Hamiltonian and intrinsic approach to gyrokinetics

Aix*Marseille université

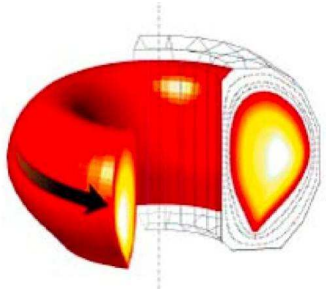
Loïc de Guillebon

Centre de Physique Théorique, Marseille

ANR GYPSI

Hot plasmas

- Low collisional
- Fluid models not accurate enough ⇒ **need for a kinetic model**



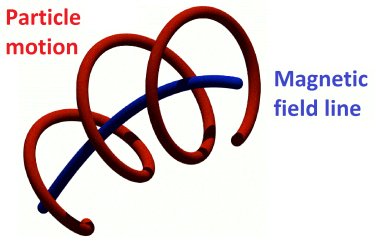
Typical fusion device

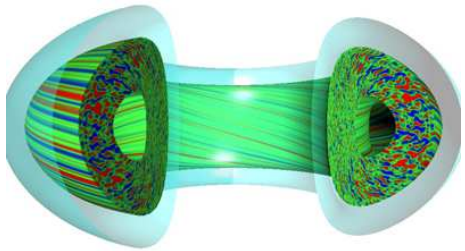
$$\frac{\partial}{\partial t} f(\mathbf{q}, \mathbf{v}) = \mathbf{v} \cdot \nabla f + \frac{e}{m}(\mathbf{E} + \mathbf{v} \times \mathbf{B}) \cdot \frac{\partial}{\partial \mathbf{v}} f$$

⇒ 6 dim. ⇒ **need for a reduction**

Strong B: Gyrokinetics

- Large-scale dynamics in $f(\mathbf{X}, v_{||})$
  ⇒ simulations doable in HPC
- Key model for magnetic fusion
  or astrophysical micro-turbulence





Typical gyrokinetic simulation

Clarified difficulties:

- the gyro-angle was gauge-dependent and not globally defined
- the plasma-field coupling could spoil the structure of the equations

Physics of Plasmas **19**, 094701 (2012)
Physics of Plasmas **20**, 032109 (2013)