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Poster on inferring the role of plasma-neutral interactions in tokamak divertors using hydrogen emission spectroscopy

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Power exhaust in the divertor region is a critical challenge in magnetic confinement fusion devices. Plasma-neutral interactions, including atomic & molecular interactions that result in plasma chemistry, can have a major impact on the hydrogenic radiation as well as the physics in the divertor region.

Atomic hydrogen emission in the divertor occurs from three different processes occur: electron-impact excitation of hydrogen atoms, electron-ion recombination of hydrogen ions, and plasma-molecular chemistry resulting ultimately in excited hydrogen atoms. This plasma-chemistry arises from interactions between the plasma and vibrationally excited molecules, resulting in the formation of molecular ions that interact with the divertor plasma.

In my poster, I will show a Bayesian Markov-Chain Monte Carlo (MCMC) approach to infer quantitative information on these processes using measurements of the hydrogen Balmer lines (n=3,4,5), including ion sources & sinks as well as hydrogenic radiation inferences in the form of Probability Density Functions. This approach works by separating the ratios of these three processes, which then enables us to calculate the divertor chemistry. To do this, we use data from the ADAS collisional-radiative model for atomic processes and from the Yacora On The Web collisional-radiative model for molecular interactions. Additionally, my poster will explore how such interactions impact the divertor plasma, showing experimental data from the MAST-U Super-X divertor where plasma chemistry has a profound impact on the divertor behaviour.