

Electron Energization Inside Magnetic Islands

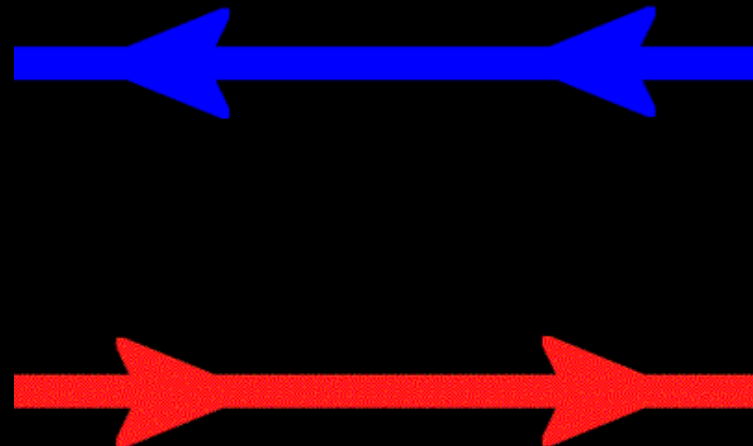
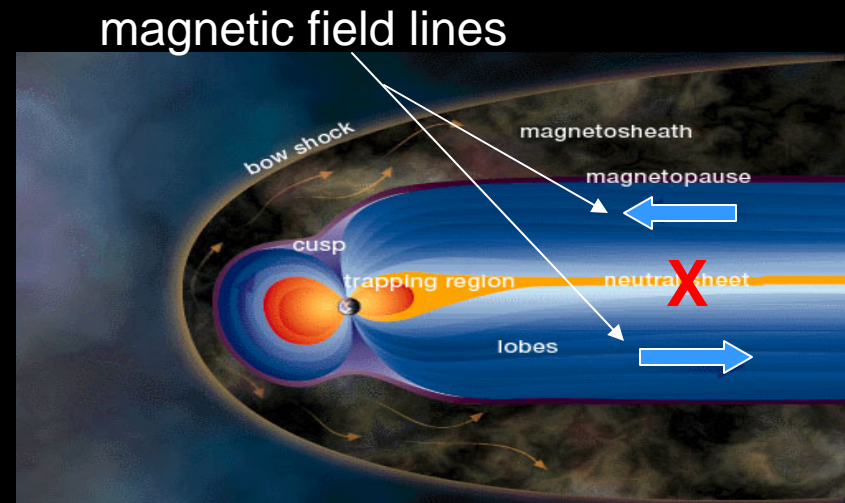
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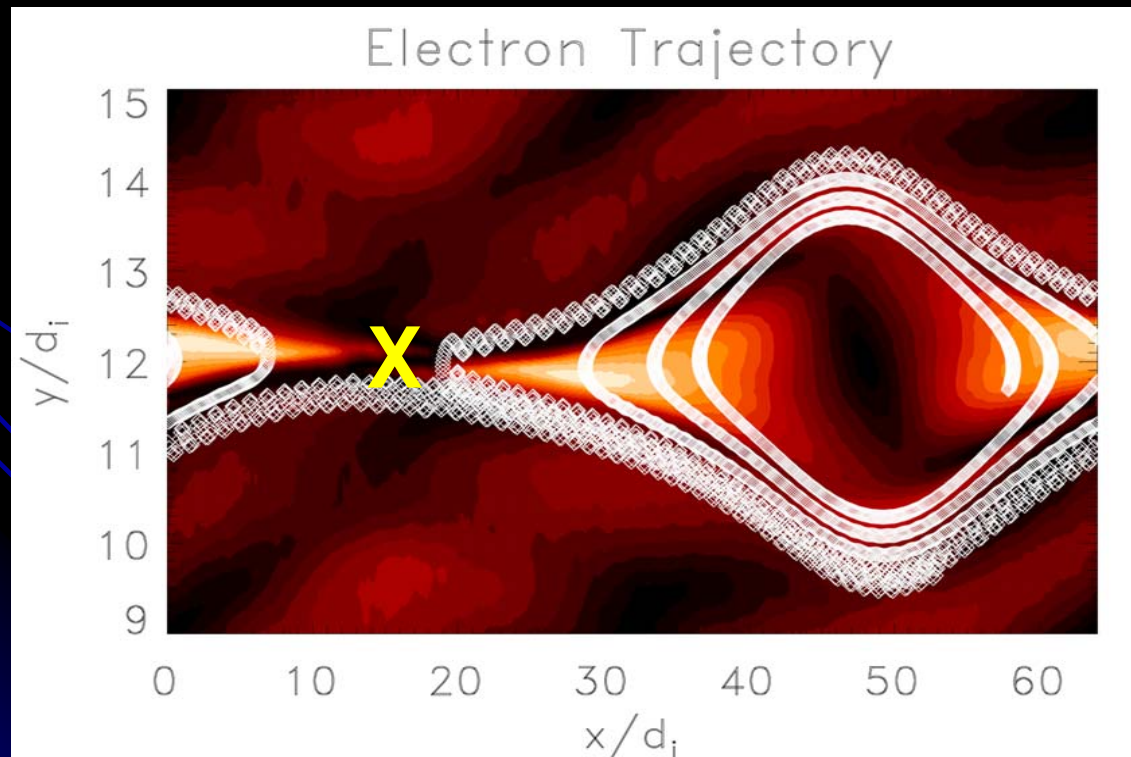
Introduction

