Z110a Rapid co-evolution into quiescence? Subaru + ALMA view on $z > 6$ low-luminosity quasars

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I will report our ALMA observations toward $z > 6$ optically low-luminosity quasars ($M_{1450} > -25$). These quasars were discovered by our on-going deep optical survey with the Hyper Suprime-Cam (HSC) on the Subaru telescope. We found with [CII] and rest-FIR continuum emissions that these HSC quasar-host galaxies typically show LIRG-class star-forming properties (e.g., star formation rate SFR $\sim$ several $\times$ 10 $M_{\rm sun}$ yr^{-1}). These values are smaller than those of SDSS-class quasars by 10 times or more. Thus we have started to explore a totally different parameter-space when compared to previous studies. Using the [CII] line profiles and spatial extents measured with ALMA, as well as our NIR spectroscopic data (Onoue et al. 2019), we found that the ratios of their SMBH masses and dynamical masses are consistent with the local co-evolution relationship (e.g., Kormendy & Ho 2013). This implies that the previously inferred *overmassive* nature of high redshift black holes (in quasars) relative to the local co-evolution relation is due to a selection bias preferring brighter or more massive objects. Furthermore, these HSC quasar-host galaxies would be on or even below the star-forming main sequence at $z \sim 6$, i.e., they appear to be transforming into quiescent galaxies after major evolutionary phases of starburst and quasar. Our ALMA works suggest that a quite rapid mechanism of galaxy evolution has worked well even at $z > 6$, which also encourages us (1) to directly measure stellar mass content in such galaxies and (2) to hunt for their descendants at $z \sim 5 - 6$, in the coming *JWST* era.