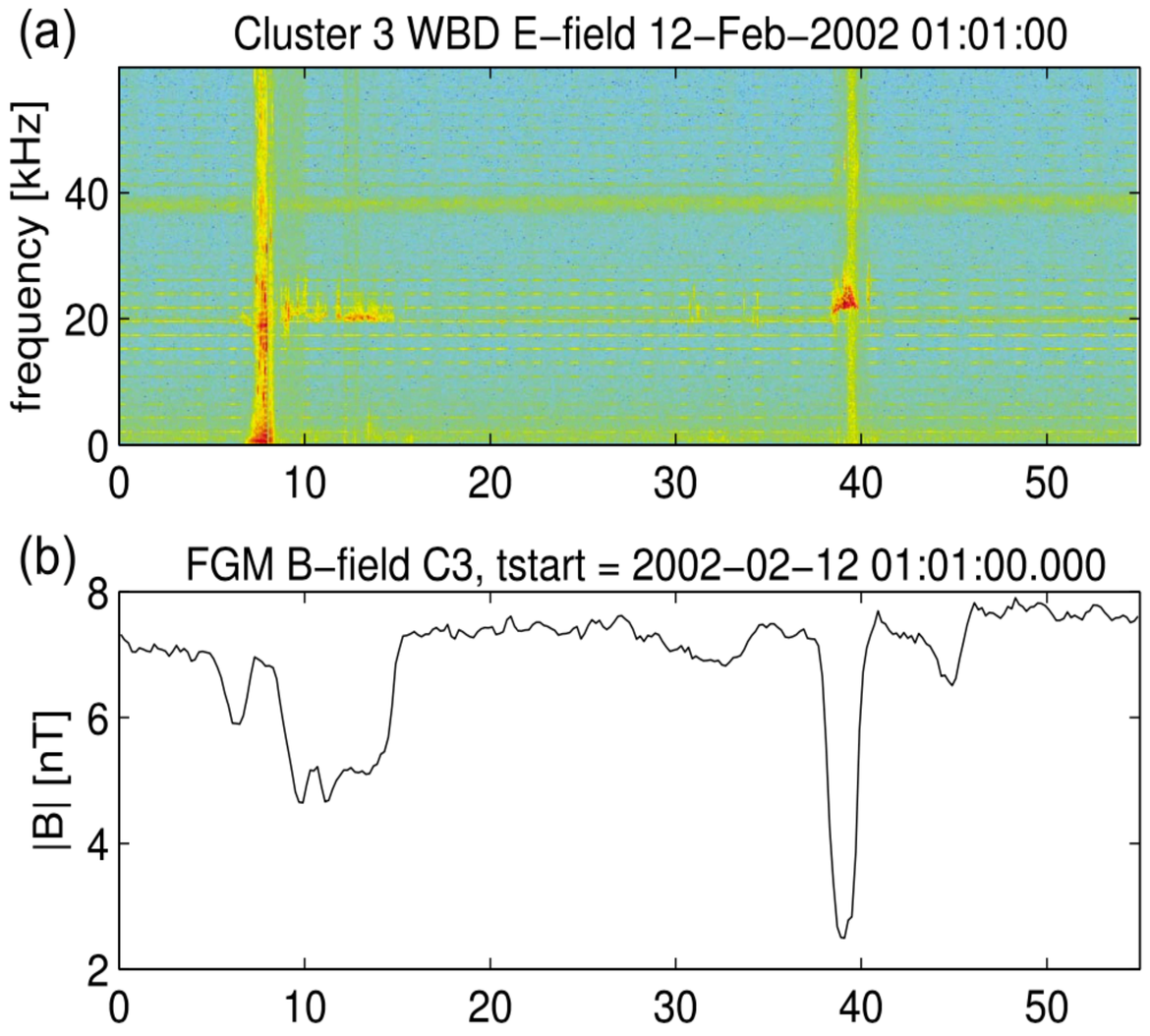
Langmuir Waves Associated with Magnetic Holes

Jordi Boldu, Daniel Graham, Michiko Morooka, Tomas Karlsson, Yuri Khotyaintsev, Mats Andre, RPW team, MAG team

Background

- Langmuir Waves, not associated to Type II or Type III emissions, have often been found within magnetic holes
- The proposed mechanisms for the formation of magnetic holes are very slow.
- Langmuir waves usually form under time-dependant electron distribution fluctuations.
- The slow formation of magnetic holes is not compatible with the presence of high frequency electrostatic waves.



