

Seminarium Astrofizyczne
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Chronicles of Galaxy Evolution from Dawn to Dusk

In contemporary observational astronomy, the synergy of powerful telescopes probing the entire electromagnetic spectrum is pivotal for uncovering the true nature of celestial objects. This seminar explores the distinctive characteristics of two cosmic realms using this synergistic approach: the enigmatic small, faint star-forming galaxies that may have played a major role in reionizing the universe, and the colossal, quiescent galaxies that puzzlingly appeared only a few hundred million years after the Big Bang.

Grasping how the numerous population of typical young, low-luminosity, low-mass galaxies at high redshifts assemble their stars in the first phases of their life is a cornerstone of every theory of galaxy formation and has deep implications on our view of the epoch of reionization. However, severe limitations on the sensitivity and resolution of our observations have been preventing us from drawing firm conclusions. In the first part of the talk, I will report on a deep and high-resolution multiwavelength campaign with JWST, ALMA, and more facilities targeting a quintuply lensed sub- L^* galaxy at $z=6.072$. The galaxy is resolved into at least ~ 15 star-forming clumps with effective radii of ~ 10 -60 pc. Yet, the cool gas traced by ALMA reveals the presence of a smooth, but gravitationally unstable rotating disks with high gas surface densities. Due to the combination of depth and lensing, ALMA also detects relevant pockets of dust, consistent with the expected gas mass estimates of a 25% solar metallicity derived with the direct method. The combination of clumpiness and smooth rotating disk challenges current zoom-in simulations. The large gas surface densities might be at the origin of the highly clumpy structure and reduced negative feedback effect. This also offers an explanation for the quick formation of a large number of stars early in the history of the Universe, consistently with the overabundance of UV bright galaxies reported in the first years of JWST observations.

In the second half of the talk, we will fast-forward to the end of the galaxy life cycle. I will present recent results on the large number of massive, quiescent galaxies that JWST now allows us to find at $z > 4$. I will introduce a simple and effective color diagram to identify these systems even recently after their main quenching epoch, demonstrating its application to purely public data and highlighting the importance and preciousness of archives.

Serdecznie zapraszam,
Prasad Sawant, on behalf of the SOC