SF2A 2025 S09: "Étudier l’évolution des galaxies et la cosmologie dans la perspective des futurs grands observatoires"

Title: Searching for variability in the highest-redshift cluster-lensed "Little Red Dot" AGN

Abstract: Active galactic nuclei (AGN) at high redshifts, observed when the Universe was only a few hundred Myr old, are crucial for our understanding of black hole growth in the early Universe and their co-evolution with galaxies. In particular, if gravitationally lensed and multiply imaged by an intervening strong lensing galaxy cluster, distant AGN can yield precious insight into AGN properties. We can even use them to constrain cosmological parameters by studying the time delay between the multiple images through the varying AGN activity. The advent of the JWST and its phenomenal near-infrared sensitivity and spatial resolution has initiated a new era in observations of strong lensing galaxy clusters and the lensed background sources. JWST observations allow us to push the frontier of observability towards fainter magnitudes and higher redshifts -- and thus uncovered a new population of dust-obscured red AGN at high redshifts dubbed "Little Red Dots" (LRDs).
In my talk, I will present a particularly unique LRD object observed with JWST in the strong lensing field of Abell 2744. It not only represents one of the first examples of the new and hitherto unobserved population of LRD AGN, but is also the highest-redshift (z=7) multiply-imaged AGN observed to date. For this object, A2744-QSO1, we obtained the deepest JWST/NIRSpec spectrum taken of a single object and leveraged the strong lensing time delays between the three images to detect significant variability in its emission lines over a rest-frame time of several years. This proves this LRD to indeed be powered by an accreting black hole and opens fascinating prospects for future reverberation mapping campaigns of both this object and other cluster-lensed AGN with the next generation of great observatories such as e.g. Roman and the ELT.