Foreword

The international community is currently preparing its next generation of large facilities for astronomical observations which will be able to answer the key astrophysical questions raised today. These have been beautifully summarized to four basic questions into the "ASTRONET Science Vision for European Astronomy": 1) Do we understand the extremes of the Universe? 2) How do galaxies form and evolve? 3) What is the origin and evolution of stars and planets? 4) How do we fit in? (see also the ESA Cosmic Vision for a similar exercise). The preparation of the new projects under discussion includes various analysis and developments in order to optimise their implementation. Among the required functions, detection is central due to its major contribution to the total performance budget of any thinkable instrument.

For many of the most ambitious programs on the ground (ELT, SKA, EST, CTA Km3NET, ...) and in space (LISA, DARWIN, IXO, EUCLID, SPICA, PLATO, ...), detectors are an important part of the cost of the instrument or of the operation facilities such as active and adaptive optics, or guiding cameras. The preparatory phases and dedicated R&D of these programs include specific actions on detection issues.

On the other hand, recent developments in nano-physics and detector technology open new capabilities that significantly impact the sensitivity of our instruments. The enhancement of detector performance opens new perspectives and enables new fields of astronomical science. A good example is adaptive optics, currently strongly limited by wavefront sensors. Each improvement in terms of limiting magnitude increases significantly the sky coverage. In a similar way, optical interferometry is even more drastically limited by the sensitivity of existing detectors. More sensitive detectors will give access to high angular resolution extragalactic science, while it is currently mostly limited to stellar observations. In the gamma ray area sensitive photon detectors with very high time resolution will support the current breakthrough in the field. Finally, using a fully cryogenic large telescope in space, as will be the case for SPICA, will open a new window to the very deep space, and this will require very sensitive infrared and far-infrared detectors that do not yet exist.

The articles gathered in this volume report most of the presentations given during a workshop held in the "Maison du Séminaire" in Nice city, November 17th to 20th 2008. This meeting has been organised by CNRS-INSU with partnerships from CNES, CEA, PopSUD, Thales Alenia Space and IRAM. Apart from stimulation of discussions beyond borders of established wavelength communities our main motivation was twofold. On one hand we intended to provide a review of existing technologies that meet the requirements of oncoming space borne and ground based programs, considering their main scientific drivers. On the other

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hand we wanted to provide a survey of emerging technologies and physical concepts that may allow to enhance the performances of future instruments.

The papers in this book address the requirements for astrophysical purposes, describe state of the art detection technology, and present advanced technologies in all energy domains, from the highest gamma-ray energies to radio wavelengths. The proceedings testify the place of astronomy as a driver of advanced detector developments with potentials much beyond their prime applications.

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