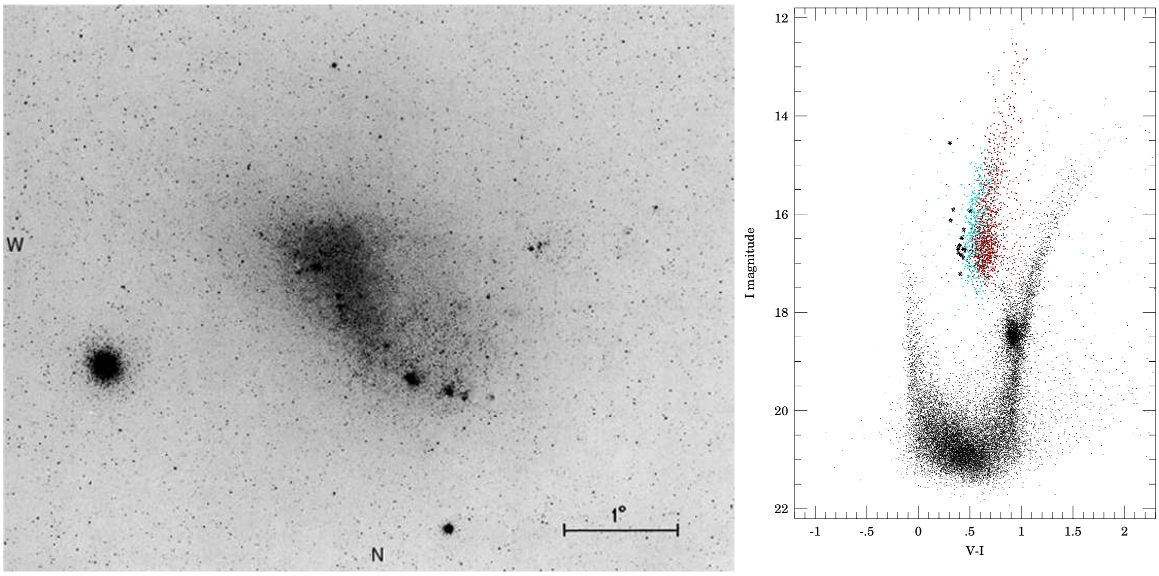

Left: the Small Magellanic Cloud as it appears on the sky. The big globular cluster (to the left) belongs to our own Galaxy. Image by Henize using the Mt. Wilson 10-inch refractor. Right: colour-magnitude diagram for an area of 14×57 arcmin^2 in the SMC bar. There are 45,500 stars with $I < 20$ mag. Overplotted are the Cepheids from OGLE, with fundamental, first overtone, and single-mode second overtone indicated separately by colour. Image from the OGLE consortium, courtesy of Andrzej Udalski. Gaia will observe millions of stars in the Large and Small Magellanic Clouds and will give even more detailed information.

The Magellanic Clouds are substantial galaxies in their own right, which provide the nearest examples of young intermediate-to-low chemical-abundance stellar populations for study. The Large Magellanic Cloud (LMC) and Small Magellanic Cloud (SMC) will provide millions of stars for Gaia analyses. The key scientific questions for Gaia involve the dynamics of the LMC–Galaxy and the LMC–SMC interactions, the luminosity calibration of stellar populations, the dynamics of star-forming regions, and the dynamical structure of the LMC 'bar'. At the LMC and SMC distance of roughly 50 kpc (parallax 20 μas), individual bright stars, with I = 12–16 mag, will have transverse velocities determined to approximately 1–2 km s^{-1} ($\sim$20 μas yr^{-1}). Gaia will allow kinematic mapping and membership analyses of young star-forming regions in the LMC and SMC with comparable precision to that presently available in the Milky Way. In other words, it will be possible to compare directly the kinematics and structure of star-forming regions in a large spiral disc with those in a mid-sized irregular galaxy.

The dynamical evolution of the solar neighbourhood is dominated by diffusion of stars in velocity space, crudely described as an age-velocity dispersion relation. This process is not well understood, but presumably involves energy input from spiral arms and molecular clouds. The Gaia kinematics in the LMC and SMC will quantify the age-kinematics relation in a very different environment, constraining the key dynamical processes.

One of the major puzzles in the structure of the LMC and the SMC is their asymmetric luminosity distribution. While the large-scale, radially-averaged luminosity profiles of both galaxies follow fairly smooth exponentials, both show significant bar-like asymmetries. This is most obvious in the LMC, and in stars of ages less than a few Gyr old. However, the LMC 'bar' is substantially offset from the dynamical centre, and seems unrelated to the stellar-dynamical m=2 modes of cold discs. It appears to be sufficiently long-lived to have survived differential rotation for several rotation periods. It is presently unknown what the dynamical status of the bar is, or even if it is in the same plane as the main LMC disc. Gaia will provide three-dimensional dynamics across the whole bar and disc region, quantifying the dynamical relationship between these features. While an individual parallax to an LMC star will be imprecise (20 per cent error), the very large number of targets will map the spatial structure of the LMC/SMC system with high spatial resolution directly.

The masses of the LMC and SMC are poorly known. Current analyses involve approximate solutions fitting the poorly known transverse velocity, and assuming simple disc structure, for a small number of test particles. Gaia proper motions will map the membership of the clouds as far as they extend, including the 'inter-cloud' regions of young metal-poor star formation, the complex SMC 'wing', and stars associated with the HI Magellanic Stream. This will map the dark-halo structures of both the intact LMC and the apparently distorted SMC, determining the extent of their halos, the density of the Milky Way at 50 kpc, and the effects of the LMC–SMC interaction.