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Relativistic Fluid Dynamics

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PREFACE

In the field of Relativistic Fluid Dynamics, there has been only one previous conference (the C.I.M.E. course of 1970, held in Bressanone with the late professor Cattaneo as Director) and the only other book on the subject is the excellent monograph by professor Lichnerowicz, dated 1967, entitled **Relativistic Hydrodynamics and Magnetohydrodynamics** and published by Benjamin. Therefore it is no surprise that after 17 years the proceedings of a course on this subject should amount to a rather substantial book. In 17 years the subject has developed greatly, mainly with regard to applications which previously would never have been imagined.

In particular there has been a tremendous development in the field of plasma physics (relativistic fluids are a good model for high-energy astrophysical plasmas) and nuclear physics (relativistic fluids are currently used in the analysis of the heavy ion reactions). Therefore relativistic fluid dynamics is a working tool in vastly different areas such as astrophysical plasmas and nuclear physics.

This is the explanation for the fact that, since 1970, there has been no other general course on the subject. In fact there have been sessions on relativistic fluids in conferences on plasma physics and on nuclear physics separately. However this tended to obscure the underlying mathematical structure of the subject and made more difficult to transfer results and techniques from one area to another.

Having realized this, we thought that a course on this subject could bring expertise and interest from several areas (astrophysics, plasma physics, nuclear physics, mathematical methods) and provide an appropriate arena for fruitful discussions and exchanges of ideas

The main lecture courses had the objective of introducing the most significant aspects of relativistic fluid dynamics. Their topics were: covariant theory of conductivity in ideal fluid and solid media; covariant fluid mechanics and thermodynamics: an Introduction; hamilton techniques for relativistic fluid dynamics; and stability theory, relativistic plasmas.

The lectures were delivered by leading scientists in these areas (B. Carter, W. Israel, D. Holm, H. Weitzner) and constitute an up-to-date and thorough treatment of these topics.

They were also several interesting contributions from the seminars on specialized topics. Not all of them, for reasons of space, have been included in this volume. In particular, the seminars by Dudynski and Ekiel-Jezewska, Granik, Hiscock and Lindblom, Deb Ray, Boillat, were omitted. The important topics treated by these authors are covered, however, in other publications.

About fifty people (including research students and senior scientists) participated actively in the course.

We thank all the lecturers and the participants for their invaluable contribution to the success of the course. We thank also the C.I.M.E. foundation and its Director, Professor Conti and secretary, Professor Zecca, for having sponsored the Course and for their constant help and encouragement. Thanks are also due to the City of Noto (world famous for its beautiful beaches and splendid baroque architecture) for its support of the conference and the lavish hospitality. Finally we are grateful to the local organizing committee (Dr. Muscato, Professors Miceli, Fianchino and Fortuna) for their support and dedication to the success of the meeting.

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