

Investigating the Evolutionary History of the Local Group Dwarf Irregular Galaxy, NGC 6822, Through Long-Period Variable Stars

The evolution and star formation history (SFH) of NGC 6822, an isolated dwarf irregular galaxy in the local group at a distance of 490kpc, has been studied through evolved asymptotic giant branch (AGB) stars with a period of longer than 100 days, known as long-period variables (LPV). As LPVs pulsate, they reach their maximum luminosity. Using the theoretical stellar evolutionary tracks and isochrones makes it possible to relate LPVs maximum luminosity to their birth mass, and consequently obtain their age and pulsation duration (the period that the stars are in the LPV stage) to estimate the star formation rate (SFR) in NGC 6822 throughout its lifetime. The photometric data of 329 variable stars, including LPV and spectroscopy-confirmed C-rich AGB stars, were collected from several published surveys. The SFH has been studied in two regions. The bar region encloses a central area of 189 square arcminutes, and the outer region covers a region beyond the bar region, extending to the radial distance of 3 kpc. In addition to obtaining the galaxy's SFH assuming 12 constant metallicity values within the $0.0001 < Z < 0.012$ range, an age-metallicity relation (AMR) is adopted to account for the variation in the galaxy's chemical content throughout its lifetime. It is found that the onset of star formation in NGC 6822 traces back to ~ 12.5 and ~ 13 Gyr ago in the bar and outer regions, respectively. There are 3 main epochs of star formation in the bar region, which reach their peak at $\log(t) \sim 9.66$ (4.6 Gyr), $\log(t) \sim 9.21$ (1.6 Gyr), and $\log(t) \sim 7.68$ (50 Myr), where t is the look-back time. The outer region undergoes 1 main epoch at $\log(t) \sim 9.66$ (4.6 Gyr), and remains almost undisturbed afterwards. The significant peak around $\log(t) \sim 9.66$ is consistent with the previous research suggesting that NGC 6822 passed through the virial radius of the Milky Way, ~ 200 kpc, around 3-4 Gyr ago.