
Contents

Part I Surveys

| | |
|---|----|
| Fundamental Physics, Space, Missions and Technologies | |
| <i>Claus Lämmerzahl and Hansjörg Dittus</i> | 3 |
| General Theory of Relativity: Will It Survive the Next Decade? | |
| <i>Orfeu Bertolami, Jorge Páramos, and Slava G. Turyshev</i> | 27 |
| Is the Physics Within the Solar System Really Understood? | |
| <i>Claus Lämmerzahl, Oliver Preuss, and Hansjörg Dittus</i> | 75 |

Part II Theory

| | |
|--|-----|
| Propagation of Light in the Gravitational Field of Binary Systems to Quadratic Order in Newton's Gravitational Constant | |
| <i>G. Schäfer and Michael H. Brügmann</i> | 105 |
| On the Radar Method in General-Relativistic Spacetimes | |
| <i>V. Perlick</i> | 131 |
| A Universal Tool for Determining the Time Delay and the Frequency Shift of Light: Synge's World Function | |
| <i>Pierre Teyssandier, Christophe Le Poncin-Lafitte, and Bernard Linet</i> | 153 |
| Unified Formula for Comparison of Clock Rates and Its Applications | |
| <i>C. Xu, X. Wu, and E. Brüning</i> | 181 |

VIII Contents

| | |
|--|-----|
| Gravity Tests and the Pioneer Anomaly | |
| <i>Marc-Thierry Jaekel and Serge Reynaud</i> | 193 |
| Laser Ranging Delay in the Bimetric Theory of Gravity | |
| <i>Sergei M. Kopeikin and Wei-Tou Ni</i> | 209 |

Part III Technologies

| | |
|--|-----|
| Measurement of the Shapiro Time Delay Between Drag-Free Spacecraft | |
| <i>Neil Ashby and Peter L. Bender</i> | 219 |
| Laser Transponders for High-Accuracy Interplanetary Laser Ranging and Time Transfer | |
| <i>John J. Deganan</i> | 231 |
| Unequal-Arm Interferometry and Ranging in Space | |
| <i>Massimo Tinto</i> | 243 |
| Technology for Precision Gravity Measurements | |
| <i>Robert D. Reasenberg and James D. Phillips</i> | 263 |
| Clocks and Accelerometers for Space Tests of Fundamental Physics | |
| <i>Lute Maleki, James M. Kohel, Nathan E. Lundblad, John D. Prestage, Robert J. Thompson, and Nan Yu</i> | 285 |
| Atom Interferometric Inertial Sensors for Space Applications | |
| <i>Philippe Bouyer, Franck Pereira dos Santos, Arnaud Landragin, and Christian J. Bordé</i> | 297 |
| Drag-Free Satellite Control | |
| <i>Stephan Theil</i> | 341 |
| Drag-Free Control Design with Cubic Test Masses | |
| <i>Walter Fichter, Alexander Schleicher, and Stefano Vitale</i> | 361 |
| Solar Sail Propulsion: An Enabling Technology for Fundamental Physics Missions | |
| <i>Bernd Dachwald, Wolfgang Seboldt, and Claus Lämmerzahl</i> | 379 |

Part IV Missions and Projects

| | |
|--|-----|
| Testing Relativity with Space Astrometry Missions | |
| <i>Sergei A. Klioner</i> | 399 |

| | |
|--|-----|
| LISA, the Laser Interferometer Space Antenna, Requires the Ultimate in Lasers, Clocks, and Drag-Free Control | |
| <i>Albrecht Rüdiger, Gerhard Heinzel, and Michael Tröbs</i> | 427 |
| Lunar Laser Ranging Contributions to Relativity and Geodesy | |
| <i>Jürgen Müller, James G. Williams, and Slava G. Turyshev</i> | 457 |
| Science, Technology, and Mission Design for the Laser Astrometric Test of Relativity | |
| <i>Slava G. Turyshev, Michael Shao, and Kenneth L. Nordtvedt, Jr.</i> | 473 |
| LATOR's Measured Science Parameters and Mission Configuration | |
| <i>Kenneth Nordtvedt</i> | 545 |
| OPTIS: High-Precision Tests of Special and General Relativity in Space | |
| <i>Claus Lämmerzahl, Hansjörg Dittus, Achim Peters, Silvia Scheithauer, and Stephan Schiller</i> | 553 |
| Testing Relativistic Gravity to One Part per Billion | |
| <i>Wei-Tou Ni, Antonio Pulido Patón, and Yan Xia</i> | 571 |
| Exploring the Pioneer Anomaly: Concept Considerations for a Deep-Space Gravity Probe Based on Laser-Controlled Free-Flying Reference Masses | |
| <i>Ulrich Johann, Hansjörg Dittus, and Claus Lämmerzahl</i> | 577 |
| Pioneer Anomaly: What Can We Learn from LISA? | |
| <i>Denis Defrère and Andreas Rathke</i> | 605 |
| Index | 631 |