[Briand et al., 2010]

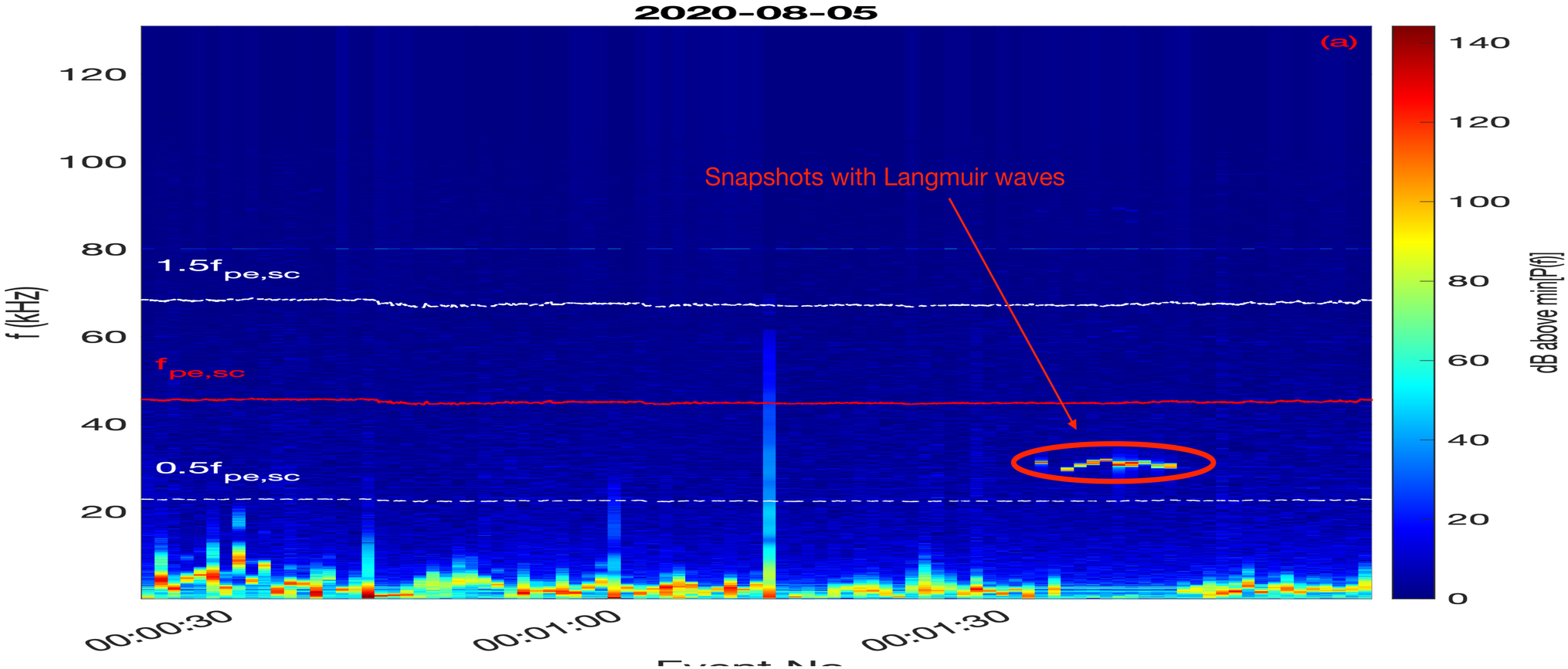
Objectives

Scientific Questions:

