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ReMKiT1D –A novel framework for building 1D reactive multi-fluid models of the Scrape-Off Layer with kinetic electrons

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Simulations of transport parallel to open magnetic field lines have been a source of insight into the complex physics of the Scrape-Off Layer and divertor for a long time, ranging from 1D fluid model simulations of detachment [1] to various kinetic models [2,3,4] looking at modifications of parallel transport coefficients due to kinetic effects.

Most existing approaches focus on a specific set of equations when tackling the parallel transport problem. While this has produced a great number of important results, many applications, such as reduced modelling for machine learning and control, require frequent fundamental modifications to the equations. Thus a flexible framework easily accessible to a wide range of users is desirable.

This contribution will aim to present one such framework - ReMKiT1D(Reactive Multifluid and Kinetic Transport in 1D)[5], geared towards solving systems of 1D fluid equations with support for including electron kinetic effects (expanding on previous work[6]) and with in-built support for Collisional-Radiative Modelling. The software design behind the framework's Modern Fortran back-end and Python interface enabling flexibility and rapid user-friendly modifications of models will be presented. Use cases and simple illustrative examples will also be shown, together with some widely used code benchmarking and verification tests. Finally, the ongoing and planned uses of the framework will be presented, with a special focus on the interplay between electron kinetic effects and various multi-fluid aspects common to the Scrape-Off Layer.

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References:

- [1] Dudson, B. D. et al. Plasma Phys. Control. Fusion, 61(6) (2019)
- [2] Tskhakaya, D. et al. Contrib. Plasma Phys., 48(1–3), 89–93 (2008)
- [3] Chankin, A. V. et al. Plasma Phys. Control. Fusion, 60 (2018)
- [4] Mijin, S. et al. Plasma Phys. Control. Fusion, 62(9) (2020)
- [5] Mijin, S. et al. ReMKiT1D - A framework for building reactive multi-fluid models of the tokamak Scrape-Off Layer with coupled electron kinetics in 1D –in preparation
- [6] Mijin, S. et al. Computer Phys. Comm., 258, 107600 (2021)

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