Abstract

The Red Clump is a compact group of stars located in the giant branch which are burning helium in their core. They are known to have an absolute magnitude that fairly weakly depends on their age and metallicity, a peculiarity which makes them good distance indicators. Gaia will provide high precision astrometry, photometry and spectroscopy for a billion stars, allowing a very accurate characterisation of the properties of the Red Clump and a new calibration of this standard candle.

We are currently developing our method to calibrate the Red Clump on the Hipparcos catalogue, adding photometry from the Mermilliod and 2MASS catalogues, to cover wavelengths from the ultraviolet to the near-infrared. The calibration is being done by using the Padova isochrones and taking into account the extinction, the metallicity and the age factors. With the first release of the Gaia catalogue we will be able to give the Gaia G band calibration of the Red Clump.

Modelling of Hipparcos RC

To characterize the Hipparcos RC in terms of age and metallicity distribution, we use a synthetic stellar population code, similar to TRILEGAL (Girard et al., 2005) but using the age-velocity dispersion relation as a constraint to the scale height of the population as done in Just & Jahreiß (2010). The galactic disc is simulated as a sum of mono-age isothermal populations and the star positions are simulated by direct Monte-Carlo integration. The stellar parameters are taken from the Padova isochrones assuming a default Chabrier 2001 log-normal Initial Mass Function (IMF), the Rocha-Pinto (2000) Age-Metallicity Relation (AMR) and a constant Star Formation Rate (SFR). The extinction model of Arenou (1992) is included. The Hipparcos astrometric and photometric errors are simulated.

We compare this simulation to the Hipparcos Survey H-R diagram in Fig. 2-4. Fig. 4. also shows the effect of changing the SFR on this simulation. It illustrates the work (in progress) which is still needed to properly understand the stellar population content of the Hipparcos RC.

Calibration of Hipparcos RC colours

To calibrate the Hipparcos RC colours we use RC stars with parallax precision <20%. High photometric quality and single systems. We complete the Hipparcos photometric information with Mermilliod (UBV) and 2MASS (JHK) catalogues. A sample of 610 stars is obtained, with a subgroup of 54 with known metallicity.

Atmosphere models are one of the most important ingredients when simulating the colours of a population of stars. As illustrated in Fig. 5, with ATLAS models used in the Padova isochrones, this “ingredient”, as we know today, does not allow us to get a good colour-relation. Other atmosphere models (MARCS, PHOENIX) as well as variations of age and metallicity have also been tested with the same result.

The method we are developing aims to derive an empirical calibration by taking into account the extinction, the age and the metallicity parameters. The calibration covers all bands from the ultraviolet to the near-infrared.

References