How do massive galaxies become quiescent? Chemical evolution and AGN feedback from JWST

Massive galaxies are thought to be quenched by feedback from accreting supermassive black holes. Before JWST, we thought that the main mechanism was preventive feedback through halo heating, but the discovery of quiescent galaxies at high redshift requires fast, efficient feedback already in the first Gyr after the Big Bang. We present JWST observations of a massive, post-starburst galaxy at z=3 hosting an X-ray AGN. We show that the system is undergoing fast, neutral-gas outflows with high mass loading, while the ionised-phase outflow (while still present) has low mass-outflow rate. This demonstrates the ability of AGN to keep quenched galaxies from forming stars *after* they became quiescent, with outflows that have been missed – before JWST – due to the challenge of observing neutral gas. We will then present a strong shock in a lower-mass star-forming galaxy at z=4.5 hosting a low-power radio AGN. The high-equivalent width of low-ionisation chemical species is similar to low-excitation radio galaxies; we interpret the lack of high-ionisation species as due to the shock running out of pre-shock gas. We measure simultaneously the star-formation history (SFH) and shocked-gas properties using a Bayesian framework, and infer solar metallicity and a flat SFR in the last 200 Myr. Combining the energetics of the ionised gas and the SFH we conclude that the radio-AGN is poorly coupled with the galaxy star-forming disc, therefore feedback must end up in the galaxy halo, setting the stage for future preventive quenching.

I will then present peculiar chemical abundances observed in galaxies at z=12.5 and in high-redshift AGN at z=5–11, and will discuss the possibility of fast-track chemical evolution in the central region of high-redshift galaxies.