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BRIGHTEST CLUSTER GALAXIES – SINGLE OR COMPOSITE STELLAR POPULATIONS?

Abstract

Brightest Cluster Galaxies (BCGs) are the most massive and luminous galaxies in a cluster. BCGs can also be described as the central dominant galaxies in clusters. This paper deals with the study of the stellar populations in BCGs, more specifically determining whether the star formation histories (SFHs) of these galaxies can accurately be represented by single stellar populations (SSPs) or composite stellar populations (CSPs). It is difficult to find the progenitors of these early-type galaxies by means of direct observations, so astronomers have used an alternative approach by studying the SFHs of large samples of nearby galaxies in terms of the properties, i.e. their ages and metallicities ($[\text{Fe}/\text{H}]$), of these stellar populations. Several studies showed that the SFR of these galaxies were expected to take place at a much reduced rate and hence it was expected that only old stellar populations can be found in these galaxies. In this paper, we report on the central stellar populations of the galaxy sample, more specifically whether the SFHs of these stellar populations are more complex than first thought, i.e. is a SSP model sufficient enough when the SFH of a galaxy is reconstructed?

Therefore high signal-to-noise ratio, long-slit spectra for a sample of 41 galaxies were obtained on the Gemini telescopes. The stellar populations were studied by using the software package ULYSS. Each galaxy was fitted against a SSP and 2 and 3 SSP models, separately. For the 2 and 3 SSP fits the stellar components of the galaxies were divided into groups by age: a young, intermediate and an old component. Each SSP component is characterised by their ages and $[\text{Fe}/\text{H}]$. A series of 500 Monte-Carlo simulations were then performed to aid in the selection of the most probable SFH of the BCGs. Then the χ^2 -maps were drawn to assist in understanding the structure of the parameter space. During the fits, two models, Pegase.HR (P.HR) and the Vazdekis-MILES (V/M) models were used as independent stellar population models. We found that the stellar population model P.HR represented the SFHs of these BCGs more accurately. The P.HR model revealed that the CSP provided the best fit for some galaxies, indicating that at least some of these BCGs have a more complex evolution and formation than first thought.