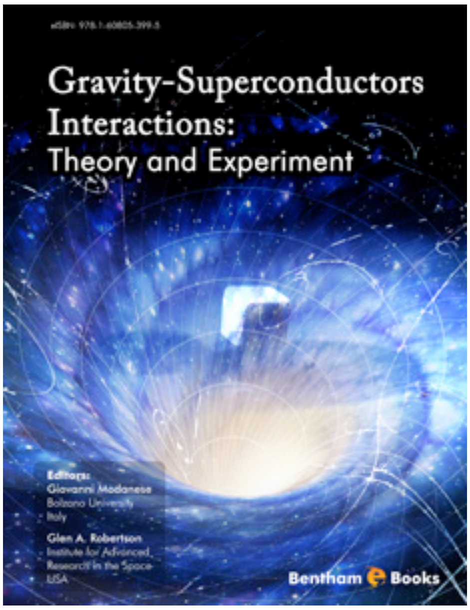

Photo of the book cover

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Gravity-Superconductor Interactions: Theory and Experiment

Editors:
G. Modanese, G. A. Robertson

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Review;

The editors of this book are G. Modanese, Free University of Bozen, Italy and G. A. Robertson, Institute for Advanced Research in the Space, Propulsion and Energy Sciences, U.S.A.
G. Modanese is a theoretical physicist and professor in the department of science and technology. G.A. Robertson is an employee of NASA. In order for the reader to get started, the editors provide a very readable and informative chapter on the history of gravity and superconductor interactions, which dates back to the 1980s, starting with the seminal paper of de Witt.

The 20th century clearly was the age of particle physics and string theory, but physics now is at crossroads, and as very recent experiments and astrophysics observations indicate the 21st century might become the age of gravitational physics, and this book perhaps stands for a paradigm shift in physics.

As expressed in the foreword of the book, the main goal of its publication was to present to the engineering and scientific community the state of theoretical and experimental research concerning the latest results in the emerging field of *physics of gravity-like fields* (as of 2011), in conjunction with condensed matter physics and phase transition. The combination of these topics represents a major extension of the very nature of gravitation, and thus might lead not only to new physics, but also might have a major impact on cosmology and on our future technology.

The book is organized into thirteen chapters of varying length, written by eleven contributors with either an engineering or physics background. Contributors are from private research institutes or academia. Most of the contributors are active researchers in the field of gravity or space science and over the years have contributed to advance the state of the art.

In light of the recent, unforeseen experimental data, the book has become *more topical* than ever. Novel experimental facts, not known a few years ago, when considered as a whole, seem to beg for substantial extensions of current physics. The findings (August 2013) from LHC (Large Hadron Collider) that means, the *lack* of any new particles (except for the Higgs boson postulated in 1964) up to about 800 GeV particle mass, along with other results from LHC, most likely rule out so called advanced models like *supersymmetry, supergravity, higher dimensions, multiverses, or even string theory*. In addition, the entirely unexpected data from observational cosmology, for instance, the confirmation of the MOND hypothesis (March 2011), but, at almost the same time, the observation that dark matter is missing inside galaxies (June 2012), are posing major challenges for the cosmological standard model, apart from our long standing inability to solve the riddle of dark matter and dark energy.

Hence, it is only logical that several different new theoretical models along with recent experimental work are presented in the thirteen chapters, attempting to continue where Einstein was forced to leave off. Unconventional topics discussed are: possible interactions between superconductors and high-frequency gravitational waves, gravity and condensed matter interactions, new types of phase transitions at low temperature, new types of matter as well as the possible interaction between electrodynamics and gravitation, which would require a major extension of Einstein’s general theory of relativity.

Gravitation has maintained the interest of researchers at every stage in the history of physics, and it became Einstein's quest to unify gravitation with the other forces since 1915, the year he published his general relativity theory. The still unfinished manuscript on his desk, found after he passed away, clearly showed that he was still elaborating on his lifelong dream, namely to extend the description of the force of gravity which had worked so marvelously well in the case of gravitation, to the other physical interactions. The geometrization of physics, i.e., associating a metric tensor with each physical interaction, is still an open question, and is a vital topic of discussion in the book.

