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Spectroscopy of the Cosmic Web: a view beyond collisional ionisation equilibrium with future X-ray telescopes

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The physical properties of the faint and extremely tenuous plasma in the far outskirts of galaxy clusters, the circumgalactic media of normal galaxies, and filaments of the cosmic web, remain one of the biggest unknowns in our story of large-scale structure evolution. Modeling the spectral features due to emission and absorption from this very diffuse plasma poses unique challenges, as both collisional and photo-ionization processes must be accounted for. In this talk I will present scenarios when the photo-ionization by galaxy cluster photons needs to be accounted for in addition to the photo-ionization by the cosmic UV/X-ray background, when inferring the properties of cosmic web filaments, like e.g. their column densities. I will also present whether the cosmic web filaments, simulated with the cosmological hydrodynamical simulations Hydrangea, can be observed in absorption against diffuse extended sources, in particular the cool-core galaxy clusters. I report the significance of the detection of filaments in OVII and OVIII with Athena X-IFU and LEM. I discuss the lower limit on the column densities that can still be observed with these instruments and provide a guide of where to look for filaments on the sky.

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