Numerical Simulation of an Ion Thruster Plasma

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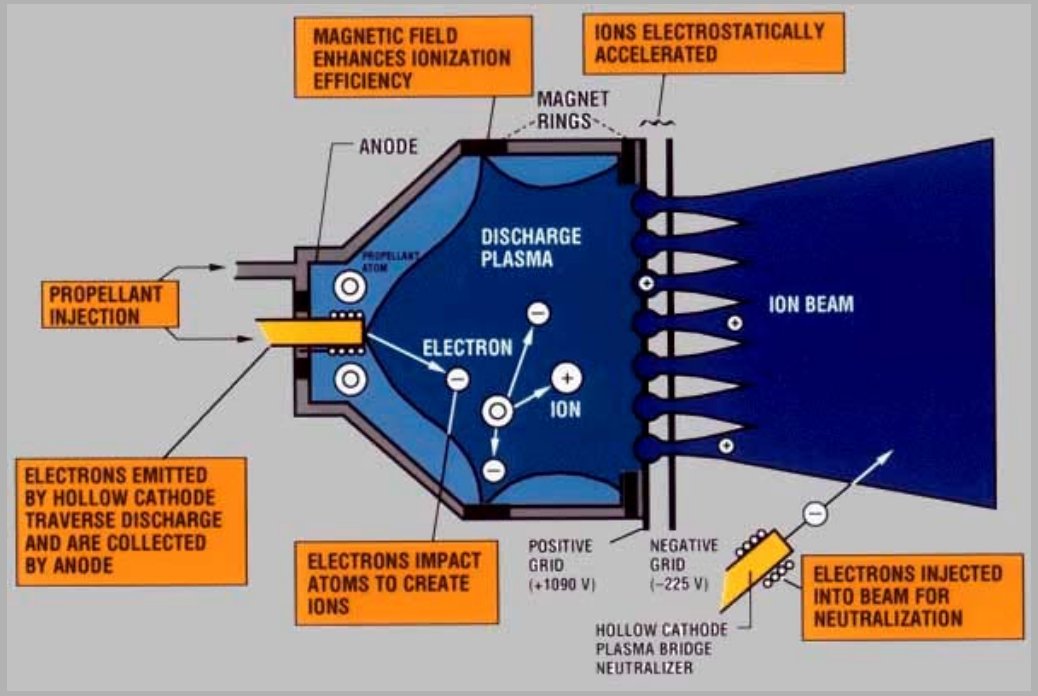
Ion Thruster

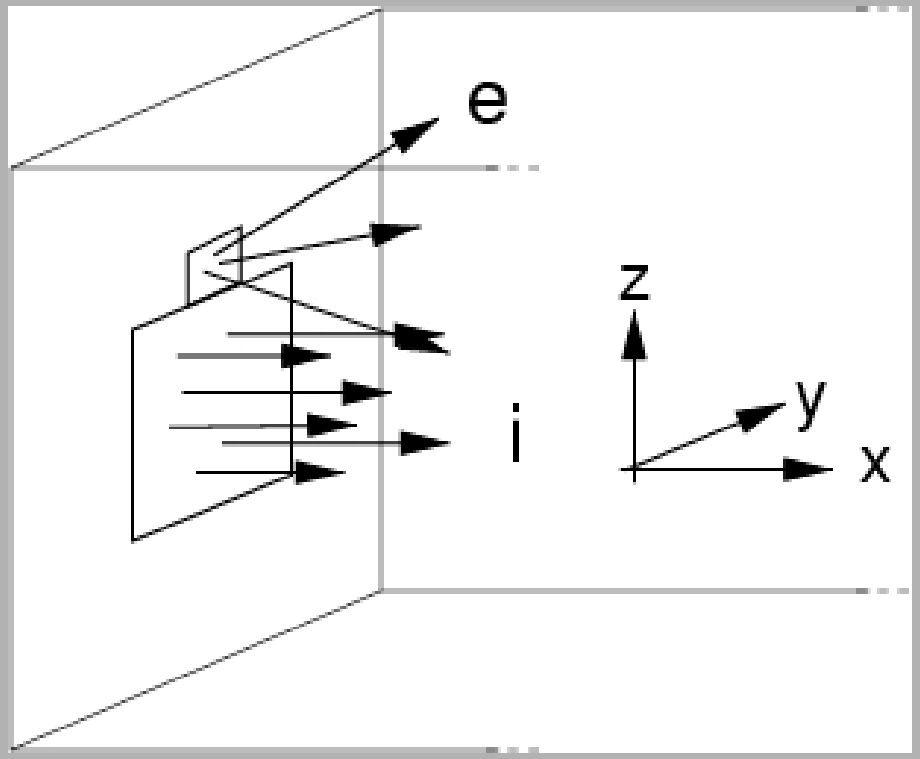
- Deep Space 1 – Mission (DS1)
  - Scientific and technological Mission



