Extended Ionized Gas out of Galaxies in the Leo Cluster (Abell 1367)

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In clusters of galaxies, the relative motion of member galaxies to the hot gas of the cluster produces a ram pressure. The ram pressure strips gas from galaxies, and sometimes the gas stripped out of the galaxy gets ionized by some mechanism to be detected as an Hα emitting cloud. We observed a part of the Virgo cluster and the Coma cluster, in Hα narrow-band, and B, and R broad-bands of the Subaru Suprime-Cam to study such intergalactic ionized gas (e.g., [1,2]). We then executed a systematic survey of the Leo cluster (Abell 1367) with an Hα filter for redshift z=0.022 of the Suprime-Cam [3].

By the survey, we detected six new extended ionized gas clouds in addition to three galaxies with known gas tails (CGCG 097-073, CGCG 097-079, CGCG 097-087; [4]), and one of the new clouds was confirmed to have much longer tail by a follow-up observation [5]. Remarkable objects compared to the previous studies were the clouds which show no relation to the galaxies; "Orphan clouds" (Figure 1 top). Other clouds known so far show the connection to the galaxy from which the gas came from (parent galaxies). Meanwhile, no parent candidates are found at least within 85 kpc from the orphan clouds, and any member galaxies around the region show no sign of stripping toward the orphans. The orphan clouds brought to us new mysteries; from where the gas came, and how the ionization is maintained in ~30 kpc.

Another discovery was that the galaxy group which is infalling onto the cluster (Blue Infalling Group; BIG; [6]) has an ionized gas tail more than 300 kpc long. The length is about twice longer than known before [7]. The apparence of the tail indicates a helical shape. We presented a hypothesis that the tail originated not from the intragroup gas but from each galaxy, and the helical shape corresponds to the motion of the galaxy around the barycenter of the group while the gas had been stripped by the ram-pressure by the cluster gas. We also found sign of star formation in a limited region of the BIG tail (Figure 1 bottom).

Future spectroscopic observation will enable us to set constraints on the motion, the metallicity, and the ionization mechanism of the gas, and to estimate the age and the mass of the star-forming regions. We will try to understand the evolution of the gas in the cluster and the effect of the stripping on the evolution of the galaxies deeply and comprehensively.

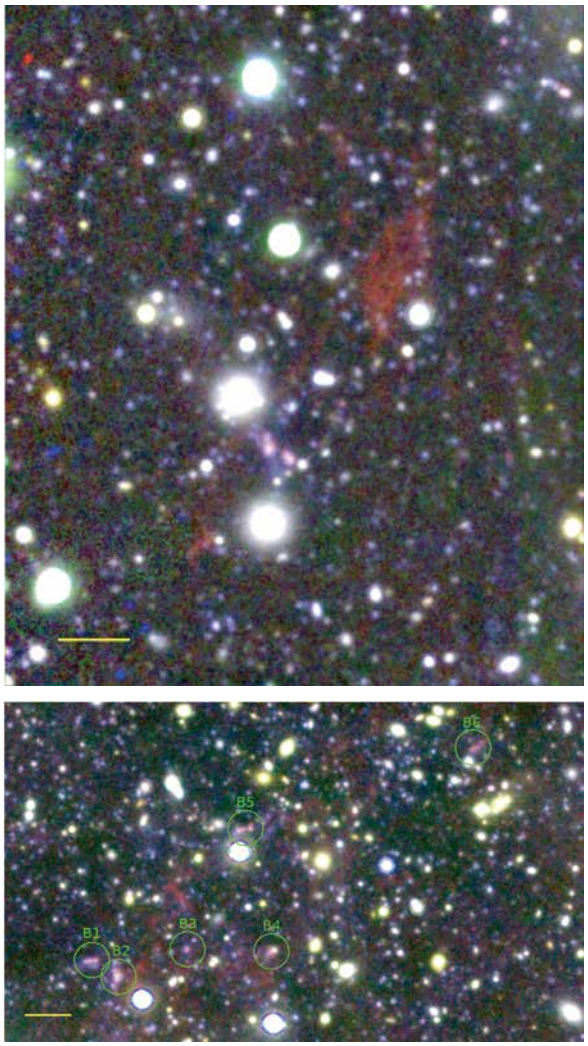

Figure 1: Intergalactic ionized gas clouds in the Leo cluster. NB671(Hα;red), R(green), B(blue) three color composite. With the color assignment, ionized clouds is shown in red, and starforming region is in magenta. Yellow bars at the bottom-left indicate 10 kpc. (top) Orphan clouds, which show no connection to galaxies. (bottom) Star-forming regions (green circles) in the tail of the blue infalling group (BIG).

References

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