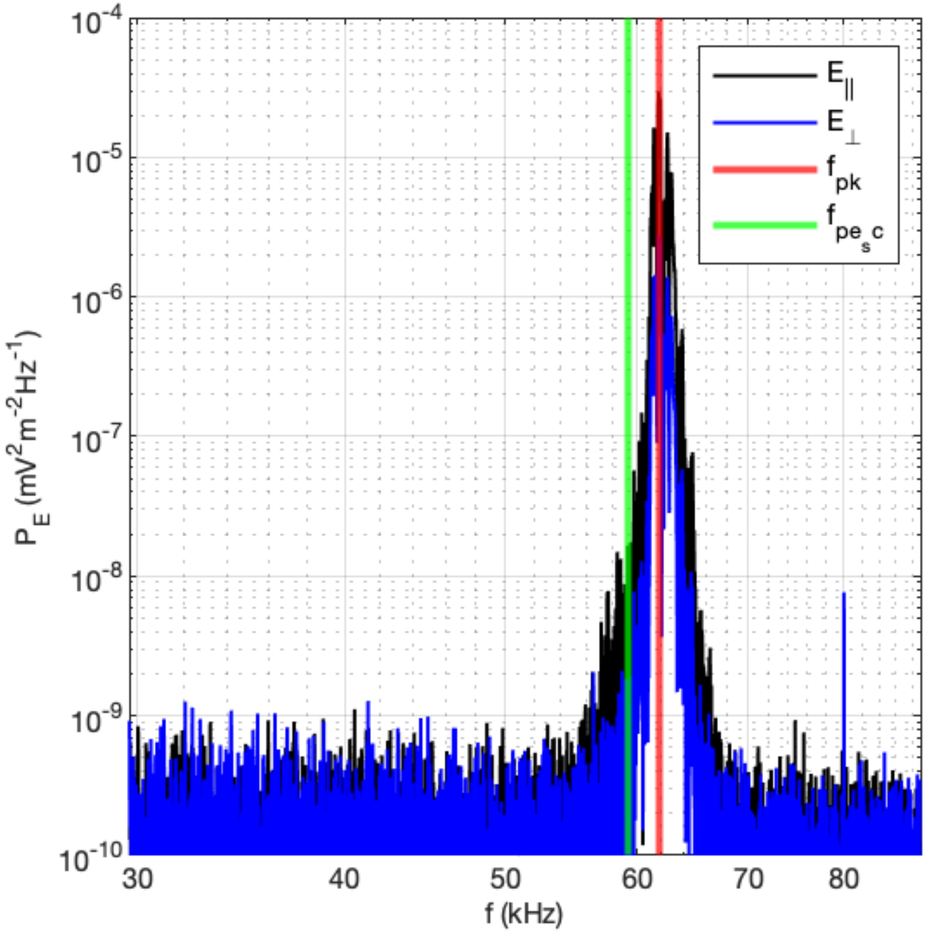
- What is the relation between Langmuir waves and magnetic holes? How the magnetic holes' morphology affects Langmuir waves' properties?
- How does this correlation changes with Heliocentric distance? What is the impact of these waves on the evolution of the solar wind?
- What drives Langmuir waves' formation inside or near the Magnetic holes? What is the role of the Strahl population in the generation of such waves?

