Workshop

Analysis of transport equations:

Vlasov and related models

Talk given by

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Title. *Kinetic issues in burning plasmas with magnetic confinement.*

Abstract. Burning plasmas for fusion energy in magnetic confinement devices are an ideal complex system. First this research is dedicated to an outstanding issue, the availability of an impressive source of energy that appears almost mandatory to be controlled in all futures dreamt by humanity. Second, this complex system is almost isolated and ruled by the fundamental Vlasov Poisson equations with a small correction to take collisions into account. Complexity stems from the geometry of the confining magnetic field, very strong departure from thermodynamical equilibrium, and consequent inhomogeneity that drives plasma turbulence. Understanding, controlling, maybe monitoring transport properties of these confined plasmas appears as a major task. In present experiments already, measurements are scarce and difficult. Simulations appear therefore as a means to interpret experimental evidence, make the best use of the available experimental run time, and as an alternative to explore novel performance capability. The simulation requirement for such a complex system is based on chains of models from the most fundamental Vlasov-Poisson system in the kinetic framework to engineering grade models suitable for plasma control during operation. After presenting the ITER challenge in the quest for fusion performance, the simulation effort with the gyrokinetic code GYSELA will be addressed. Open questions regarding self-organisation of turbulent transport, kinetic features and developing appropriate model reduction processes, and quantifying their strength, complete this presentation.