

## S11b Discovery of a hyperluminous quasar at $z = 1.62$ with Eddington ratio $> 3$ in the eFEDS field confirmed by KOOLS-IFU on Seimei Telescope

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We report the discovery of a hyperluminous type 1 quasar (eFEDS J082826.9–013911; eFEDS J0828–0139) at  $z_{\text{spec}} = 1.622$  with a super-Eddington ratio ( $\lambda_{\text{Edd}}$ ). We conducted optical spectroscopic observations utilizing KOOLS-IFU (the Kyoto Okayama Optical Low-dispersion Spectrograph with optical fiber) on the Seimei Telescope. The black hole mass ( $M_{\text{BH}}$ ) based on the single-epoch method with Mg II  $\lambda 2798$  is estimated to be  $M_{\text{BH}} = (6.2 \pm 1.2) \times 10^8 M_{\odot}$ . To measure the precise infrared luminosity ( $L_{\text{IR}}$ ), we obtained submillimeter data acquired by SCUBA-2 on the James Clerk Maxwell Telescope and performed spectral energy distribution analysis with X-ray to submillimeter data. We determined that  $L_{\text{IR}}$  of eFEDS J0828–0139 is  $L_{\text{IR}} = (6.8 \pm 1.8) \times 10^{13} L_{\odot}$ , confirming the presence of a hyperluminous infrared galaxy (HyLIRG).  $\lambda_{\text{Edd}}$  is estimated to be  $\lambda_{\text{Edd}} = 3.6 \pm 0.7$ , establishing it as a quasar with one of the highest BH mass accretion rates at cosmic noon (Toba et al. 2024b, PASJ, in press).