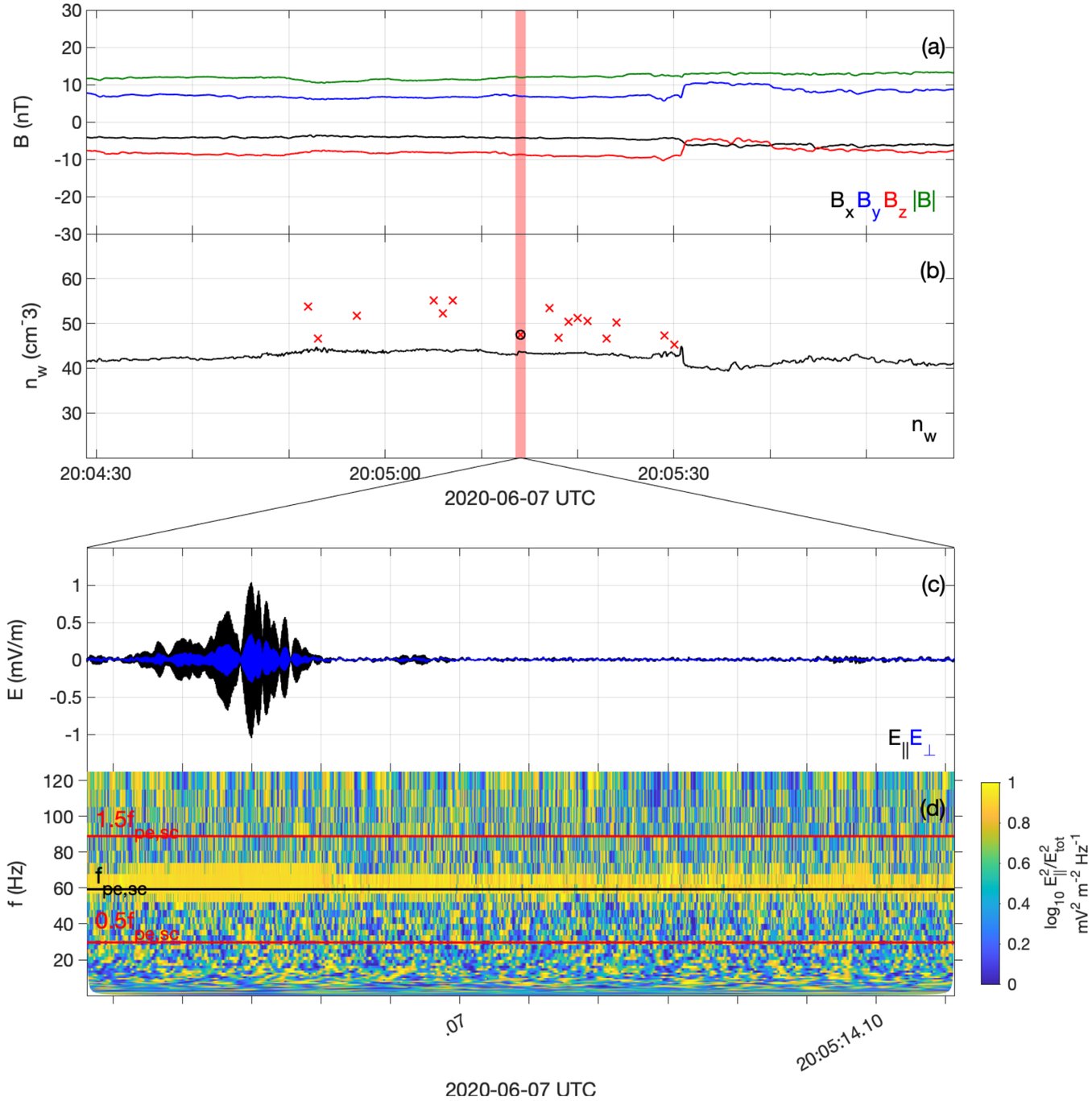
Langmuir Waves-TDS Snapshots

- Wave Electric field PSD peak is between 0.5 and 1.5 fpe obtained from the S/C potential and two orders of magnitude above the background power.