Loading of the environment (solar wind or ionosphere) with Xe ions

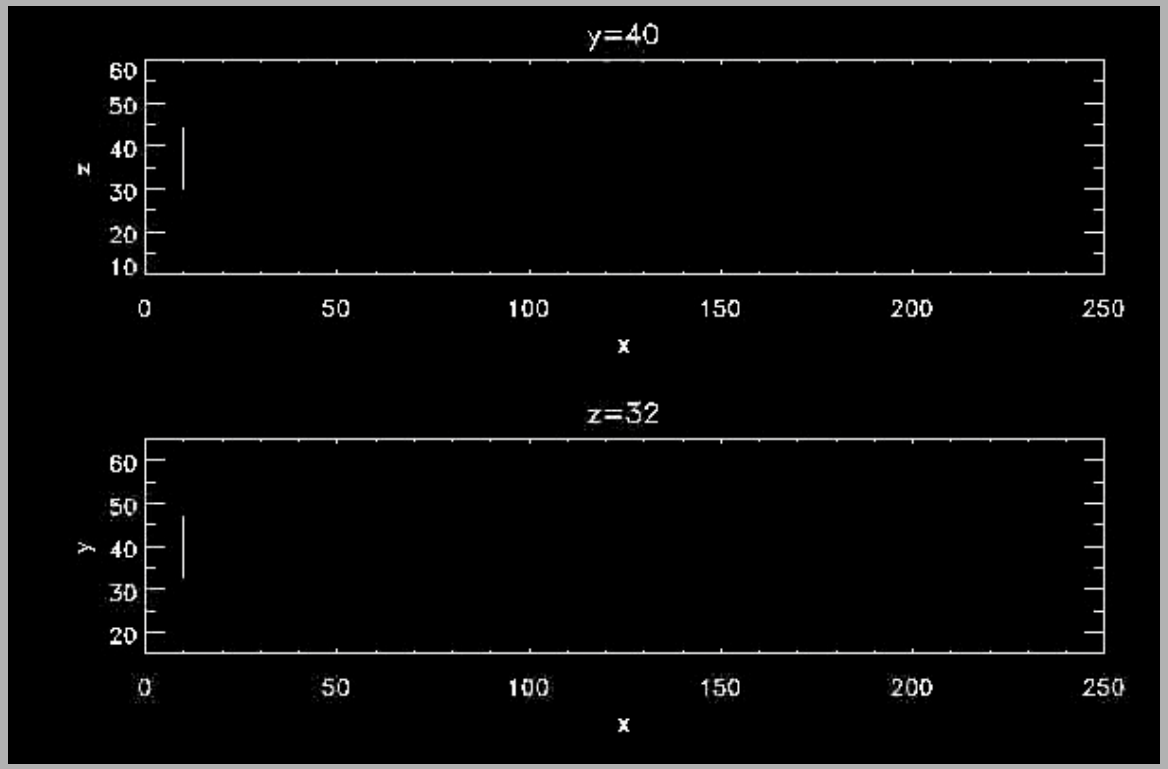
Ion Thruster Simulation

- Fully electromagnetic particle-in-cell code (PIC)
- 3D in configuration space and in velocity space
- Parallelized for Cray T3E
- C. Othmer et al., Physics of Plasmas, 7, 5242, 2000



