

The fundamental cosmic distance scale: state of the art and the Gaia perspective

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Received: 10 July 2012 / Accepted: 10 July 2012 / Published online: 2 August 2012
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We are pleased to present in this Special Issue of *Astrophysics & Space Science* a compilation of the latest research on the challenging issue of the cosmic distance scale. In this context, the *Gaia* astrometry satellite, planned for launch in the fall of 2013, will have a dramatic impact on the definition of the cosmic distance scale as it will provide trigonometric parallaxes, hence geometric distances to unprecedented accuracy of the most powerful “primary” distance indicators thus, in turn, enabling a direct re-calibration of the “secondary” indicators and a global re-assessment of the entire cosmic ladder. At the same time, due to its frequent repeated observations of the sky, *Gaia* will also have a significant impact revealing the “transient sky” and, most noteworthy, many SNe events. This volume is meant to bring together different aspects of the astronomical distance scale in order

to set the status of the art of the cosmic distance ladder before *Gaia*, discuss the extraordinary improvements expected from the mission, and, at the same time, identify preparatory work both on theoretical and empirical sides needed to allow for the full exploitation of *Gaia*'s outcomes. The papers collected in the volume provide a reference point of the cosmic distance scale for several years to come, until the completion of the *Gaia* mission and the full exploitation of the *Gaia* catalogue.

We have organized the research material of this special issue around the following four main sections: (i) the cosmological distance ladder into context, (ii) stellar pulsation and evolution distance indicators, (iii) from local to cosmological distances to H_0 , (iv) *Gaia*: the “transient” sky and the cosmic distance ladder.

The cosmological distance ladder into context The calibration of the extragalactic distance scale leading to the final evaluation of the Hubble constant relies on geometric distance estimates for the closer stars and stellar systems. The trigonometric parallaxes measured by the *Hipparcos* satellite have represented a significant step forward but a much more significant improvement is expected from the results of the *Gaia* mission. A cornerstone in the calibration of the cosmic distance scale is represented by the distance to the Large Magellanic Cloud (LMC) and different methods have been recently adopted to reduce the uncertainty of this “first step” of the extragalactic distance ladder. The possibility to directly measure with *Gaia* the trigonometric parallaxes of LMC stars will definitely allow setting the distance to this crucial system.

Stellar pulsation and evolution distance indicators Several tools based on the comparison between observations and the theories of stellar evolution and stellar pulsation have been

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