- Magnetic reconnection occurs in the Earth's magnetotail
- Magnetic field lines cross-link and snap away, accelerating electrons



Contracting Island Theory

- Spacecraft detected very fast particles
- The theory: already fast electrons bounce inside magnetic islands
- The question: what happens to slower electrons?



The Simulation

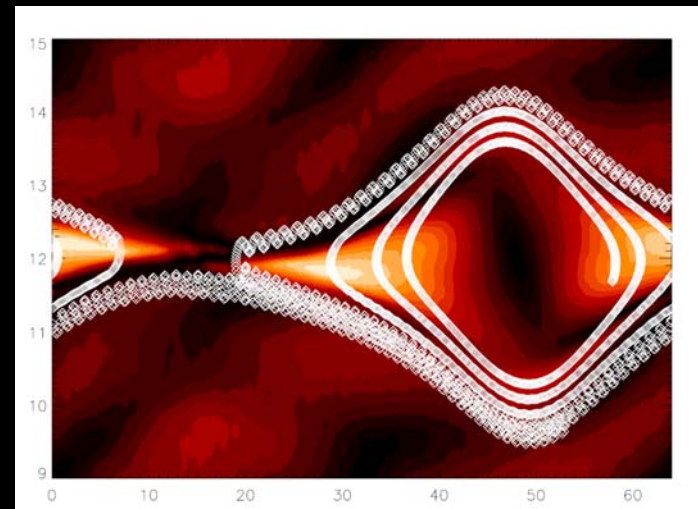
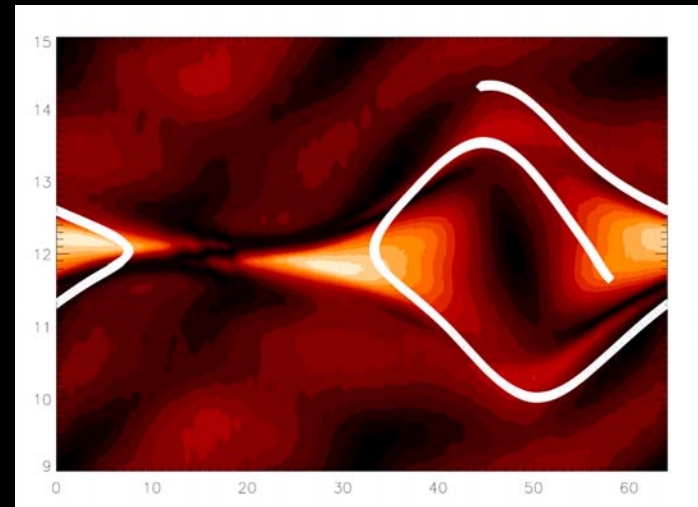
- Simulations were run to predict and study the behavior of 1000 electrons inside the magnetic islands
- The code was based on solving these two equations:

