

INRIA Project Lab - IPL Fusion

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The main topics

- Kinetic and gyrokinetic models, collision models : SeLaLib platform - 5D and 6D software
- Fluid models : edge plasma turbulence, MHD instabilities (ELMs,...) - PLATO platform
- Mixed fluid-kinetic models
- Electromagnetic waves for reflectometry and RF heating
- Optimization of scenarii and control

Teams involved

- Castor
- Kaliffe
- Tonus
- LJLL, MIP....
- CEA IRFM

Kinetic and Gyrokinetic models :

- Transport : Vlasov equation
 - ▶ Efficient advection solvers in high dimensions
 - ▶ Adapted meshes for gyrokinetic simulations
 - ▶ Advection solvers in curvilinear geometry
 - ▶ Magnetic fluctuations, electron effects
 - ▶ AP methods
- Collision models
- Test cases
 - ▶ 2D+2D Vlasov-Poisson model
 - ▶ 3D+1D Drift kinetic model
 - ▶ 3D+2D gyrokinetic model
 - ▶ Full 3D+3D Vlasov-Maxwell modelling
 - ▶ Numerical simulation of collisional plasmas

Fluid models :

- PLATO Toolbox
- MHD instabilities : Edge Localized Modes (ELMs)
- Reduced MHD
- Plasma anisotropy type instabilities
- Edge plasma turbulence
- Test case : 16 millions of unknown variables (400x400x100)

Mixed fluid-kinetic models :

- Two different approaches for the plasma core and for the edge plasma

Electromagnetic waves used for reflectometry and heating

- ANR project : Chrome (LJLL + Calvi + Poems)
- 3D Maxwell code

Optimization of scenarios and control

- Coupling transport + free boundary equilibrium
- Optimization of current density profile
- Determination of external parameters (poloidal field circuit voltages, RF heating parameters)
- Optimal control techniques