Relativistic electrons in the radiation belt and Current sheet in the solar wind

First Oral Exam

Graduate Student: Zijin Zhang Supervisor: Vassilis Angelopoulos Committee Members: Marco Velli, Hao Cao, Anton Artemyev

Part 1: Relativistic electron flux decay and recovery: relative roles of EMIC waves, chorus waves, and electron injections

Conclusion

Preliminary Results

- We examined a particular event on 17 April 2021 characterized by a series of strong electron and ion injections, significant electron precipitation driven by EMIC and chorus waves, and electron acceleration mainly attributable to chorus waves.
- This case study is unique in the sense that strong EMIC and chorus wave-driven electron losses do not necessarily correspond to a simultaneous decrease of trapped electron fluxes. Sufficiently strong injections and chorus wave-driven electron acceleration in the presence of a sufficiently steep negative electron energy PSD gradient can balance such wave-driven losses.

Future Work

- Statistically study the conditions that lead to relativistic electron flux decay and recovery.
- Understand the physical mechanisms that lead to the observed electron flux: strong diffusion or non-linear wave-particle interactions.

Part 2: Current sheet in the solar wind: JUNO and PSP Observations

Preliminary Results

- The normalized occurrence rate decreases with radial distance from the Sun, following a 1/ relationship in the outer heliosphere.
- Normalized thickness and current density of discontinuities remain constant with radial distance (negligible change compared to their spread)
  - Thickness => ion inertial length
- Current density => Alfven velocity (current density)
- Better alignment period has a slightly better agreement of the properties of the discontinuities (normalized thickness, current density, $|\Delta\mathbf{B}/B|$ and rotation angle). B_N/B and in-plane rotation angle, however, are significantly different.

Future Work

- Understand the constant normalized thickness and current density of discontinuities with radial distance and change in the B_N/B and in-plane rotation angle.

References

References