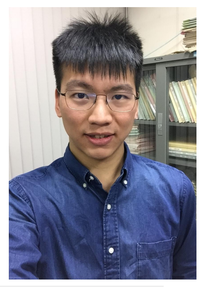
Galaxy Clusters in the AKARI North Ecliptic Pole field detected by Subaru Hyper Suprime-Cam



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Introduction

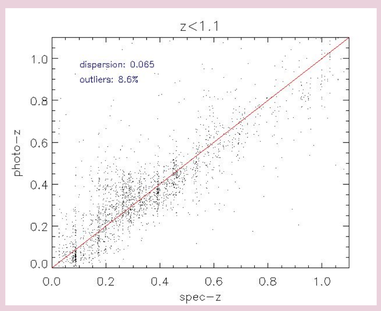
Galaxy Clusters for Galaxy Evolution

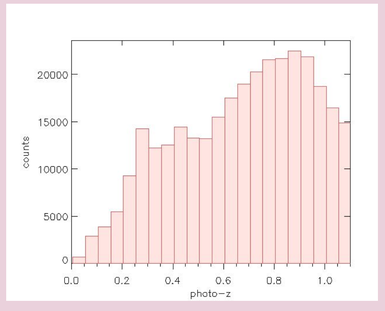
Galaxy cluster is a very important astronomical object, for it can be used in various research fields, for example, cosmology and galaxy evolution. We are interested in the environmental effects on physical properties of a galaxy, such as star formation rate, stellar mass, AGN fraction, PAH luminosity, and their evolution with redshift (z).

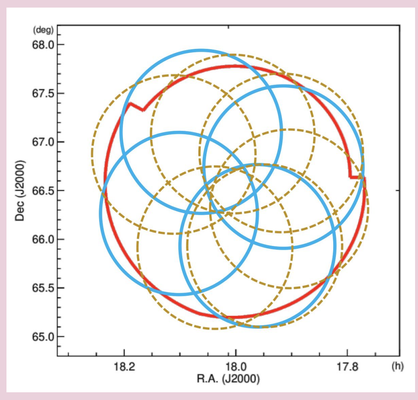
More Galaxy Clusters

This work is based on the HSC observations in the AKARI North Ecliptic Pole (NEP) field, which is a 5.4-deg^2 area. AKARI NEP data was obtained by the 9 mid-infrared filters of AKARI Infrared Camera, which continuously cover the most important wavelength range for studying many dust properties of galaxies. However, the number of known galaxy clusters in the AKARI NEP field from previous studies is small. There were only 7 clusters confirmed by ROSAT X-ray survey and 16 high-redshift clusters found in a 0.5-deg^2 field. A sufficient number of clusters is necessary for us to study the environmental effect of galaxy evolution.

Data & Method







[left] The photo-z performance of this work. [middle] The number distribution of photo-z. [right] The HSC observations coverage (blue and brown) on the AKARI NEP field (red).

HSC catalog (~1 million sources)

photometric redshift (photo-z) calculation

star-galaxy separation

Photo-z catalog (366791 galaxies)
(HSC g, r, i, z, y, NB816, NB921 + CFHT u band + Spitzer IRAC1,2)

10th-nearest neighborhood

normalized density > 2

Overdensities (z<1.1)
(27500 galaxies)

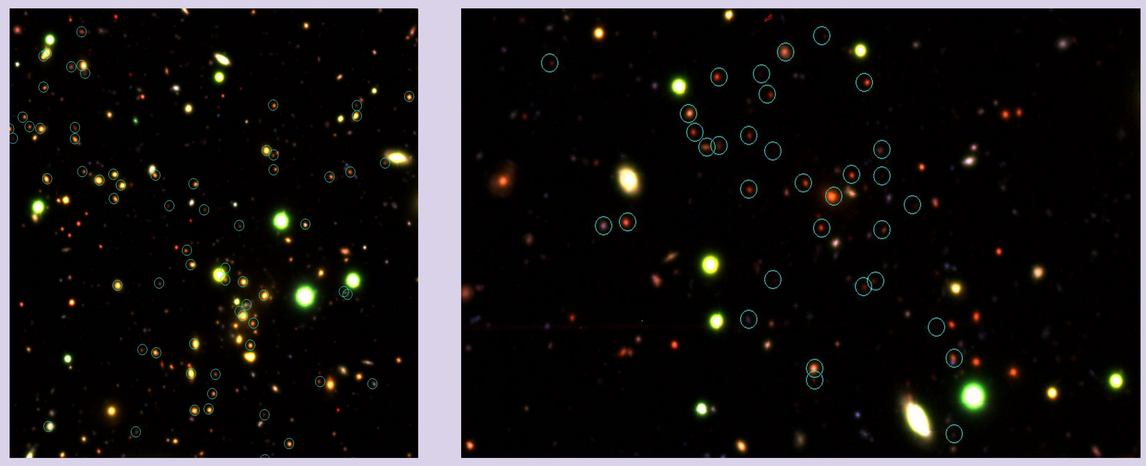
friends-of-friends algorithm

redshift dependent linking length

Cluster candidates
(91 clusters, 4362 galaxies)

