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A NIRSpec/IFU view of a quasar-galaxy merger at cosmic dawn

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Quasars are among the most active sources emerging in the early universe (z > 6). Their host galaxies have stellar masses and star formation rates orders of magnitude higher than what is observed in typical galaxies at the same redshifts. Investigating these sources is thus necessary if we want to unveil how the first massive galaxies formed. Here we present the rest-frame optical spectrum of a z = 6.23 quasar obtained with JWST/NIRSpec IFU. The spectrum shows the quasar emission with exquisite quality (S/N ~ 100 - 400 per spectral element). As shown by previous ALMA and HST data, the quasar presents two companion galaxies and lies within a prominent Lyman-alpha halo. This makes this source a perfect target to investigate several aspects, such as, the black hole properties, the quasar-host and companion galaxies, and the environment. Specifically, the NIRSpec data provide us with: Accurate estimates of the black hole mass and the Eddington ratio; study of AGN feedback via ionized outflows. A map of the ionized gas in the host galaxy and companion sources, showing a complex velocity structure, which enables a detailed study of the dynamics within this system; A chart of the photoionization conditions in the gas, which enables shedding light on the physics of the interstellar medium (metallicity, hardness of the ionization field, powering source, etc); A map of the halo seen in Halpha, which reveals resonance scattering as the main mechanism powering the Lyman-alpha halo. These data offer a deep insight into the assembly and early growth of the first massive galaxies and black holes.

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