



Globular clusters will be extensively observed by Gaia, giving precise distances and ages for these objects which are among the oldest objects in the Milky Way. Their distances provide a clue to Population-II distance scales and their ages give a lower limit for the age of the Universe. Images NGC 6093 and Omega Centauri, copyright NASA & The Hubble Heritage Team (STScI/AURA); NGC 6397, copyright ESA & Francesco Ferraro; 47 Tucanae, copyright NASA & Ron Gillard (STScI).

Gaia will have a major impact upon our knowledge of the distance scale in the Universe by providing accurate distances and physical parameters for all types of observable primary distance indicators in the Milky Way and in the closest galaxies of the Local Group. It will generate a complete sampling of these indicators versus the corrections due to metal, oxygen, or helium contents, colour, population, age, etc. In particular, Gaia will extensively observe many Galactic open and globular clusters and countless Cepheids and RR Lyraes, thus providing solid calibrations for cluster-sequence fitting and period-luminosity relations.

Major efforts have been made during the past decade to observe distance indicators in external galaxies (for example, the Hubble Space Telescope key project). Nowadays, the dominant contribution to the uncertainty on these distances, and hence on the most important cosmological parameter describing the Universe – the Hubble constant – is the uncertainty in the distance to the Large Magellanic Cloud (LMC).

Gaia will provide a firm foundation to the sequence of steps leading to the determination of distances of far-away galaxies and, as a consequence, to the determination of the Hubble constant by measuring individual trigonometric distances to the Cepheids and brightest stars of the LMC. Moreover, Gaia will establish a first check of the universality of the period-luminosity relationship for pulsating variables, with direct distances of all Galactic and LMC Cepheids and with mean Gaia distances for Cepheids in the closest galaxies of the Local Group.

Gaia will also provide an extensive picture of the whole Hertzsprung–Russell diagram, undoubtedly leading to new or renewed insight (Mirae period-luminosity relation, eclipsing binaries, white-dwarf luminosity function, etc.).

Moreover, Gaia will touch a second crucial parameter for the description and understanding of the Universe: its age. The accurate determination of the distances of the oldest objects in the Galaxy, namely subdwarf stars and globular clusters, combined with a fit to theoretical models of stellar evolution, will lead to a precise estimation of their ages. These age estimates naturally provide a lower limit to the age of the Universe, since these objects formed some time after the Big Bang.