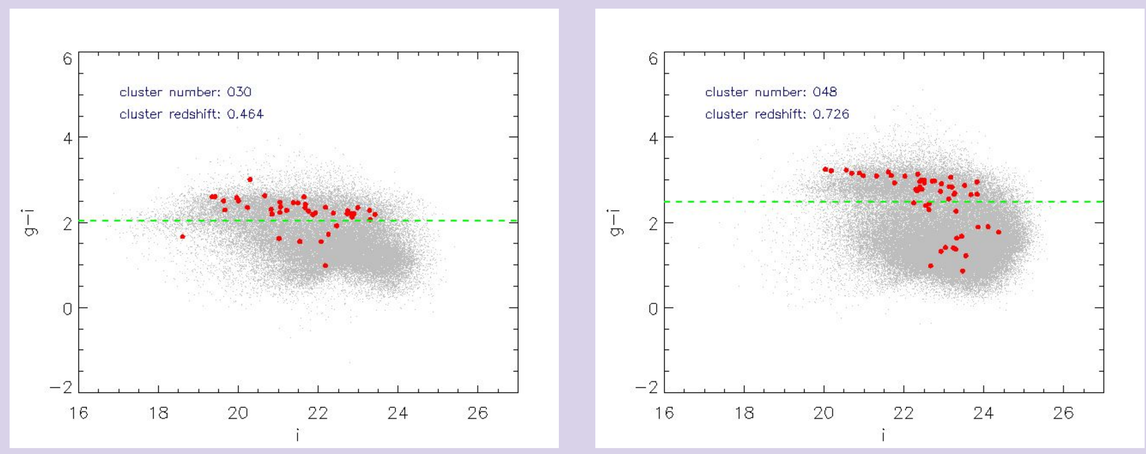
Results

Galaxy Cluster images



The RGB images of two cluster candidates stacked by HSC g, r, and i band.

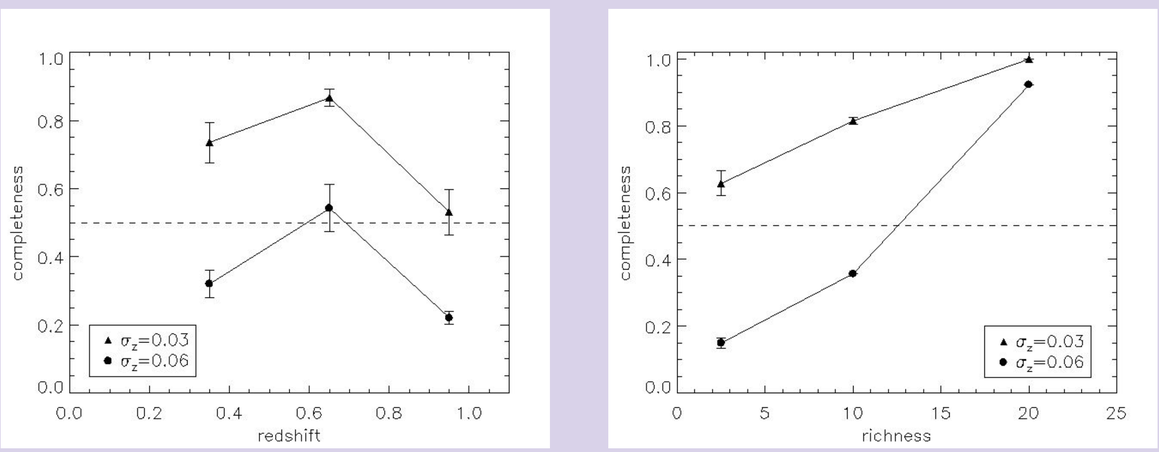
Color Magnitude Diagrams



The color magnitude diagrams of two cluster candidates. The red circles are cluster galaxies, and the grey dots are field galaxies. The green dashed line is the color cut for defining red galaxies.

Completeness Test

We estimate the completeness by applying our cluster finding code on mock clusters with different photo-z uncertainties.



The completeness as a function of redshift (left) and richness (right) with photo-z dispersion of 0.03 and 0.06.

Summary

In order to investigate the environmental effects of galaxy evolution, we have selected galaxy cluster candidates by applying the friends-of-friends algorithm to the galaxies with high local density. 91 cluster candidates with 4362 member galaxies from redshift 0.2 to 1.1 were found in the AKARI NEP field. Some cluster candidates look promising according to the optical images and the color-magnitude diagram. Our method has been examined by the completeness tests. We plan to compare physical properties between cluster and field galaxies in the future.