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TH/P7-05: Gyrokinetic Total Distribution Simulations of Drift-wave Turbulence and Neo-classical Dynamics in Tokamaks with Elmfire

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One of the outstanding problems of transport processes in tokamaks is the L-H transition and in general transport barrier formation, explanation of which has attracted several possible hypotheses ranging from purely neo-classical (rotational runaway) to parametric instabilities between turbulent eddies and zonal flows. Total f gyrokinetic simulation allows for the investigation of all the most important transport processes simultaneously, or by distinguishing between neo-classical and turbulent mechanisms in flow generation and transport. Elmfire is a gyrokinetic 5D total distribution simulation capable of transport time scale simulations of a multi-species plasma with self-consistent evolution of microturbulence, neo-classical physics and large scale structures.
Generally gyrokinetic investigations of neo-classical processes have been obtained potential flux surface averaging, eliminating all modes except the (0,0) zonal mode in simulations. We present an improved model for gyrokinetic particle simulations of neo-classical physics. We also discuss theoretical aspects of the gyrokinetic theory which includes the polarization drift in particle equations of motion, and present conservation of total angular momentum and energy in Elmfire. The role of sampling error is investigated, and the effect of noise on long time scale evolution of the system.

Country or International Organization of Primary Author

Finland

Collaboration (if applicable, e.g., International Tokamak Physics Activities)

EURATOM-TEKES association

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