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This volume records the lectures and symposia of the 12th International Conference on General Relativity and Gravitation. Plenary lecturers reviewed the major advances since the previous conference in 1986. The reviews cover classical and quantum theory of gravity, colliding gravitational waves, gravitational lensing, relativistic effects on pulsars, tests of the inverse square law, numerical relativity, cosmic microwave background radiation, experimental tests of gravity theory, gravitational wave detectors, and cosmology. These provide a useful summary of research areas in which there is intense current activity.

The plenary lectures are complemented by summaries of symposia, provided by the chairmen. Almost 700 contributed papers were presented at these and they cover an even wider range of topics than the plenary talks.

The book provides a comprehensive guide to research activity in both experimental and theoretical gravitation and its applications in astrophysics and cosmology. It will be essential reading for research workers in these fields, as well as theoretical and experimental physicists, astronomers, and mathematicians who wish to be acquainted with modern developments in gravitational theory and general relativity.

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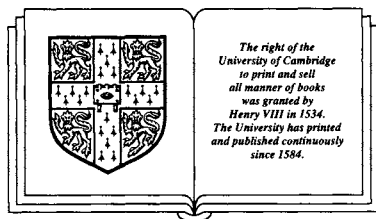
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Proceedings of the 12th International Conference on
General Relativity and Gravitation
University of Colorado at Boulder, July 2–8, 1989

Edited by

Neil Ashby, David F Bartlett and
Walter Wyss

Department of Physics, University of Colorado at
Boulder



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Preface

We note with sadness that GR-12 was the last important conference for two of the significant figures in physics in the last half of the twentieth century: William M. Fairbank and Eduardo Amaldi. Ironically, they were raised in traditions far removed from general relativity but both had made important experimental contributions to the field during the past twenty years. Fairbank, with Schiff, Cannon, and Everitt, started the investigation that we now call the Stanford Relativity Gyroscope experiment and helped bring it to the point that it will be put into orbit as NASA's Gravity Probe B. He then, with Hamilton, started the cryogenic gravity wave detection project at Stanford to further advance the pioneering experiments of Weber. Amaldi joined with Pizzella to build tuned gravity wave detectors in Italy. When the Italian bureaucracy became too difficult he helped move the experimental laboratory to CERN where it has become the world's strongest program.

In the evening of the next to last day of GR-12 both Fairbank and Amaldi attended a small informal meeting of experimentalists representing all of the major tuned bar groups. The focus of the meeting was to establish times when all of the experiments would be operated in coincidence and to establish protocols for exchanging the data that would be generated by these coincidence experiments. They both expressed great confidence that such a coordinated effort would lead us to the discovery of gravitational waves and the development of gravitational wave astronomy. And they both felt that when gravity waves were discovered, the discovery would be by their group and that the other groups would confirm the discovery.

Their enthusiasm and instinct for physics will be sorely missed.

We are grateful to William O. Hamilton for stepping in to write the report on the C3 Workshop, on resonant bar and microwave gravitational

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wave experiments, after the death of Bill Fairbank, the Chairman of the workshop. We also thank him for assisting with the above biographical notes about Amaldi and Fairbank.

The speakers and workshop chairs have done outstanding work with the articles presented here, and the editors are particularly grateful to them for their contributions. The fortunate readers of these Proceedings will find the articles to be comprehensive, excellent reviews and reports on the current status of the various subfields. We regret only that an article on Cosmic Strings was not received and could not be included in these Proceedings.

We also express our appreciation to the GR-12 Conference's Scientific Program Committee and the Local Organizing Committee, whose members are listed on the following page, for the meticulous planning and careful selection which made the conference such a success.

Wanda Derushia provided able assistance during the conference and early part of the preparation of these Proceedings. We also acknowledge the help of Sandy Rush with preparation of some of the manuscripts.

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The National Institute of Standards and Technology
The Gravity Research Foundation
The University of Colorado at Boulder

Boulder, Colorado, May 1990

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