ALMA reveals a warm and compact starburst around a heavily obscured supermassive black hole at $z = 4.75$

R. Gilli[1], C. Norman[2], C. Vignali[3], et al.

[1] *INAF – Osservatorio Astronomico di Bologna, via Ranzani 1, 40127 Bologna, Italy*
[2] *Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD 21218, USA*
[3] *Dipartimento di Fisica e Astronomia, Università degli Studi di Bologna, viale Berti Pichat 6/2, 40127 Bologna, Italy*

Abstract

Hidden AGN in distant submillimeter galaxies (SMGs) feature both efficient nuclear accretion and vigorous star formation. As such, they appear as ideal laboratories to study the concurrent growth of galaxies with their black holes. I will present ALMA 1.3mm observations of XID403, an SMG at $z = 4.75$ in the Chandra Deep Field South hosting a heavily obscured, Compton-thick QSO. ALMA data show that the dust heated by star formation is distributed within ∼0.9 kpc from the nucleus (effective radius). The SFR and dust temperature obtained from the Herschel+ALMA far-IR SED, reveal a warm and compact starburst with surface density of 200 $M_\odot$ yr^{-1} kpc^{-2}. I will show that, if most of the host gas mass were confined within the same dust region, its density would be so high that it would produce an absorbing column towards the nucleus comparable to what is measured in the X-rays ($\sim 10^{24}$ cm^{-2}). I will then elaborate on the high compactness of star formation, that, together with the presence of a powerful AGN, likely produce an outflowing wind, for which circumstantial evidence is presented. Finally, I will conclude by showing that, besides the mass, SFR and gas depletion timescale, objects like XID403 have also the right size to be among the best candidate progenitors of the compact quiescent massive galaxies seen at $z \sim 3$.