Ion Thruster Simulation

- Elektron density: z-x and y-x plane
- Injection separated in space

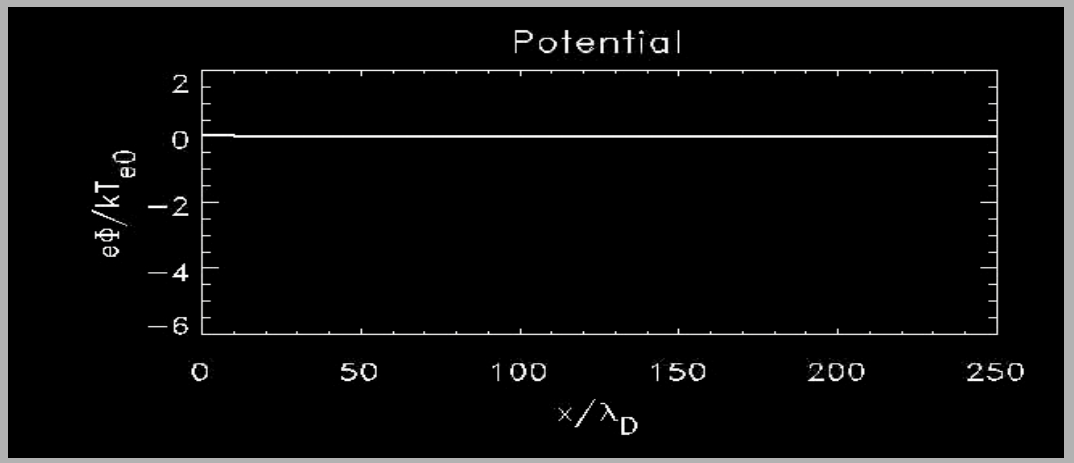


Ion Thruster Potential

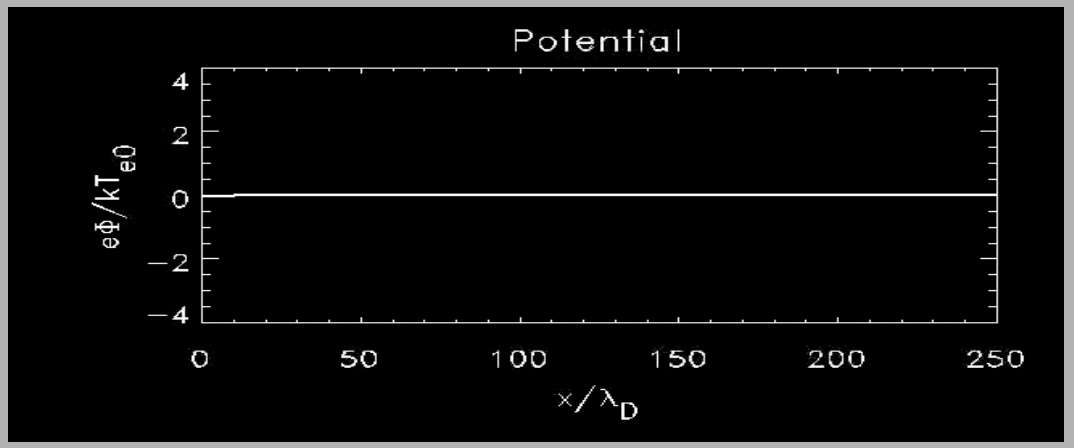
- Plasma potential

$\eta = v^{th}_{e0} / v_{i0}$

