

Standard candles from the Gaia perspective

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Abstract The ESA Gaia mission will bring a new era to the domain of standard candles. Progresses in this domain will be achieved thanks to unprecedented astrometric precision, whole-sky coverage and the combination of photometric, spectrophotometric and spectroscopic measurements. The fundamental outcome of the mission will be the Gaia catalogue produced by the Gaia Data Analysis and Processing Consortium (DPAC), which will contain a variable source classification and specific properties for stars of specific variability types. We review what will be produced for

Cepheids, RR Lyrae, Long Period Variable stars and eclipsing binaries.

Keywords Stars: distance · Stars: variables · Stars: binaries · Stars: statistics · Cosmology: distance scale · Space vehicles · Surveys · Catalogs

1 Introduction

The subject of standard candles is a fundamental scientific case that will greatly benefit from the Gaia mission. In this respect Gaia is unique and this scientific subject will take advantage from all aspects of the mission. The astrometry will obviously provide a major contribution. However, other aspects of the Gaia measurements will contribute to this subject as well. The classical standard candles are RR Lyrae and Cepheid stars. But Gaia will also offer the possibility to exploit other classes of variable stars as standard candles. Examples of “non-classical” standard candles include Long Period Variables (LPVs) (Feast et al. 1989; Matsunaga et al. 2009), OGLE Small Amplitude Red Giants (OSARGs; Wray et al. 2004), eclipsing binaries (Paczynski 1997) and High Amplitude δ Scuti stars (McNamara 1997).

Certain types of stellar variability occur within specific mass and metallicity ranges and at given evolutionary stages. The size of the Gaia dataset will ensure that all these cases will be covered statistically. Gaia data will allow us to establish the fundamental astrophysical properties of these stars, in particular their luminosity, and thereby establish their usefulness as standard candles. They will also determine their cosmic scatter. Gaia will therefore be able to test the universality of many different standard candles.

The astrometric precision of the Hipparcos satellite has been exploited to its limit in the case of standard candles.

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