$$\frac{d\vec{x}}{dt} = \vec{v}$$

$$m \frac{d(\gamma\vec{v})}{dt} = q\vec{E} + q\frac{\vec{v}}{c} \times \vec{B}$$

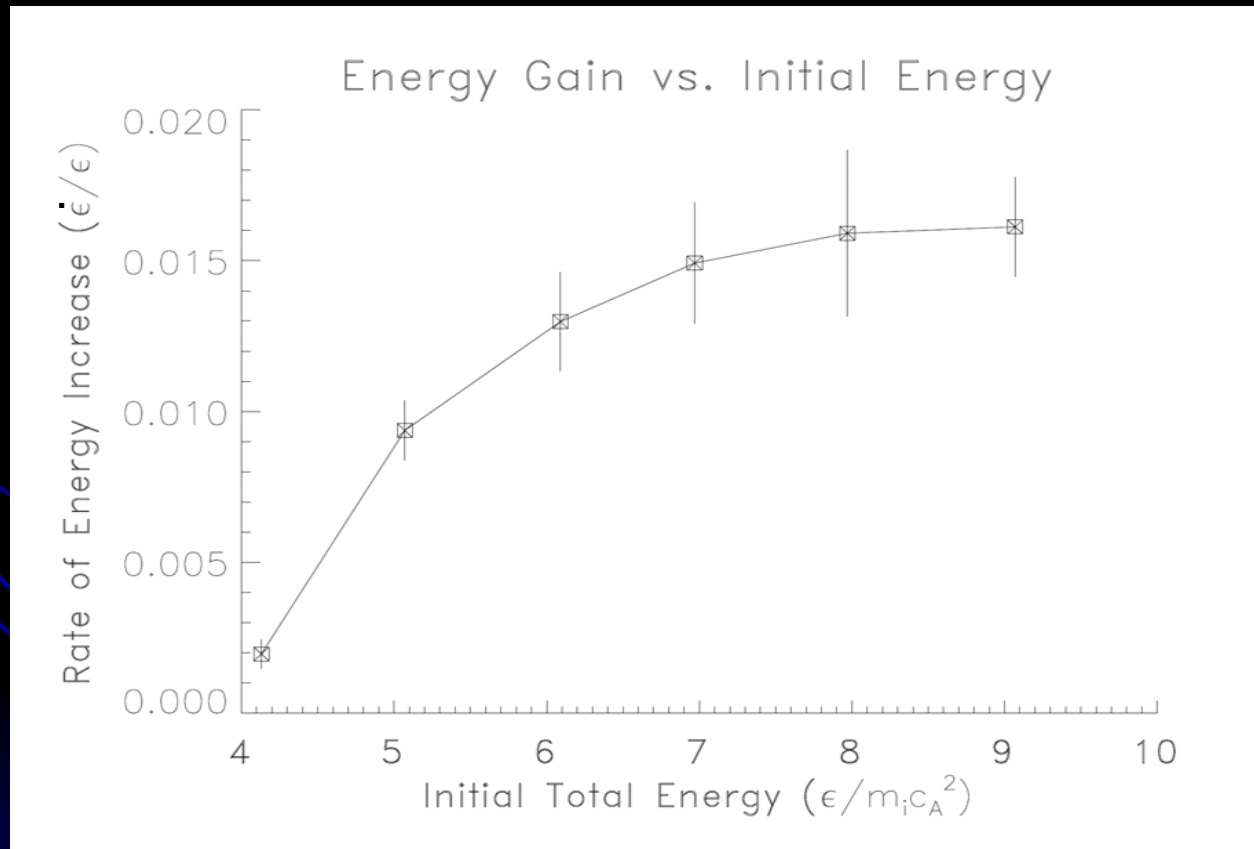
Results

- Electrons with high velocities parallel to the magnetic field (bottom) fly farther
- The parallel velocity scatters when electrons exit the island



Results

- Electrons with varying initial energies gain energy at different rates



Conclusions

- Electrons with a large parallel velocity component (and large initial energy) gain energy much faster than slower electrons
- The slow electrons also gain energy from bouncing inside islands, but do it at a much slower rate

