Adélaïde Claeyssens
Présentation orale

Session S19: A new picture of galaxy evolution from Cosmic Dawn to Cosmic Noon: after the first years of JWST operation and towards the ELT

Titre:
Resolving star formation processes at 10-100s pc resolution within distant galaxies with JWST and the future ELT instruments

Abstract:
Distant galaxies present an irregular morphology dominated by compact sub-structures called "clumps". The physical properties of these systems remain relatively unexplored and their role in galaxy evolution is not clear. The first detections indicate that these clumps could be a major mode of star formation and morphological evolution of galaxies. However, resolving structures at 10-100s pc scales in high-redshift galaxies is hardly achievable with current telescopes even with space-based observations. Combining the unprecedented sensitivity and spatial resolution of JWST with the natural gravitational lens telescopes is the only way to reach sub-hundred pc resolutions necessary to resolve individual clumps and star clusters.
I will present the properties of the first statistical sample of distant JWST clumps obtained from NIRCam observations of strongly lensed galaxies in multiple galaxy cluster fields. The optical restframe, probed with the JWST, enables us to measure physical properties of >2000 star-forming clumps from z=1 to z=10. We derive clumps properties overlapping with massive star clusters properties in the local universe and compact star-forming regions. Comparing these results with the most recent hydrodynamical simulations of star-forming clumps and star clusters within galaxies, we can understand the physical processes involved in the formation and evolution of the stellar clumps/ star clusters and their host galaxies: gas turbulence, stellar feedback, galaxy mergers and bulge formation. These studies show the potential of JWST observations for understanding the conditions of the formation and evolution of star-forming regions and star clusters in rapidly evolving galaxies. However, spatially resolved spectroscopic observations will also be crucial to detect ISM nebular lines emission from individual clumps/clusters and understand how star formation operates in galaxies in the early Universe. I will present the first results on high redshift clumps from JWST observations of lensed and distant galaxies and how its combination with future IFU instruments (such as ELT/HARMONI) will help to build a coherent view of star formation from low to high redshift.