

# From a clump cluster to a disc galaxy

Shigeki Inoue<sup>1</sup>

<sup>1</sup> Korea Astronomy and Space Science Institute

Recently, clumpy galaxies, so-called clump clusters, have been observed in the high-redshift Universe. They are thought to correspond to the formative stages of disc galaxies although their appearance is largely different from the current galaxies. These clumpy galaxies have some ‘giant clumps’ in their disc regions, of which masses are  $\sim 10^9 M_\odot$  at the largest. The formation process and the massive masses of the giant clumps are discussed to exert significant influence on dynamical and chemical properties of remnant disc galaxies.

These results, however, do not necessarily mean that all of the current disk galaxies were once clumpy galaxies. How common was the clumpy disk formation in the Universe? Can we know which disk galaxy was once a clumpy galaxy? Was the Milky Way once a clump cluster? To answer these questions, it is important to seek a clue concerning the past clumpy disk formation in current galactic structures.

In this study, I performed  $N$ -body/SPH simulations using isolated galaxy models to study bulge and disc formation in the clumpy galaxy formation process. And I will discuss the properties of thick-disc stars, bulge classification and influence on the clumps on halo stars and dark matter distribution.