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Cryogenic Pellet Ablation Modelling in a Hot Magnetised Plasma[1] KYLE MARTIN, ALASDAIR WILSON, DECLAN DIVER, University of Glasgow — The development of efficient refuelling schemes for tokamaks is essential for the success of fusion as an energy source. There are several techniques for replenishing the fuel, and one of the most promising is pellet injection, in which a cryogenic pellet of fuel is fired at speeds of a few 100 m/s into the tokamak plasma. This solid structure is ablated by the ambient plasma, dispersing fuel through the chamber. The ablation of this pellet creates a dense cloud of neutral particles which interacts with the background plasma, creating strong transient ionization and density gradients and making the evolution of the pellet-plasma system a complex gas-plasma problem. We attempt to model this process holistically by extending evaporative surface models (e.g. the "D^2" law) and collisional plasma processes (informed by cloud profile diagnostics) in order to infer the ablation rate, density structure, cloud terminal radius and pellet size as a function of time, balancing mass-transfer and ionization rates, diffusion and sheath evolution. Fluid instabilities may play a role in the strongly sheared flows between contrasting density media. This project brings a combination of theoretical and computational modelling to bear on a fusion technology problem.

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Kyle Martin
Univ of Glasgow

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