

## 0.1 Outline

### 1. Expanded Abstract

- Summary of thesis

### 2. Theoretical background

- Plasma
  - Where is plasma
  - Plasma as a medium
  - Quasineutrality, cold, warm
  - $\lambda_D, \omega_{pe}$
  - Scale description, assumptions, simplifications due to cold etc, length-time scales descriptions that are valid
  - Linearization  $\rightarrow$  Langmuir
  - Single particle motion
    - \* Gyration
    - \*  $E \times B$  drift
  - Multifluid
- Numerical simulations
  - Relate Vlasov, MHD, PiC to length-time scales
  - PiC flexible.
  - Electromagnetic PiC, doesn't need Poisson solvers, ways to solve Lorentz force
  - Hybrid
  - Electrostatic, in what regimes is it valid
  - Short about poisson solvers

### 3. Method (Theory)

- PiC description
  - Cycle
  - Charge interpolation
  - Pusher interpolation
  - Non-dimensionalizing variables
  - More advanced meshes
  - Boris Pusher
  - Enough information to vaguely understand PiC
- Field Solvers

- Multigrid
  - Needed bits
  - Restrictors
  - Prolongators
  - Smoothers
  - Boundary Conditions, physical mechanism
    - \* Periodic
    - \* Dirichlet
    - \* Von Neumann
- Parallelism
  - Scaling
  - Discuss ways MG could be parallellized
- Grid Partitioning
  - Domain Partitioning
  - Calculation of various boundary-volume stuff

#### 4. Implementation

- Write pseudo codes, remove code\_snippets