The massive quiescent galaxies in the protocluster at $z=3.09$

We studied the protocluster at $z=3.09$ in the SSA22 field by using NIR imaging and spectroscopic data taken with Subaru MOIRCS.

The core of the protocluster was observed. 24 out of 67 targets are at $z_{\text{spec}}=3.04-3.12$.

Top: sky distribution of LAEs at $z=3.09$ in the SSA22 field (Yamada+12)
Left: the targets of NIR spectroscopy
From the spectral energy distribution (SED) fitting, we found that the five reddest (J-K_AB>2.4) galaxies in the protocluster have the SEDs dominated by old stellar population (Burst like SFH, Age>1.4Gyr, M_s~10^{11}M_{sun}).

This may be for the first time to confirm the association of massive quiescent galaxies with the protocluster at z>3.

(Left) Continuum spectrum of a quiescent galaxy at z_cont~3.1. (Right) Examples of the rest-frame UV to NIR SED of the quiescent galaxies in the SSA22 protocluster.