

Foreword

A Summer School dedicated to the GAIA satellite, a cornerstone of the European Space Agency's science programme, was held in Les Houches (France), at the "Centre de Physiques des Houches", from 14 to 18 May 2001. It was aimed at engaging the curiosity, interest and participation of the next generation of astronomers to the GAIA mission, and at guiding young scientists through the huge scientific harvest expected from this highly exciting and challenging project.

The GAIA mission will provide a stereoscopic and kinematic map of our Galaxy at micro-arcsec level accuracy, and will survey more than one percent of the Galactic stellar population with the precision necessary to unravel its composition, formation scenario and subsequent evolution. Additional scientific products include characterisation of tens of thousands of extra-solar planetary systems, stringent tests of general relativity, and a comprehensive survey of objects ranging from minor bodies in our Solar System, through galaxies in the nearby Universe, to some 500 000 quasars.

The GAIA mission will give access to extremely high accuracy on distances and kinematics, and will provide on-board radial velocities and multi-colour photometry, *i.e.* to the full six-dimensional phase-space distribution function, combined with astrophysical diagnostics, for one billion stars in our Galaxy and throughout the Local Group.

A more complete description of the mission, and of its expected scientific products, is available at <http://astro.estec.esa.nl/GAIA>

The lectures given in Les Houches reviewed the mission design and accuracy performance, and the impact of the GAIA mission on various fields of astrophysics: covering the history of the various stellar populations in our Galaxy and in our neighbouring galactic companions, but also covering stellar physics and evolution with characterisation of all types of stars, planetary formation and census of extra-solar planetary systems in the solar neighbourhood, fundamental physics with stringent tests of general relativity, etc. In each domain, the most recent results were presented, along with the major key steps forward expected from the GAIA data. Highlights of the presentations are summarised at <http://astro.estec.esa.nl/GAIA/resources/leshouches.html>

This book presents the text of the lectures and presentations given during a week in Les Houches to the 70 participants. The main goal of this conference was to open this project to the full astronomical community, and to guide young scientists in the direction of the most promising and exciting project concerning the understanding of the history of the Universe from a complete survey and detailed sampling of its local populations. The many fold improvement in the number of stars and measurement accuracy will urge scientists to reconsider classical methodologies and to develop new tools in order to be prepared for the analysis of the future GAIA data.

The scientific organization of the meeting was in the hands of the Scientific Organising Committee: O. Bienaymé, M.A.C. Perryman, C. Turon, A. Baglin, J. Binney, A. Coradini, P. Fayet, K. Freeman, G. Gilmore, A. Gimenez, M.T. Lago, M. Mayor, F. Mignard, H.W. Rix, and P.T. de Zeeuw.

We wish to thank particularly warmly the Strasbourg Observatory and the Centre de Physique des Houches for ensuring that the School ran so smoothly. In this respect, we are especially indebted to the Local Organising Committee members, and particularly to C. Bruneau and J. Pluet, and to the staff members of the Centre de Physique, and of the Strasbourg and Paris Observatories.

We also wish to extend our gratitude to Cécile DeWitt-Morette who founded the Summer School at Les Houches, fifty years ago.

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