Data Visualization 201

Advanced concepts
using OpenSource software

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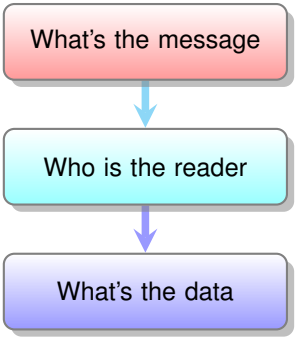
Introduction

Objectives and reminding



Introduction

Objectives and reminding

What do we want to look at ?

- Electron anomalous axial transport
  - azimuthal instability [1]
  - near-wall conductivity
- Role of wall materials [2]
  - Secondary electron emission
  - Dielectric relative permittivity

[1] A. Ducrocq, J.C. Adam, A. Héron, G. Laval, Phys. Plasmas, 13, 102111 (2014)

[2] Goebel & Katz, *Fundamentals of electric propulsion: Ion and Hall thrusters* , Wiley (2008)

Kinetic simulation

Model Set-up

Electrostatic

- **E** from Poisson equation
- Imposed **B**

Monte-Carlo Collisions

- e/n: elastic, excitation, ionization
- i/n: elastic & inelastic scattering

Particle In Cell (PIC)

- Magnetized electrons $\rightarrow$ Boris scheme
- Un-magnetized ions $\rightarrow$ Leapfrog scheme

Verified

- Unitary tests
- Benchmarks [1] , [2]

[1] M. Turner et al., Phys. Plasmas, 20 (2013)
[2] J.P. Boeuf, soon to be published.

Preliminary results

Plasma potential

($\mathbf{R} - \theta$) Simulation of the exit plan

Kinetic theory considerations

- Electron drift instability

$$\omega \simeq k v_d \pm \frac{k c_s}{\sqrt{1 + k^2 \lambda_{De}^2}} \qquad (1)$$

- Associated electron transport
- confirmed by 2D PIC for X_e [1]

PIC: $\mu_{\mathrm{PIC}} = \dfrac{< v_{e,z} >}{E_0}$

Effective:[2] $\mu_{\mathrm{eff}} = \dfrac{< n_e \mathbf{E} \cdot \mathbf{e}_\theta >}{n_e B_0 E_0}$

Saturation:[2] $\mu_{\mathrm{sat}} = \dfrac{\sqrt{T_e/U}}{4\sqrt{3} B_0}$

[1] V. Croes et al., Plasma Sources Sci. Tech., 26, 034001 (2017)
[2] T. Lafleur, S.D. Baalrud, P. Chabert, Phys. Plasmas, 23, 053502 (2016)

Alternative propellants

presentation

What about the other propellants ?

$\Rightarrow$ Parametric study with different propellant candidates

- 4 gases: H_e, A_r, K_r and X_e
- real chemistry or X_e chemistry only
- Metallic or dielectric walls

AMU	4.003	39.95	83.8	131.3
Case 1: Dielectric walls with SEE	$\{\sigma_{He}\}$	$\{\sigma_{Ar}\}$	$\{\sigma_{Kr}\}$	$\{\sigma_{Xe}\}$
Case 2: Metallic walls without SEE				
Case 3: Metallic walls without SEE	$\{\sigma_{Xe}\}$			