(第3号様式)(Form No. 3)

学位論文要旨
Dissertation Summary

氏　名 (Name) Akie Ichikawa

論　文　名: THE EVOLUTION OF POST-STARBURST GALAXIES IN THE COSMOS ULTRAVISTA FIELD

(Dissertation Title) COSMOS UltraVISTA領域におけるポストスターバースト銀河の進化

Galaxies are one of the most important constituents of the universe, and are known to evolve throughout the cosmic time. Therefore, revealing their formation and evolution gives us a crucial clue to better understanding the nature of the universe we live today. This thesis brings post-starburst galaxies into focus, as the transition phase between star-forming and passive galaxies, which must be accompanied by some form of star-formation quenching. The purpose of the thesis is to shed new light on (i) whether all galaxies pass through the post-starburst phase when transiting from star-forming to passive galaxies, (ii) what is the major quenching mechanism of star formation, and (iii) whether the putative active galactic nucleus (AGN) feedback contributes to the quenching.

This thesis rests on the Cosmic Evolution Survey (COSMOS) UltraVISTA data, which enable us to probe a large number of post-starburst and other types of galaxies over a large cosmic volume. We first measured the stellar mass function at $z \sim 2$, where the cosmic star formation rate density has peaked. It was found that the number density of low-mass passive galaxies decreases toward low-mass end, which is in clear contrast to monotonically increasing number of low-mass star-forming galaxies toward lower mass. On the other hand, post-starburst galaxies have an almost flat stellar mass function at low-mass side. If these post-starburst galaxies become gradually passive with time, the number density of low-mass passive galaxies would increase more rapidly than at the high-mass side, and we would obtain flat slope of the stellar mass function of passive galaxies as observed in the local universe. The more efficient quenching of lower-mass galaxies may hint at the so-called "environmental quenching" starting to work at $z \sim 2$.

We then set out to measure the evolution of post-starburst galaxies at $z = 0.2 - 4.8$, using the latest COSMOS2015 catalog. This is the first time that the stellar mass functions of post-starburst galaxies are consistently measured and studied in such a wide range of

redshift. We found an increasing number density of post-starburst galaxies with time in a broad mass range at $z > 1$. At the lower redshift down to $z = 0.2$, low-mass post-starburst galaxies start to increase their number very rapidly, which may be due to the environmental quenching as al- ready indicated above. We confirmed that the evolution of the stellar mass function of passive galaxies can be explained largely by transition of post-starburst galaxies in the previous era into passive galaxies. This transition naturally reproduces the flattening of the stellar mass function of passive galaxies over time. We also found that the AGN fraction, indicated by *Chandra* X-ray detection, tends to be higher in post-starburst galaxies than in star-forming or passive galaxies at $z > 1$. This may point to the presence of AGN feedback process, as a potentially important mechanism to produce post-starburst galaxies. Furthermore, we found that the morphological early- to disk-type ratios of post-starburst galaxies are intermediate between those of star-forming and passive galaxies – a result consistent with the picture that post-starburst galaxies represent a transitional phase between star-forming and passive galaxies, which may be accompanied by the build up of spheroidal component.

Overall, our results indicate that post-starburst galaxies represent a major transitional phase of galaxy evolution, in which star-forming galaxies turn into passive galaxies. The prevalence of low-mass post-starburst galaxies suggests that the environmental quenching plays a significant role in this transition, while the high AGN fraction may imply a contribution from the AGN feedback. Future wide and deep observations will help disentangle further the galaxy evolution through post-starburst phage, as the present analyses are still limited by a small sample size at high redshifts.