Contribution ID: **284** Type: **Poster**

The "MARTA" Survey: An in-depth characterisation of electron temperatures, metallicity, and ISM properties in z~2-3 galaxies via simultaneous detections of strong and faint emission lines

Chemical abundances are crucial tools in our understanding of the processes driving galaxy evolution, but their accurate determination in high redshift galaxies is challenging.
The advent of JWST finally enabled the detection of faint auroral lines, required to perform more 'direct', physically motivated metallicity measurements via the Te method, in high-z sources, completely revolutionising the landscape of chemical abundance studies in the early Universe.
I will present results from 'Measuring Abundances at high Redshift with the Te Approach' (MARTA, PID 1879, PI Curti), a deep NIRSpec/MSA JWST GO programme aimed at delivering simultaneous, high signal-to-noise detections of rest-frame optical emission lines, including multiple temperature-sensitive auroral lines like [O III]4363, [O II]7320,30, and [S III]6312, in individual spectra of z~2-3 galaxies, and hence allowing a detailed characterisation of ionisation conditions, dust properties, metallicity, and chemical abundance patterns (e.g. N/O, S/O, Ar/O), and their constraints on the star-formation history of galaxies at the "Cosmic Noon".
I will also show the relationship between electron temperatures probed by different ionic species, their cosmic evolution, and their impact on the metallicity determination via standard diagnostics, trying also to interpret and reproduce them in the framework of novel, multi-cloud photoionisation models.

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