Z206b Unveiling the nature of HST-dark galaxies by using SPICA

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Recent ALMA observations start to convincingly suggest the presence of mm/submm-selected galaxies without any significant counterpart seen in the optical and near-IR: HST-dark galaxies (e.g., Simpson et al. 2014; Fujimoto et al. 2016; González-López et al. 2017; Franco et al. 2018; Yamaguchi et al. 2016, 2019). What is the role of such an HST-dark but mm/submm-bright galaxy population? In fact, recent ALMA studies clearly point the importance of HST-dark but IRAC-detected (a.k.a. H-dropout) galaxies as a key tracer of the early phases of massive galaxy formation, which can not be captured by the Lyman break technique relying on the rest-frame UV light using the state-of-the-art near-IR deep surveys using HST/WFC3 (Caputi et al. 2012, 2014; Wang et al. 2016). Such HST-dark but IRAC-detected galaxies are systematically fainter than the classical SMGs and therefore much ubiquitous ($>$500 deg^{-2}, i.e., 2 orders of magnitude higher sky density than Herschel/SPIRE-selected SMGs; Wang et al. 2019) than the classical SMGs. However, the difficulties to obtain accurate (spectroscopic) redshifts of these HST-dark galaxies (either optical/near-IR spectroscopy or mm/submm line scans) hamper the efforts to advance our understanding of this newly recognized important population. Here, we argue that the mid-infrared spectroscopy using SPICA will play crucial roles to unveil the nature of these HST-dark ALMA galaxies, by providing spectroscopic redshifts via PAH features, and indication on the presence or absence of growing super-massive blackholes via high ionization fine structure lines and MIR continuum. Detailed feasibility analysis and implications will be presented.