

PREFACE

It is becoming increasingly clear that we live in a High Energy Universe with the acceleration of particles to Ultra-high Energy (UHE) as the underlying cause. These particles interact to produce Gamma-rays and Neutrinos as well as surviving to be observed as Ultra-high Energy Cosmic Rays. Under the auspices of the International School of Cosmic Ray Astrophysics (M. M. Shapiro, Director), this 15th biennial Course entitled “Astrophysics at Ultra-high Energies” brought together students, faculty and researchers to explore the exciting new work that is underway at UHE. The school featured a full program of lectures and discussion in the ambiance of the Ettore Majorana Centre in Erice, Italy, including visits to the local Dirac and Chalonge museum collections as well as a view of the cultural heritage of southern Sicily. This course was attended by 60 participants from 15 different countries.

The program provided a rich experience, both introductory and advanced, to the inter-connected areas of High Energy Astrophysics: powerful astrophysical sources, ultrahigh energy cosmic rays, gamma ray astronomy and ultra-high energy neutrinos. Gamma ray bursts, as observed on the SWIFT Spacecraft, were described and possible sources, most involving massive black holes, were analyzed. In the TeV region, atmospheric Cherenkov telescopes have matured into a new observation tool that can study a large variety of high energy source objects. New technical advances in gamma-ray astronomy are underway making this an important area for future discovery. Moreover, “neutrino astronomy” is on the verge of becoming a new window to the universe and the techniques, instruments under development, preliminary results and the anticipated sources and propagation of these particles were addressed by experts in the field. Finally, recent advances both on the experimental side and in the theory and interpretation of UHE cosmic ray particles were fully discussed.

Contained in this volume is a collection of the lectures and presentations made at the School involving the physics and astrophysics of the newly emerging research area that already has been, and will continue to be, an important contributor to understanding our high energy universe. The volume is suitable for students and advanced researchers wanting a current

picture of the high energy situation, both experiment and theory, either for personal use or as part of a course of study for advanced students.

A highly successful course requires the combined effort of many individuals, foremost of whom are the Lecturers who give their time and expertise in both formal presentations and informal discussions. To them goes our heartfelt thanks. This course was co-directed by J. P. Wefel and T. Stanev. We acknowledge G. Sutton, and S. Rowland-Perry for their help with the organization, program and manuscripts. Executive Secretary A. Smith helped keep everything running efficiently.

We were delighted with the exceptional facilities of the Ettore Majorana Centre for Scientific Culture, the host for this school, and we acknowledge Centre Director A. Zichichi, plus Fiorella, Pino, Alessandro, Alberto, and a host of others who contributed to the course. We also thank the Sicilian Regional Government, the Italian Ministry of Education, and all of the institutes, universities and government agencies who helped to support the participants — the true beneficiaries of the Course.

M. M. Shapiro, T. S. Stanev and J. P. Wefel