Referente: Fabrizio Fiore (fabrizio.fiore@inaf.it), Chiara Feruglio (chiara.feruglio@inaf.it)
Titolo: *Building the Giants*: mass assembly, accretion and feedback in high redshift QSOs
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Luminous QSOs, powered by accretion onto SMBHs, already exist at the epoch of Reionisation, when the Universe was only 0.5-1 Gyr old. These BH masses are not smaller than those of hyper-luminous QSOs at lower redshift, meaning that BH growth had to be a fast process, and that the process had to stop with a similar high efficiency after the rapid build up. How huge BHs formed and grew-up in such a short time is indeed highly debated, and it is unknown what slowed down BH growth and when this process occurred, leading towards the symbiotic growth with the host galaxy observed in the local Universe. Candidate processes are inefficient gas accretion and/or feedback through BH winds. At the same time, the host galaxies of high-z QSOs are likely growing rapidly. Therefore, the onset of significant BH feedback hampering BH growth would mark the transition from BH dominance to BH-and-galaxy symbiotic growth phases. We propose a PhD thesis on the subject of the build-up and properties of high redshift QSOs, from the Reionization Epoch (z>6) down to Cosmic Noon (z~2-4). The thesis is observationally-oriented and requires data analysis and interpretation as outlined below.

The student, depending on interest, will work on:

- Dust properties and SFR in the host galaxies, analysis of spectral energy distributions of z>=6 QSOs including radiative transfer, based on archival and proprietary ALMA (including an ongoing program in cycle 8 and an ALMA Large Program submitted for cycle 9), NOEMA, JVLA, LOFAR data
- Kinematics and dynamical modeling of the cold gas component in QSOs host galaxies at z>=6 and z=2-5 QSO samples. This includes rotation curves, dynamical masses for from the resolved [CII] and/or CO distributions and state-of-the-art dynamical modeling tools (3DBAROLO,Qubefit)
- Characterization of QSO winds of the cold gas phase, based on (sub)-mm data (ALMA, NOEMA), and of the warm gas phase traced by emission lines in the UV, based on XSHOOTER/VLT data.

A list of recent publications by our team related to the topic of AGN host galaxies and feedback
https://blackholewinds.inaf.it/index.php/science/publications/

Our Team
Prof. Fabrizio Fiore, group leader
Dr. Chiara Feruglio, staff researcher
Dr. Valentina D'Odorico, staff researcher
Dr. Manuela Bischetti, senior postdoc
Roberta Tripodi, PhD student Uni Ts
Maria Vittoria Zanchettin, PhD student SISSA