

1 Report

by Gullik Vetvik Killie, Add yourself

Abstract

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1.1 Introduction

- State of the art
- Why are we doing this
- What is being done
- Aims of report/study (want to see if)

We are using something to prove something!!!

1.2 Theory

1.3 Numerical Methods

- Short PiC (EMSES) explanation
- Experimental set up
-

1.3.1 Numerical methods

To solve the problem numerically we use the EMSES code

1.3.2 Test case setup

We wish to simulate the effects of Photon emission in different test cases, and have thus set up the following 6 cases:

| Case | Plasme flow | Photon emission |
|------|------------------------|---------------------------|
| 1: | $41600 \vec{e}_x$ m/s | 0 |
| 2: | $-41600 \vec{e}_z$ m/s | 0 |
| 3: | $-41600 \vec{e}_y$ m/s | 0 |
| 4: | $41600 \vec{e}_x$ m/s | $10^{-3} A/m^3 \vec{e}_x$ |
| 5: | $-41600 \vec{e}_z$ m/s | $10^{-3} A/m^3 \vec{e}_x$ |
| 6: | $-41600 \vec{e}_y$ m/s | $10^{-3} A/m^3 \vec{e}_x$ |

So test case 1-4, 2-5, and 3-6 are the “same” cases except that we run the simulation with and without photon emission to compare the cases two and two.

1.4 Results

- Comparison of cases with P-E and without
- Acc of charges at probes + ϕ , diff flows and α
- ϕ num vs ana

1.4.1 Induced electric current

The plasma is flowing in in relation to the coordinate system in the simulations. Due to this an induced electrical field, ε , will appear. To analyze the potential we want to correct for this potential field. The induced electrical field will neutralize the Lorentz force. Combined with the electrostatic approximation we can obtain the ε

$$\vec{\varepsilon} = v_D \times \vec{B} \quad (1.1)$$

$$\int E dx = -\phi \quad (1.2)$$

$$\phi = - \int \vec{v}_d \times \vec{B} \approx - \int (41600 \text{m/s} \cdot 50E - 6T) dx \quad (1.3)$$

$$\phi = 2.08x \quad (1.4)$$

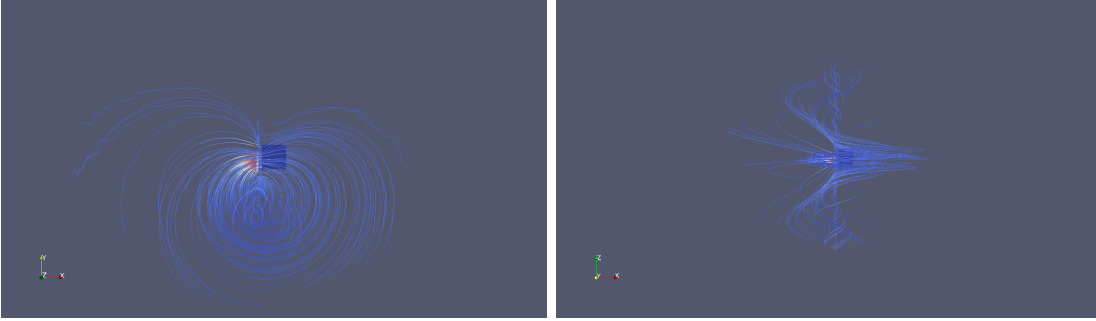


Figure 1.1: The trajectories of the electrons emitted by the photoelectric effect in simulation 6. It can be seen that some of the trajectories coincide with the volume occupied by the langmuir probes. The electrons are strongly affected by the magnetic field \vec{B} , and follows a gyrating path.

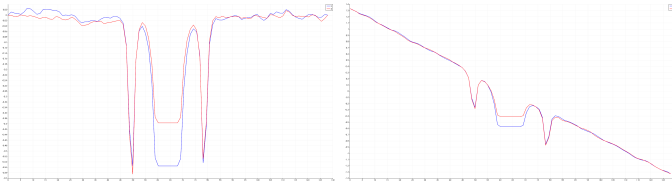


Figure 1.2: Potential of spacecraft and surroundings with P-E and without P-E. Figure on the left displays difference between case 1 and 4. Middle figure displays difference between case 2 and 5. Rightmost figure displays difference between case 3 and 6.

1.4.2 Photoemmission paths

1.4.3 Potential difference with P-E and no P-E

1.5 Discussion

1.6 Conclusions

- Proposal for further studies (Probably see if photoemmission is relevant in tenuous plasma (MEO CASE, magnetospheric tail lobes))

Bibliography