Contribution ID: **31** Type: **Poster**

Fluid and Kinetic Modelling of Sheath Transition Region with a Novel Anisotropic Ion Pressure Model and Enhanced Boundary Conditions

Sheath boundary conditions are an unavoidable fact of fluid based Scrape-Off Layer (SOL) modelling. The choice of boundary conditions can dictate the equilibrium that is reached, this choice is usually the Bohm criterion [1]. Recent work by Li et al [2,3,4] proposed a novel boundary condition, in the form of a correction to the Bohm criterion, for modelling based on 1D Particle In Cell (PIC) simulations and an improved plasma transport model which allowed for temperature anisotropy.

While Li et al proposed this correction to the Bohm criterion, the implementation of such a correction was not performed. The work to be presented in this poster has taken the proposals given in [2,3,4] and implemented an anisotropic transport model capable of handling this boundary condition correction within the ReMKiT1D framework [5]. Discussions over the feasibility of this correction to the Bohm criterion, along with the transport model that has been implemented are given. Both of which introduce numerical challenges to a fluid solver, which have required a collection of different numerical methods to overcome.

Alongside this, complimentary PIC simulations with the code BIT1 [6] have sought to provide an additional connection between fluid modelling and first principles kinetic data. Ongoing PIC simulations seek to extend the scope of simulations performed by Li et al. Seeking to explore how anisotropy develops in the pre-sheath, as well as how different sheath entrance criteria affect the application of the Bohm criterion. This will be given alongside a discussion of how this kinetic data is being used to improve the closure of the anisotropic fluid model.

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This work has been part-funded by the EPSRC Energy Programme [grant number EP/T012250/1] as well as the EPSRC Doctoral Studentship bursary [grant number EP/W524323/1]. This work used the ARCHER2 UK National Supercomputing Service (https://www.archer2.ac.uk).

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Session Classification: Poster Session #1