X21a **Galaxy Clusters at 0.9< z <1.6 in the AKARI NEP deep field.**

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There has been a missing link in past galaxy cluster surveys: Traditional 4000Å break surveys are limited to $z < 1$ due to the redward limit of optical filters. Searches for proto-clusters using Lyα emission/break can be possible only at $z > 3$.

We aim to fill this cluster desert by using the deep near-infrared $N2(2.4\mu m)$ imaging with the infrared satellite AKARI, combined with the Subaru z-band imaging. The $z - N2$ color is a powerful separator of cluster red-sequence galaxies at $z > 1$. Combined with our own efficient cluster finding technique, we carefully selected 15 promising cluster candidates at $0.9 < z < 1.6$. These galaxy clusters all show obvious over-density of galaxies and a prominent red-sequence.

At this redshift range, the mid-infrared $S_{15\mu m}/S_{9\mu m}$ flux ratio is an extinction-free indicator of galaxy star formation activity due to the redshifted PAH emission lines (6.2,7.7 and 8.6μm). We show statistically that cluster galaxies at $0.9 < z < 1.6$ have a lower $S_{15\mu m}/S_{9\mu m}$ flux ratio than field galaxies at the same redshift range, i.e., cluster red-sequence galaxies already have lower star-formation activity at $0.9 < z < 1.6$, pushing the formation epoch of these galaxy clusters to much higher redshift.