Several articles therefore address the prevailing question of an extension of current physics, for instance, stimulated graviton emission in superconductors, and, in particular, physical models are discussed that might account for the novel experimental facts which might have been observed in recent gravitomagnetic experiments, e.g. Tajmar et al., Graham et al., or Gravity Probe-B, i.e., the possible generation of extreme gravitomagnetic fields outside general relativity. Relativistic gravitational effects based on Einstein's general relativity cannot be seen on Earth, because these effects are too small to be measured.

Therefore, any experiment that claims to have measured such an effect, for instance, an extreme gravitomagnetic field, is subject to suspicion. All these experiments are notoriously difficult, as is well known from recent CERN neutrino speed measurements that were eventually *recanted* in 2012. One should also remember experiments for a (non-existent) fifth force, the cold fusion announcement in 1989, gravitational shielding (disproved by the late E. Harris in 1996 and R. C. Woods 2001), or the Bielfeld-Brown effect shown to be based on ionic winds (i.e., being of electrodynamic origin, see experiments by Tajmar et al.) and thus does not work in vacuum.

Hence, it should not come as a surprise to the reader that at the moment the (revolutionary) results of the extreme gravitomagnetic experiments cannot be considered conclusive, but measured data of these experiments have *not* been recanted (as was *incorrectly stated* by a colleague in an e-mail to this reviewer!). However, there exist different interpretations of the results, ranging from simple acoustic vibrations to the generation of extreme gravitomagnetic fields (about 18 orders of magnitude larger than predicted by general relativity), and time will tell which view to be correct.

Two articles are addressing the numerous pitfalls in superconductor gravity experiments, written from both experimental and theoretical viewpoints, providing a comprehensive list for setting up rigorous experimental standards.

The quantization of the gravitational field has been unsuccessful, despite great efforts in this direction. The problem may be that the number of fundamental forces is not known, in other words, in current physics there is a *belief* that exactly four forces exist (strong, weak, electromagnetic, and gravitational force). Perhaps gravity is of a more subtle nature than Newtonian gravity, and an interaction between gravity and electromagnetism might exist? At least, the Maxwell equations of electrodynamics and the linearized Einstein field equations, termed Einstein-Maxwell equations, show surprising structural similarity, which is discussed in two further articles.

Finally, in order for science to progress, both theorists and experimenters have to be willing to take a certain scientific risk that is, getting off the trodden path, and this book represents a bold move in this direction. If a blind alley is met, the courage to reverse one's direction of research is required. If, however, ideas of novel gravitational fields at cryogenic temperatures turn out to be true, the new scientific age of gravitational engineering might have begun. It also would mean that astrophysics is up for a major change in order to reveal further mysteries of the Universe.

Whether or not this book is telling the final scientific truth, or even stands for a paradigm shift in physics, cannot be decided at this moment. Recent experimental data coming in from very diverse areas most likely will force physicists to accept drastic, unprecedented modifications of current physics over the coming years.

This book describes quite a few novel and exciting ideas, not found in the mainstream literature, which may turn out to be essential to provide consistent physical explanations for novel properties of both gravity and quantum gravity, in particular. The physical models presented may also shed new light on the existence and the behavior of extreme gravitomagnetic fields, unraveling the confusing data obtained from gravitomagnetic experiments.

I am convinced that the book contains a substantial amount of scientific material not found elsewhere, opening up the mind of the reader and aiding to elucidate some of the most pressing and fascinating facets of both future physics and technology (e.g. gravitational engineering and energy generation). Readers looking for an elementary *non-mathematical* introduction into this emerging and exciting field are referred to the recent book by G. Daigle, *Gravity 2.0* (available through Amazon).