

## X32a Ionized gas outflows from an AGN in a massive quiescent galaxy in a protocluster at $z = 3.09$

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Galaxies in protoclusters are important targets to understand the evolutionary passway of giant elliptical galaxies today. We present a detailed study of a type-2 like QSO in a protocluster at  $z = 3.09$  in the SSA22 field. This object is an X-ray AGN whose host galaxy is identified by the near-infrared photometry with MOIRCS on Subaru Telescope. With the near-infrared slit spectroscopy using MOIRCS on Subaru and MOSFIRE on Keck telescope, [O III] emission with the broad linewidth ( $W_{80} \approx 1000 \text{ km s}^{-1}$ ) and wide spatial extent ( $\approx 15 \text{ kpc}$  in physical) are detected. They indicate strong outflows of ionized gas. On the other hand, it is characterized as a type-2 like QSO hosted by a massive galaxy with a strong Balmer break, i.e., a galaxy quenched several 100 Myr ago by a X-ray to radio (JVLA 6 GHz) spectral energy distribution fitting. It is classified as a radio-quiet QSO but has a low SFR ( $< 9 - 20 M_{\odot} \text{ yr}^{-1}$ ); not like traditional radio-quiet QSOs hosted by star-forming galaxies and radio-loud QSOs hosted by giant ellipticals. According to the  $H\beta$ , [O II], and [O III] emission line diagnostics, photoionization is likely the dominant ionizing mechanism. This AGN may work to complete the quenching and/or maintain the quiescence of the star formation of the host galaxy.