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978-0-521-19184-5 — X-ray Polarimetry
Edited by Ronaldo Bellazzini, Enrico Costa, Giorgio Matt, Gianpiero Tagliaferri
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X-RAY POLARIMETRY: A NEW WINDOW IN ASTROPHYSICS

Due to the advent of a new generation of detectors, X-ray polarimetry promises to join X-ray imaging, spectroscopy and timing as one of the main observational techniques in high energy astrophysics. This has renewed interest in the field, and indeed several polarimetric missions have recently been proposed. This volume provides a complete and up-to-date view of the subject for researchers in astrophysics. The contributors discuss the present status and perspectives of instruments, review current theoretical models, and examine future missions. As well as detailed papers, the book contains broad reviews that can be easily understood by astrophysicists new to the field.

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Preface

Advances in X-ray astronomy over the almost five decades since the first rockets were launched have been impressive in the domains of imaging, spectroscopy and timing. On the contrary, polarimetry has not progressed much since the historic results of the Columbia team headed by Bob Novick with rockets and with the OSO-8 satellite. The introduction, since *Einstein*, of X-ray telescopes and imaging detectors produced a dramatic jump in the sensitivity of X-ray missions. Polarimetry based on the conventional techniques of Bragg diffraction and Compton scattering has suffered from the increased mismatching in terms of sensitivity which resulted in the preclusion of the whole extragalactic sky. Moreover the shift from satellites stabilized on one axis to those stabilized on three axes made cumbersome the hosting of polarimeters, which needed the rotation of the whole instrument, in the focal plane of telescopes. As a consequence no polarimeter was included in the final design of *Einstein*, *Chandra* and *XMM-Newton*.

The advent of a new generation of detectors, to be combined with large area X-ray telescopes, has renewed interest in X-ray polarimetry, as demonstrated by the several polarimetric missions recently proposed. One of them, *GEMS*, has been recently selected by NASA within the SMEX program, with a launch due in 2014. There are discussions in Italy about the possibility of a national X-ray mission including polarimetry, to be launched in the same time frame. On a longer time frame and more ambitious scale, it should not be forgotten that a polarimeter is one of the focal plane instruments of the proposed ESA/JAXA/NASA International X-ray Observatory, *IXO*.

These new instruments, although based on traditional gas counters in the proportional-multiplication regime, benefit from the fantastic improvements, in terms of fine subdivision, introduced by VLSI electronics. It is worth noting that a similar evolution toward finely subdivided detectors has also rejuvenated the field of scattering polarimetry, both in the hard X-ray range and in the domain of future Compton telescopes. It is reasonable to expect that some of the proposed

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experiments will be launched in the next few years, along with *GEMS*, providing the scientific community with real data.

In parallel with this evolution of the experimental landscape, in recent years we have had significant progress in theoretical studies. The improved knowledge of X-ray emission in astrophysical sources, deriving from imaging, spectroscopic, and timing data, often makes it possible to predict in detail the polarization properties of such emission. For instance, the present knowledge on magnetars, on accretion onto black holes or on jets in blazars and in microquasars allows us to identify polarization measurements with the capability to confirm or disprove current scenarios.

We believed therefore that, five years after the Conference in Stanford, the time was ripe to organize a conference on X-ray polarimetry with the aim of discussing the present status and perspectives of instruments as well as reviewing and discussing theoretical models. Our aim was not only to gather the community actively involved in the field (both on the instrumental and theoretical sides), but also and foremost to stimulate the interest of a wider community, which so far suffered the lack of observational perspectives. 'The Coming of Age of X-ray Polarimetry' conference was held in Rome, at the Center for American Studies in Via Caetani 32, on 27-30 April 2009. This book collects the Proceedings of the conference.

It is a pleasure here to thank the Center for American Studies, chaired by Senator Professor Giuliano Amato and directed by Professor Karim Mezran, for allowing us to hold our conference in their beautiful library, even if our topics were a little bit off their humanistic mainstream. We appreciated very much the courtesy and willingness to help of the library staff; the participants were also stunned by the richness and beauty of the library rooms inside the historic building.

We also thank the representatives of organizing science institutions and of ASI who kindly attended the opening of the conference.

Gabriella Ardizzoia and Rachele Millul performed, with their usual competence and kindness, the never sufficiently appreciated secretarial work. Riccardo Campana, Ettore Del Monte, Yuri Evangelista and Fabio Muleri provided invaluable help in the organization of the conference and in the editing of this book. Andrea Marinucci and Francesco Tamborra also helped during the conference. Last but not least, we want to thank Sergio di Cosimo. Without him, neither the conference nor this book could ever have became a reality.

The success of a conference is eventually determined by the number of participants and the quality of their contributions, and by the liveliness of the scientific discussions, both during the formal sessions and at coffee breaks, lunches, dinners, etc. It is not appropriate for us to judge the success of the conference we organized. We can only say that at the end we felt extremely relieved and satisfied.

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More Information

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