$\eta > 1.7$

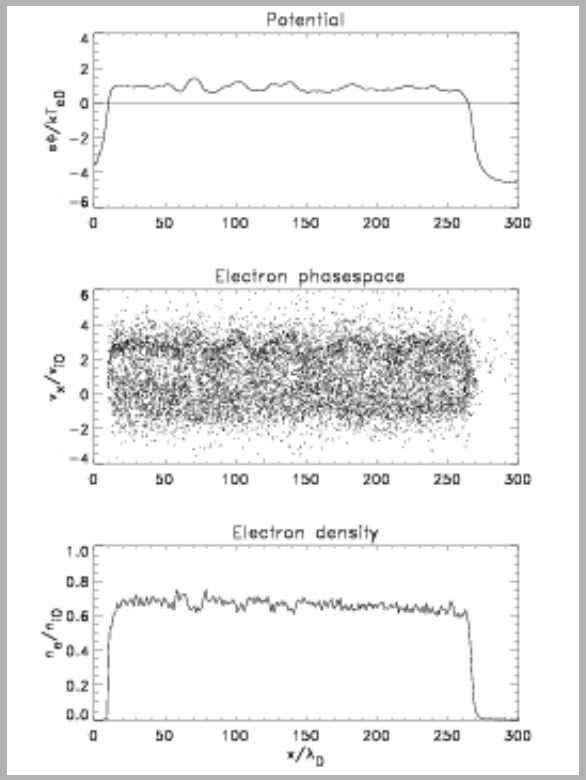


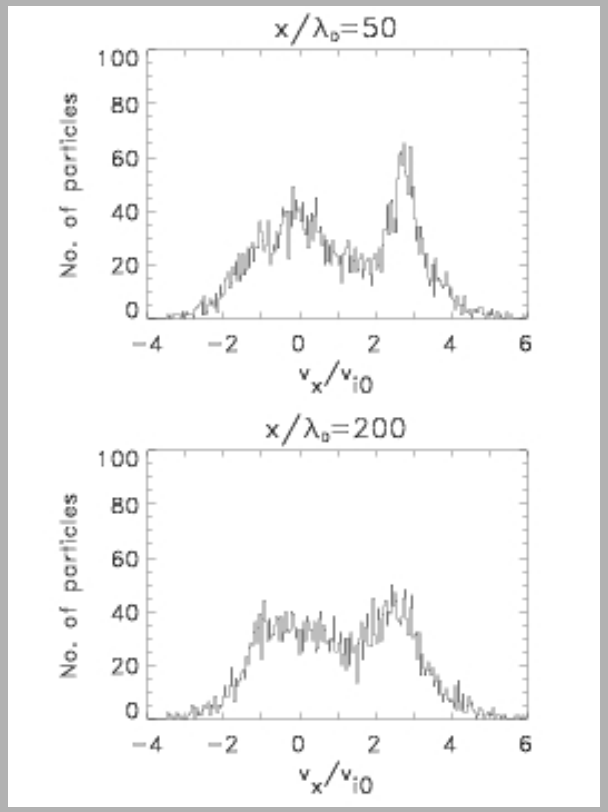
$\eta < 1.7$



Ion Thuster Potential

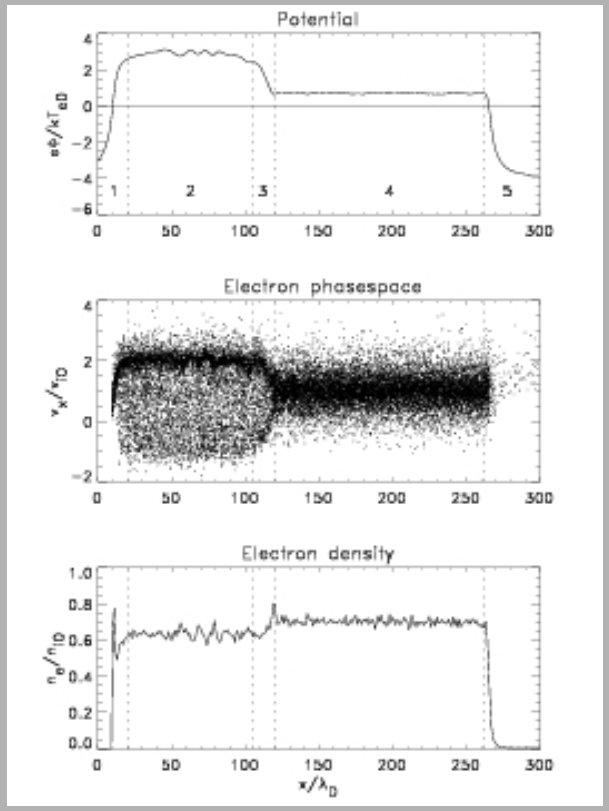
- $B_0 \approx 0$, $\eta = v_{e0}{}^{th}/v_{i0} > 1.7$

