N-body Simulations of the Small Magellanic Cloud and the Magellanic Stream

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An extensive set of N-body simulations has been carried out the gravitational interaction of the Small Magellanic Cloud (SMC) with the Galaxy and the Large Magellanic Cloud (LMC). The SMC is assumed to have been a barred galaxy with a disc to halo mass ratio of unity before interaction and was modelled by a large number of self-gravitating particles, whereas the Galaxy and LMC have been represented by rigid spherical potentials. We have employed orbital parameters for the Magellanic Clouds derived by Gardiner et al. (1994) (MNRAS 266, 567). The best simulation we have found succeeded in matching a number of observational characteristics of the Magellanic system. The Magellanic Stream (MS) was reproduced as a tidal plume created by the perigalactic passage of the SMC 1.5 Gyr ago in similar way to the model of Murai & Fujimoto (1980) (PASJ 32,581) but with significant improvements in morphology and velocity structure. A novel feature of the model is the formation of a leading arm on the opposite side of the Magellanic Clouds to the Magellanic Stream. which we propose is identified with several neutral hydrogen clumps observed in the corresponding region of the sky. The elongation of the SMC bar along the line-of-sight direction suggested by Cepheid observations has been partially reproduced, alongside its projected appearance on the sky. We also showed that the underlying velocity structure of the H I gas in the central regions is due to the regular kinematics of the bar. Certain velocity-distance correlations for the stellar populations of the SMC have been explained as a result of the LMC's tidal perturbation. Lastly, the model successfully describes major trends in the overall velocity pattern for the gas, young stars, and carbon stars in the inter-Cloud region.

Photometric Evolution of Elliptical Galaxies

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We have calculated the photometric evolution of elliptical galaxies taking into account the time variation of metallicity during chemical evolution and the stellar evolutionary models covering the wide ranges of metallicity and mass, and adopting the different IMFs (simple IMF & time-dependent bi-modal IMF).

The model with a simple IMF can't reproduce the observed integrated properties(magnitudes and colors). However, by using the time-dependent bi-modal IMF, we could obtain reasonable models which can reproduce the observed integrated properties. These models show the following properties of giant elliptical galaxies. (1) Most of stars are born within 2Gyr and the metallicity increases abruptly up to [Fe/H] $\sim$ 0.6 during the very early phase(1Gyr) of the evolution. (2) The integrated color and magnitude become redder