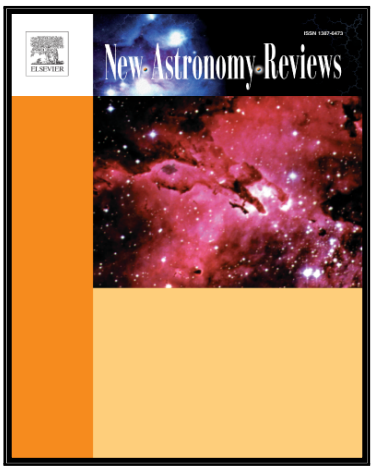

Paving the way to simultaneous multi-wavelength astronomy

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1 Introduction

Whilst astronomy as a science is historically founded on observations at optical wavelengths, studying the Universe in other bands has yielded remarkable discoveries, from pulsars in the radio, signatures of the Big Bang at submm wavelengths, through to high energy emission from accreting, gravitationally-compact objects and the discovery of gamma-ray bursts. Unsurprisingly, the result of combining multiple wavebands leads to an enormous increase in diagnostic power, but powerful insights can be lost when the sources studied vary on timescales shorter than the temporal separation between observations in different bands. In July 2015, the workshop "Paving the way to simultaneous multi-wavelength astronomy" was held as a concerted effort to address this at the Lorentz Center, Leiden. It was attended by 50 astronomers from diverse fields as well as the directors and staff of observatories and spaced-based missions. This community white paper has been written with the goal of disseminating the findings of that workshop by providing a concise review of the field of multi-wavelength astronomy covering a wide range of important source classes, the problems associated with their study and the solutions we believe need to be implemented for the future of observational astronomy. We hope that this paper will both stimulate further discussion and raise overall awareness within the community of the issues faced in a developing, important field.