Z128a Unveiling the formation and evolution of SMBHs with PFS and HETDEX

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Recent observational results from James Webb Space Telescope (JWST) have revealed a large population of AGNs at $z > 3$ that hosts supermasive black holes (SMBHs) with masses of $M_{\rm BH} \sim 10^6$–$10^8 M_\odot$, ~ 1 dex more massive than expected if assuming the local relation of stellar mass (M_*) and MBH. However, due to the sample pre-selections and limited field of views, it remains unknown that whether high-z AGNs generally host overmassive SMBHs or these objects are selected with observational biases. To answer this question, a sample selected within a large volume and without continuum pre-selection is needed. In this talk we propose a synergetic study on the co-evolution of galaxies and SMBHs probed by faint type 1 AGNs at cosmic noon ($z \sim 2$–3) utilizing the untargetted integral spectroscopic survey of Hobby-Eberly Telescope Dark Energy Experiment (HETDEX) and the upcoming Subaru Prime Focus Spectrograph (PFS). Without any continuum pre-selection, HETDEX will provide ~ 2000 faint type 1 AGNs with spectroscopic con rmation and $M_{\rm UV} > -22$ that are likely to host SMBHs with $M_{\rm BH} \sim 10^7 M_\odot$ and not biased in M_*. With PFS covering the Mgii emission lines redshifted to $z = 2$–3.5, we will precisely estimate their MBH. Combined with M_* derived from photometric data and forward modelling that accounts for observational uncertainties, we will determine the intrinsic M_*–$M_{\rm BH}$ relation with data covering both the high-M_*, low-$M_{\rm BH}$ end and the low-M_*, low-$M_{\rm BH}$ end, constraining the galaxy-SMBH co-evolution throughout the cosmic time.