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The SPHINX simulations of reionisation

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The epoch of reionisation marks a major shift from a cold neutral Universe to a warm ionised one, a transition which was thought to be powered by UV radiation emitted from young massive stars in the first galaxies. Our understanding of this epoch is still limited: observationally we glimpse a handful of the most luminous galaxies existing at the end of the epoch, but with the advent of the James Webb Telescope and other upcoming instruments we will soon start getting better information about the sources powering reionisation. Theoretically, the best way to gain an understanding is with cosmological simulations. I will present our suite of SPHINX simulations, where we have developed new methods that allow us to perform radiation-hydrodynamical simulations of cosmic reionisation, resolving the emission and escape of radiation in the inter-stellar medium of tens of thousands of galaxies all evolving together in the same simulation, hence capturing the interplay of multiple star-formation and feedback processes from ISM to IGM scales. I will show how the escape of ionising radiation from the SPHINX galaxies is regulated by stellar feedback and how this translates into an escape fraction of ionising photons that is sensitive to the evolution of the stellar population luminosity with age. I will also discuss the strategies we were forced to deploy to allow the very large and memory-heavy SPHINX simulations to run on the memory-light supercomputer that was allocated to us via PRACE.

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