains accessible introductions to the main and less well known approaches to quantum gravity. It includes exciting topics such as the fate of spacetime in various theories, the so-called 'problem of time' in canonical quantum gravity, black hole thermodynamics, and the relationship between the interpretation of quantum theory and quantum gravity.

This book will be essential reading for anyone interested in the profound implications of trying to marry the two most important theories in physics.

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Contemporary theories in quantum gravity

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For Joanna and Lisa

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Preface

Both philosophy and quantum gravity are concerned with fundamental questions regarding the nature of space, time, and matter, so it is not surprising that they have a great deal to say to each other. Yet the methods and skills that philosophers and physicists bring to bear on these problems are often very different. However, and especially in recent years, there is an increasing recognition that these two groups are indeed tackling the same issues, and moreover, that these different methods and skills may all be of use in answering these fundamental questions. Our aim in this volume is thus to introduce and explore the philosophical foundations of quantum gravity and the philosophical issues within this field.

We believe that some insight will be gained into the many deep questions raised by quantum gravity by examining these issues from a variety of perspectives. Toward this end, we collected together ten original and three previously published contributions on this topic from eminent philosophers of science, mathematicians, and physicists. Though the papers assume that the reader is scientifically literate, the majority are written with the non-specialist in philosophy or quantum gravity in mind. The brief that we gave the contributors was to write pieces that would introduce the key elements of the physics and philosophy, whilst making original contributions to the debates. The book should therefore be of interest to (and appropriate for) anyone challenged and fascinated by the deep questions facing the cutting edge of fundamental theoretical physics. We also feel that these essays will lay the foundation for a wider consideration of quantum gravity in the philosophical community, and hopefully a fruitful dialogue between physicists and philosophers. After all, many of the greatest advances in physics were inseparable from philosophical reflection on foundational questions.

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Craig Callender
Nick Huggett