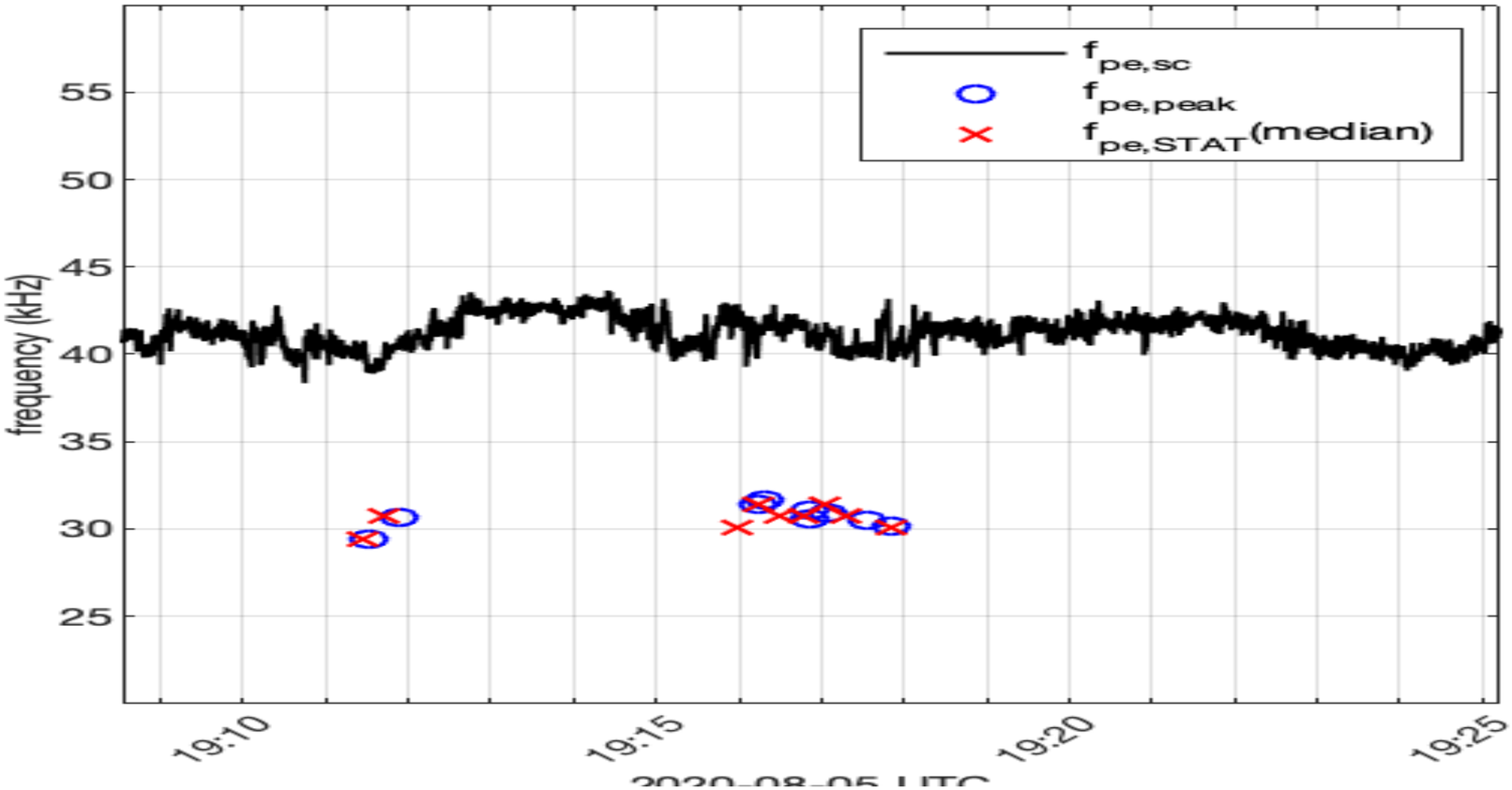


Langmuir Waves



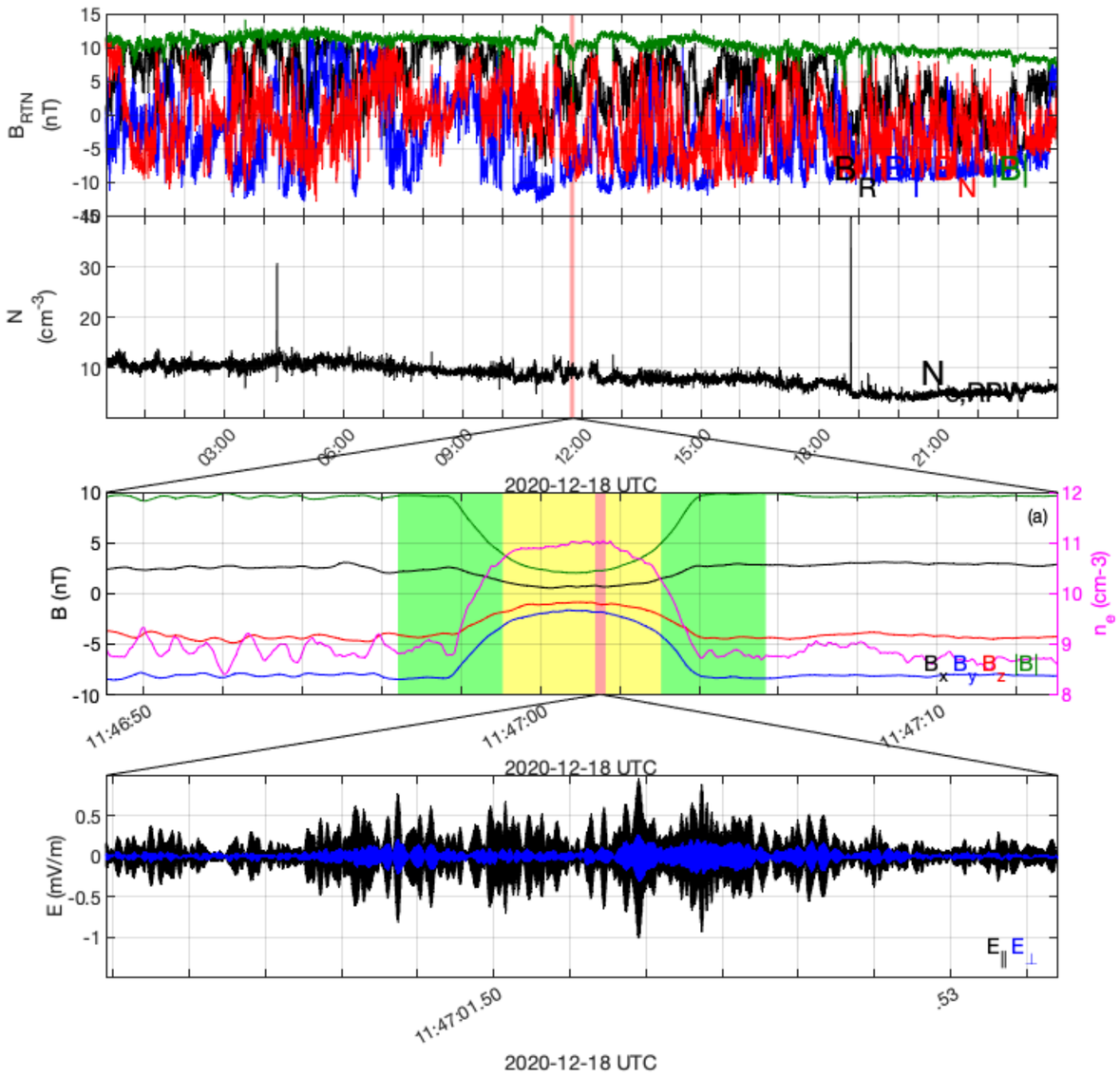