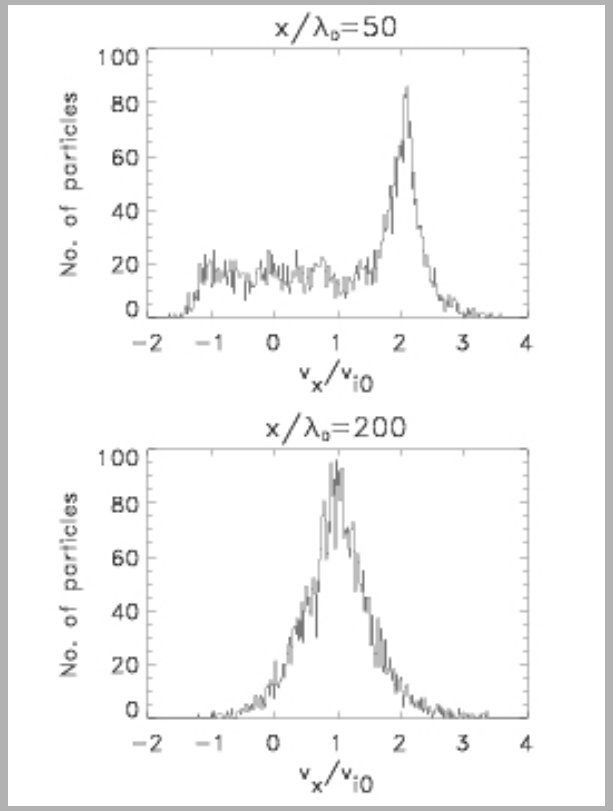




Ion Thruster Potential

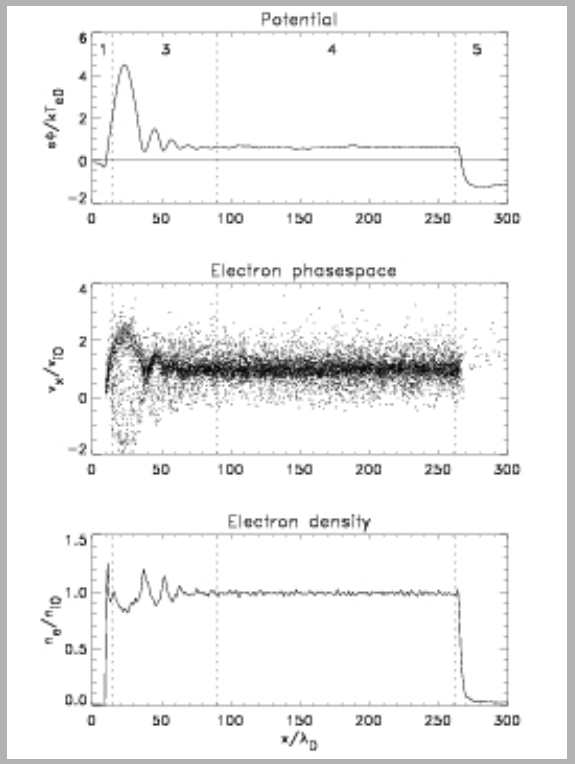
- $B_0 \approx 0$, $\eta = v_{e0}{}^{th}/v_{i0} < 1.7$

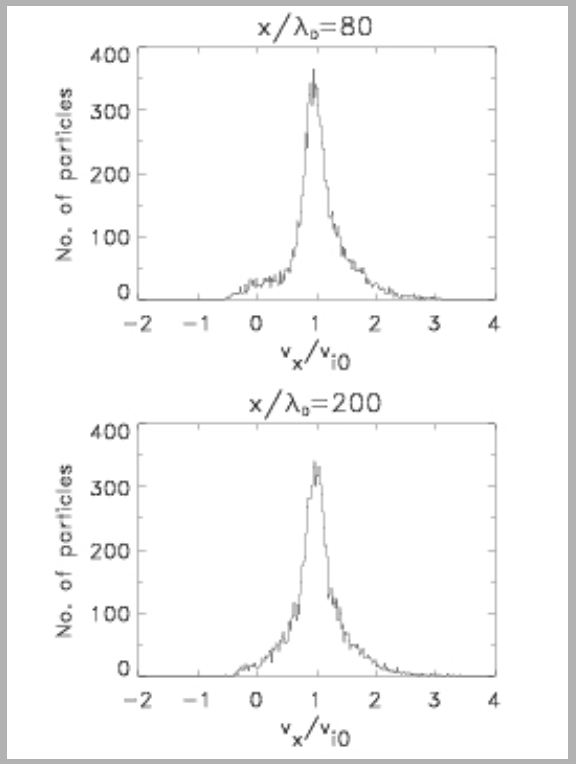




Ion Thuster Potential

- $B_0 \neq 0$, $\eta = v_{e0}{}^{th}/v_{i0} = 1$





Ion Thruster Simulation

- Mismatched beam