Z102a How are supermassive black holes in galaxies fed?

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How to efficiently feed a supermassive black hole (SMBH) in the center of a galaxy in order to produce the enormous energy output observed in quasars is a key open problem. Possible mechanisms to provide gravitational torques that can transport gas to the nuclear region are major, gas rich galaxy mergers or internal 'secular' processes. Recent observations have shown that major mergers are not the dominant mechanism to trigger AGN activity even for massive black holes. Multi-scale hydrodynamical simulations rather suggest that secular processes may also be effective in massive AGN. A key prediction of such a scenario is that the central sub-kiloparsec gas surface-density is a decisive parameter for fueling supermassive black holes, implying a significantly enhanced gas surface density within the central ~ 300 pc region, in excess of $\sim 10^{10} M_{\odot}$ kpc^{-2}.

We here present new ALMA observations to observationally test this hypothesis for the first time. We present high angular resolution data of the CO(2-1) line for 5 nearby, massive and high accretion rate AGN and 5 matched (star forming) comparison galaxies. We find consistent sub-kpc gas masses and gas surface-densities for our luminous QSO sample and the comparison galaxy sample, with gas surface-densities $\sim 10^{9}$ $M_{\odot}$ kpc^{-2}. Our results do not support the picture of central gas surface-densities as the main driver of AGN activity in massive black hole systems. They rather suggest that quasars can be widely triggered in normal galaxies as long as they contain abundant gas.