Z108b Formation of dwarf galaxies induced by dark matter subhalo collisions

Koki Otaki, Masao Mori (University of Tsukuba)

The standard model of galaxy formation, the Λ Cold Dark Matter model, supports observational properties of the large structure formation in the Universe. However, several discrepancies between theoretical predictions and observational results for smaller scales than galaxies have been pointed out. In 1999, the missing satellite problem was reported, which is that the number of satellite galaxies observed in the Milky Way is more than ten times smaller than theoretical estimates. The most successful solution to this problem is the hypothesis that many dark satellites are too faint to be observed. Recent improvements in observational devices and techniques have contributed to the discovery of a large number of galaxies with low surface brightness.

This study focuses on the collision–induced formation of dark–matter–dominated galaxies and dark–matter–deficient galaxies and their collision frequencies. The gaseous medium highly compressed at the collision surface triggers an instantaneous burst of star formation, leading to the generation of a single stellar population. Such past collision events would have been imprinted by observational features such as star formation histories and metallicities of stars. Utilizing simulations of the orbital evolution of subhalos based on cosmological N–body simulations, we estimate the collision frequency between subhalos moving within a Milky Way–like host halo. The results indicate that collisions with the relative velocity of $100\,\mathrm{km\,s^{-1}}$ occur frequently in the host halo. This study discusses the observational possibilities of dwarf galaxies induced by collisions, providing insights into the missing satellite problem.