

# Preface

On the occasion of the 60th Birthday of Professor Emilio Elizalde, a conference was organized on March 8-10, 2010, to discuss current progress in the main areas of his research: cosmology, quantum vacuum fluctuations and zeta functions.<sup>1</sup> The conference was planned to take place at the Universitat Autònoma de Barcelona, in Bellaterra, but due to an unexpected snow storm during the afternoon and evening of Monday 8, the venue had to be rescheduled: it continued on Tuesday and Wednesday at the Hotel 1898, in Barcelona's Ramblas.

The following is a more detailed list of the topics dealt with at the symposium:

- Dark energy and dark matter
- Modified gravity
- Cosmological evolution
- Cosmology and string theory
- Quantum vacuum fluctuations
- Zeta functions in physics and mathematics

Since the workshop was a success from the point of view of the quality of the speakers and the research works presented, and also by the quantity of participants, it was decided that a volume of proceedings would be published. The subsequent call for papers had a very positive response and we are pleased to present the result in this volume.

The papers have been grouped into three main areas: Quantum field theory (QFT) and the Casimir effect, Gravity and Cosmology, and Zeta functions in Physics and Mathematics. Written by highly qualified specialists in the different specific fields, they cover some major developments of Physics in the last three decades and a wealth of applications. A number of closely related issues are also considered, such as the nature of dark energy, modified gravity models ( $f(R)$  and Gauss-Bonnet, for example), Hořava-Lifshitz gravity, and a couple of non-standard approaches. The

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<sup>1</sup> We refer the reader to the recent volume

<http://www.ieec.fcr.es/english/reerca/ftc/eli/book2010.pdf>,

which gathers a selection of Elizalde's papers. This material is also available as a book.

cosmological applications of these theories play a crucial role and are at the very heart of the book. In particular, the possibility to explain in a unified way the whole history of the evolution of the Universe, from primordial inflation to accelerated expansion, one of the landmark discoveries of the last century. Further, a nice and rigorous description of the mathematical background underlying many of the physical theories considered above is provided. This includes the uses of zeta functions in physics, as in the regularization problems in QFT already mentioned, specifically in curved space-time, and in Casimir problems as, e.g., those involving pistons, which are now very fashionable.

The prerequisites to read this book are some good background knowledge of quantum physics, relativity, and basic functional analysis. Many of the articles give a detailed description of their subject and they try to be as pedagogical as possible.

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