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Cosmic Dawn II (CoDa II): a new radiation-hydrodynamics simulation of the self-consistent coupling of galaxy formation and reionization

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Cosmic Dawn II (CoDa II) is a new, fully-coupled radiation-hydrodynamics simulation of cosmic reionization and galaxy formation and their mutual impact, to redshift z < 6. With 4096^3 particles and cells in a (94 Mpc)^3 box, it is large enough to model global reionization and its feedback on galaxy formation while resolving all haloes above 10^8 Msun. To accomplish this massive numerical enterprise, CoDa II uses the hybrid CPU-GPU code RAMSES-CUDATON (Ocvirk et al. 2016), deployed on 16384 GPUs and 65536 CPUS. CoDa II modified and re-calibrated the subgrid star-formation algorithm with respect to our previous simulation CoDa I, making reionization end earlier, at z ~ 6, thereby better matching the observations of intergalactic Lyman-alpha opacity from quasar spectra and electronscattering optical depth from cosmic microwave background fluctuations. The post-reionization UV background intensity is somewhat high, however, making the H I fraction after overlap lower than observed, a possible sign of missing bound-free opacity from unresolved substructure. I will use the unique CoDa II dataset to build predictions on the behaviour of the observable galaxy population at high redshift, in particular the luminosity function, and the observable fraction of the star formation rate density with current and future telescopes. Pushing deeper into the (currently) unobservable territory, I will present results on the environmental dependence of radiative star formation suppression in low mass galaxies. I will also show the first implementation of the CoDa II galaxy catalog public database.

Presenter: Mr OCVIRK, Pierre (Observatoire astronomique de Strasbourg)

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