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# Gyros, Clocks, Interferometers...: Testing Relativistic Gravity in Space



Springer

# Gyros Clocks Interferometers Testing Relativistic Gravity In Space Lecture Notes In Physics

**C. Lämmerzahl, C.W.F. Everitt, F.W. Hehl**



## **Gyros Clocks Interferometers Testing Relativistic Gravity In Space Lecture Notes In Physics:**

*Gyros, Clocks, Interferometers...: Testing Relativistic Gravity in Space* C. Lämmerzahl, C.W.F. Everitt, F.W.

Hehl, 2007-09-04 Many new tests of gravity and in particular of Einstein's general relativity theory will be carried out in the near future. The Lense-Thirring effect and the equivalence principle will be tested in space; moreover, gravitational waves will be detected and new atomic interferometers and clocks will be built for measurements in gravitational and inertial fields. New high precision devices have made these experiments feasible. They will contribute to a better understanding of gravitational physics. Both experimental developments and the theoretical concepts are collected in this volume. Exhaustive reviews give an overall insight into the subject of experimental gravitation. **Gyros, Clocks, Interferometers...: Testing**

**Relativistic Gravity in Space** C. Lämmerzahl, C.W.F. Everitt, F.W. Hehl, 2001-03-13 Many new tests of gravity and in particular of Einstein's general relativity theory will be carried out in the near future. The Lense-Thirring effect and the equivalence principle will be tested in space; moreover, gravitational waves will be detected and new atomic interferometers and clocks will be built for measurements in gravitational and inertial fields. New high precision devices have made these experiments feasible. They will contribute to a better understanding of gravitational physics. Both experimental developments and the theoretical concepts are collected in this volume. Exhaustive reviews give an overall insight into the subject of experimental gravitation. Relativistic Celestial Mechanics of the Solar System Sergei Kopeikin, Michael Efroimsky, George Kaplan, 2011-10-25 This authoritative book presents the theoretical development of gravitational physics as it applies to the dynamics of celestial bodies and the analysis of precise astronomical observations. In so doing, it fills the need for a textbook that teaches modern dynamical astronomy with a strong emphasis on the relativistic aspects of the subject produced by the curved geometry of four-dimensional spacetime. The first three chapters review the fundamental principles of celestial mechanics and of special and general relativity. This background material forms the basis for understanding relativistic reference frames, the celestial mechanics of N-body systems, and high precision astrometry, navigation, and geodesy, which are then treated in the following five chapters. The final chapter provides an overview of the new field of applied relativity based on recent recommendations from the International Astronomical Union. The book is suitable for teaching advanced undergraduate honors programs and graduate courses while equally serving as a reference for professional research scientists working in relativity and dynamical astronomy. The authors bring their extensive theoretical and practical experience to the subject. Sergei Kopeikin is a professor at the University of Missouri, while Michael Efroimsky and George Kaplan work at the United States Naval Observatory, one of the world's premier institutions for expertise in astrometry, celestial mechanics, and timekeeping. Relativity in Fundamental Astronomy (IAU S261) International Astronomical Union. Symposium, 2010-01-28 IAU S261 summarizes the present state of applied relativity and discusses the applications and future tests of general relativity. **Atom Optics and Space Physics** E. Arimondo, W. Ertmer, Wolfgang Schleich, E. M. Rasel, 2009

The goal of this volume is to discuss the rapidly moving field of atom optics and interferometry with all its intricate aspects ranging from fundamental physics to applications and the theory of relativity. The breathtaking success in manipulating atoms using lasers has encouraged these two so far disjunct communities to move closer together and begin collaborations. After an introduction to atom optics and Bose-Einstein condensation, the theoretical foundations of cold atom interferometers, their use to test gravity and their implementation in laboratory measurements of the Earth rotation and of Newton's gravitational constant are discussed. Several papers discuss the characteristics of gyroscopes and interferometers as sensors for inertial forces, starting from gyroscopes based on light waves and comparing their sensitivity to those based on matter waves. The final topic is the variation of fundamental constants, a subject that during the last years has attracted a lot of attention from different communities of physics.

*Earth Gravity Field from Space - from Sensors to Earth Sciences* G. Beutler, M.R. Drinkwater, R. Rummel, Rudolf von Steiger, 2013-04-18. Volume resulting from an ISSI Workshop 11-15 March 2002, Bern, Switzerland.

*2001, a Relativistic Spacetime Odyssey* Ignazio Ciufolini, Daniele Dominici, Luca Lusanna, 2003. This volume offers a comprehensive overview of our understanding of gravity at both the experimental and the theoretical level. Critical reviews by experts cover topics ranging from astrophysics: anisotropies in the cosmic microwave background, gamma-ray bursts, neutron stars and astroparticles; cosmology: the status of gravitational wave sources and detectors; verification of Newton's law at short distances; the equivalence principle; gravito-magnetism; measurement theory; time machines; and the foundations of Einstein's theory to string theory and loop quantum gravity.

*2001: A Relativistic Spacetime Odyssey: Experiments And Theoretical Viewpoints On General Relativity And Quantum Gravity - Proceedings Of The 25th Johns Hopkins Workshop On Current Problems In Particle Theory* Ignazio Ciufolini, Daniele Dominici, Luca Lusanna, 2003-01-16. This volume offers a comprehensive overview of our understanding of gravity at both the experimental and the theoretical level. Critical reviews by experts cover topics ranging from astrophysics: anisotropies in the cosmic microwave background, gamma-ray bursts, neutron stars and astroparticles; cosmology: the status of gravitational wave sources and detectors; verification of Newton's law at short distances; the equivalence principle; gravito-magnetism; measurement theory; time machines; and the foundations of Einstein's theory to string theory and loop quantum gravity.

Quantum Electrodynamics: Atoms, Lasers And Gravity Ulrich D. Jentschura, Gregory S. Adkins, 2022-05-30. This book introduces readers to a variety of topics surrounding quantum field theory, notably its role in bound states, laser physics, and the gravitational coupling of Dirac particles. It discusses some rather sophisticated concepts based on detailed derivations which cannot be found elsewhere in the literature. It is suitable for undergraduates, graduates, and researchers working on general relativity, relativistic atomic physics, quantum electrodynamics, as well as theoretical laser physics.

**General Relativity, Cosmology and Astrophysics** Jiří Bičák, Tomáš Ledvinka, 2014-06-12. The articles included in this Volume represent a broad and highly qualified view on the present state of general relativity, quantum gravity, and their cosmological and astrophysical

implications As such it may serve as a valuable source of knowledge and inspiration for experts in these fields as well as an advanced source of information for young researchers The occasion to gather together so many leading experts in the field was to celebrate the centenary of Einstein s stay in Prague in 1911 1912 It was in fact during his stay in Prague that Einstein started in earnest to develop his ideas about general relativity that fully developed in his paper in 1915 Approaching soon the centenary of his famous paper this volume offers a precious overview of the path done by the scientific community in this intriguing and vibrant field in the last century defining the challenges of the next 100 years The content is divided into four broad parts i Gravity and Prague ii Classical General Relativity iii Cosmology and Quantum Gravity and iv Numerical Relativity and Relativistic Astrophysics

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