S28a Revisit the Dragonfly Galaxy I. High-resolution ALMA and VLA Observations of the Radio Hot Spots in a Hyper-luminous Infrared Galaxy at z=1.92

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Radio-loud active galactic nuclei (RLAGNs) are rare among AGN populations. Lacking high-resolution and high-frequency observations, their structure and evolution stage are not well understood at high redshifts. In this work, we report ALMA 230 GHz continuum observation at $0.023''$ resolution and VLA 44 GHz continuum observation at $0.08''$ resolution of the radio continuum emission from a High-redshift Radio and Hyper-Luminous Infrared Galaxy at $z = 1.92$. The new observations confirm the South-East (SE) and North-West (NW) hot spots identified by previous low-resolution VLA observations at 4.7 and 8.2 GHz, and spot a radio core undetected in all previous observations. The SE hot spot has a much higher flux density than that of the NW one, suggesting that the SE one may have its intrinsic flux density Doppler boosted. In this scenario, we estimate the advance speed of the jet head, spanning $\sim 0.2c - 0.4c$, which yields a mildly relativistic case. The projected linear distance between the two hot spots is ~ 15 kpc, yielding a linear size (≤ 20 kpc) of a Compact-Steep-Spectrum (CSS) source. Combined with new high-frequency and archived low-frequency observations, we find that injection spectra of both NW and SE hot spots can be fitted with a continuous injection (CI) model. Based on the CI model, the synchrotron ages of NW and SE hot spots have an order of 10^5 yrs, consistent with the values of $10^3 - 10^5$ yrs observed in CSS sources related to radio AGNs at an early evolution stage.