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Non-local Electron Parallel Heat Transport in Divertor Plasmas and Atomic Physics Rates

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Abstract

The problem of simulating steep parallel electron temperature gradients in divertor plasmas with the fluid code UEDGE [1] is addressed. Previously, an electron kinetic code, FPI, has been used to develop non-local heat flow formulas by running in a perturbation mode, i.e. by imposing small modulations of temperature or of a heater field and analyzing the resulting heat flux, to obtain the kernel of the non-local convolution formula, and this was validated by doing runs with large temperature gradients [2]. This formula is being implemented into UEDGE. The electron kinetic code (FPI), now includes inelastic collisions (ionization, excitation, recombination) of atomic hydrogen, using a set of cross sections [3] such that the rates precisely match those used in UEDGE when the distribution is Maxwellian. This will be used to further improve the formula for non-local heat flow in the presence of neutrals. Validation will be by comparing 1-D UEDGE runs to FPI simulations. The effects of the non-Maxwellian distribution functions on rates (both for hydrogen and for trace impurities of boron) will also be illustrated, and the use of non-local formulas to compute them in a fluid code such as UEDGE will be discussed.

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[3] R.K. Janev , J.J. Smith, Atomic and Plasma-Material Interaction Data for Fusion (Supplement to Nuclear Fusion), Vol. **4** (1993)).