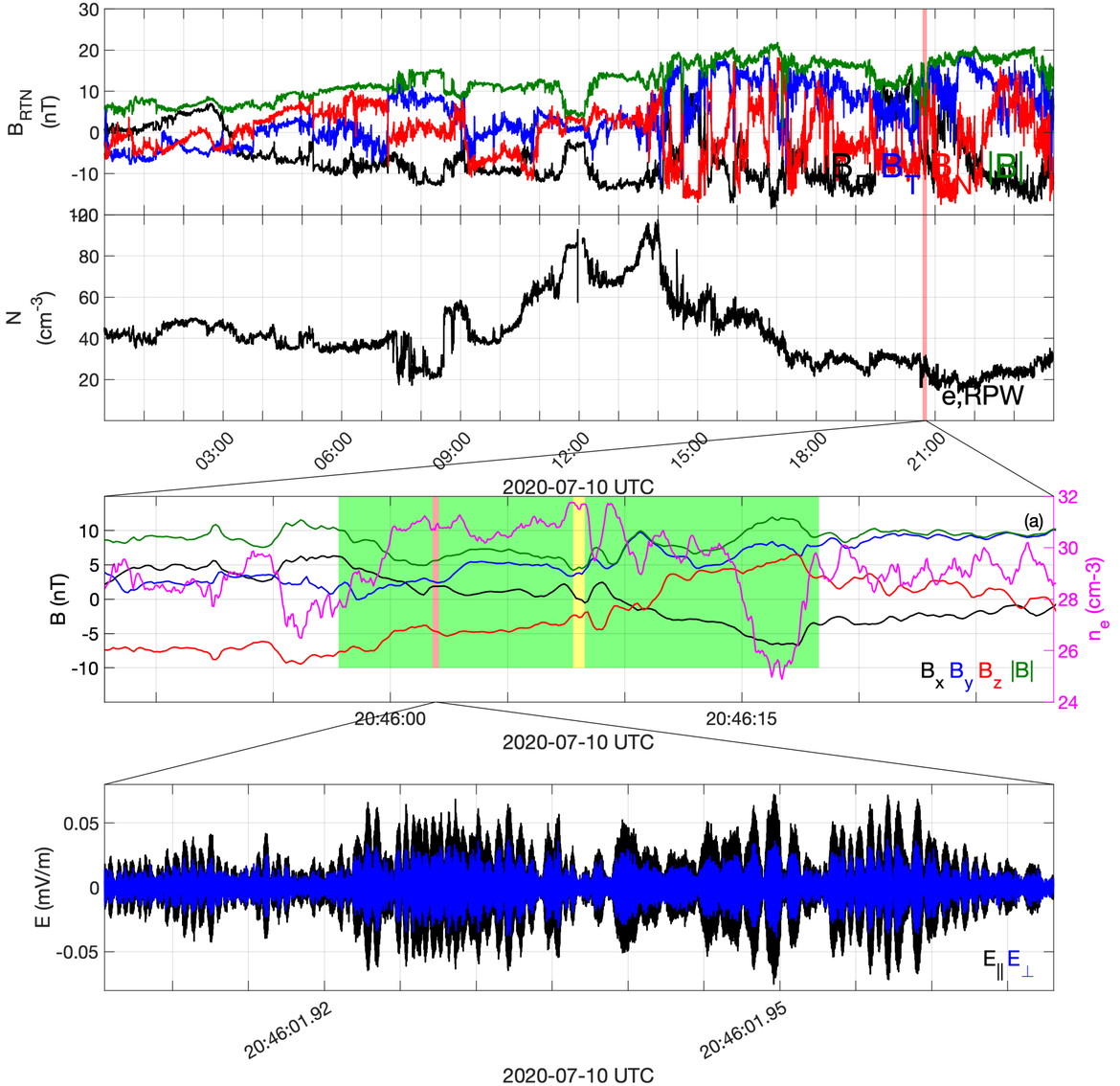
Langmuir Wave TDS-STAT data



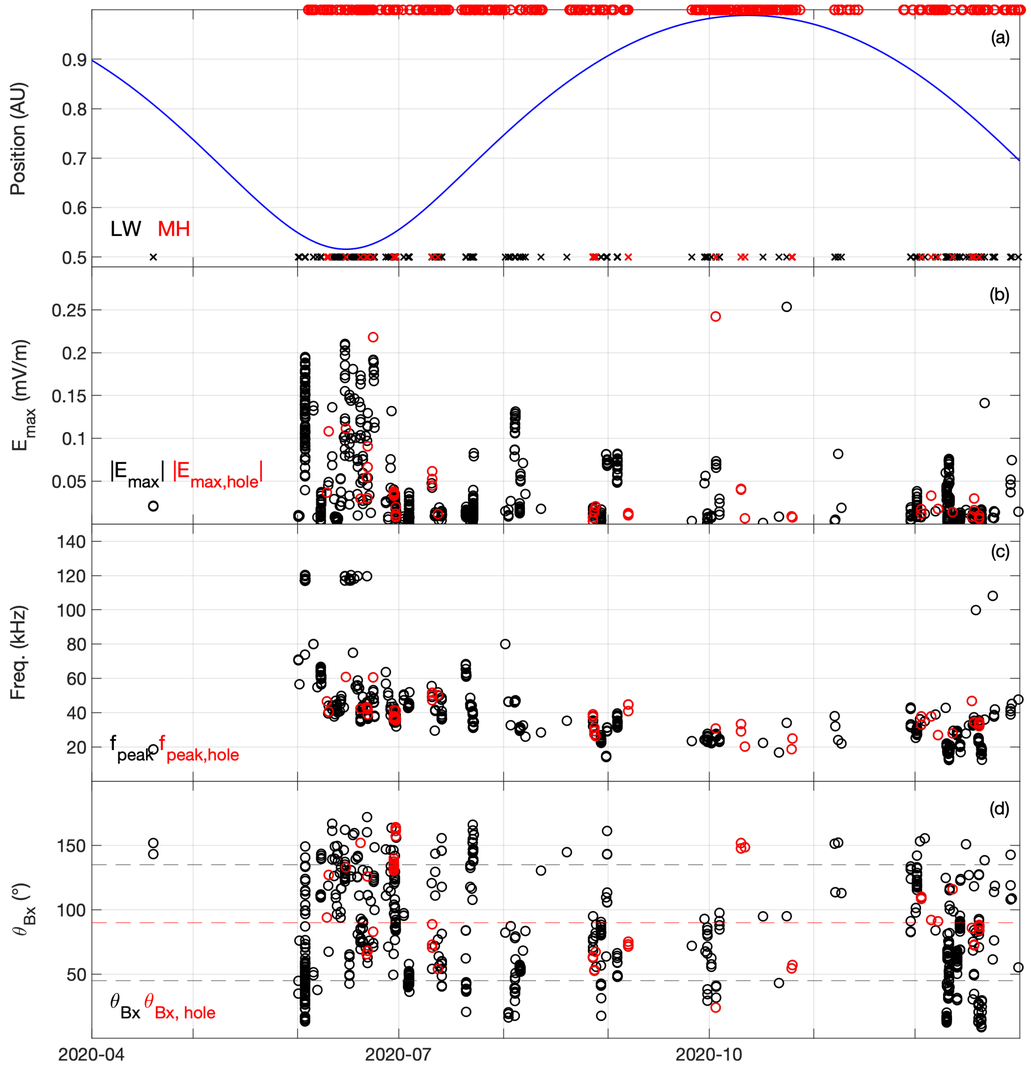
Consistency between LW findings and TDS STAT data.

Langmuir Waves associated with Magnetic Holes



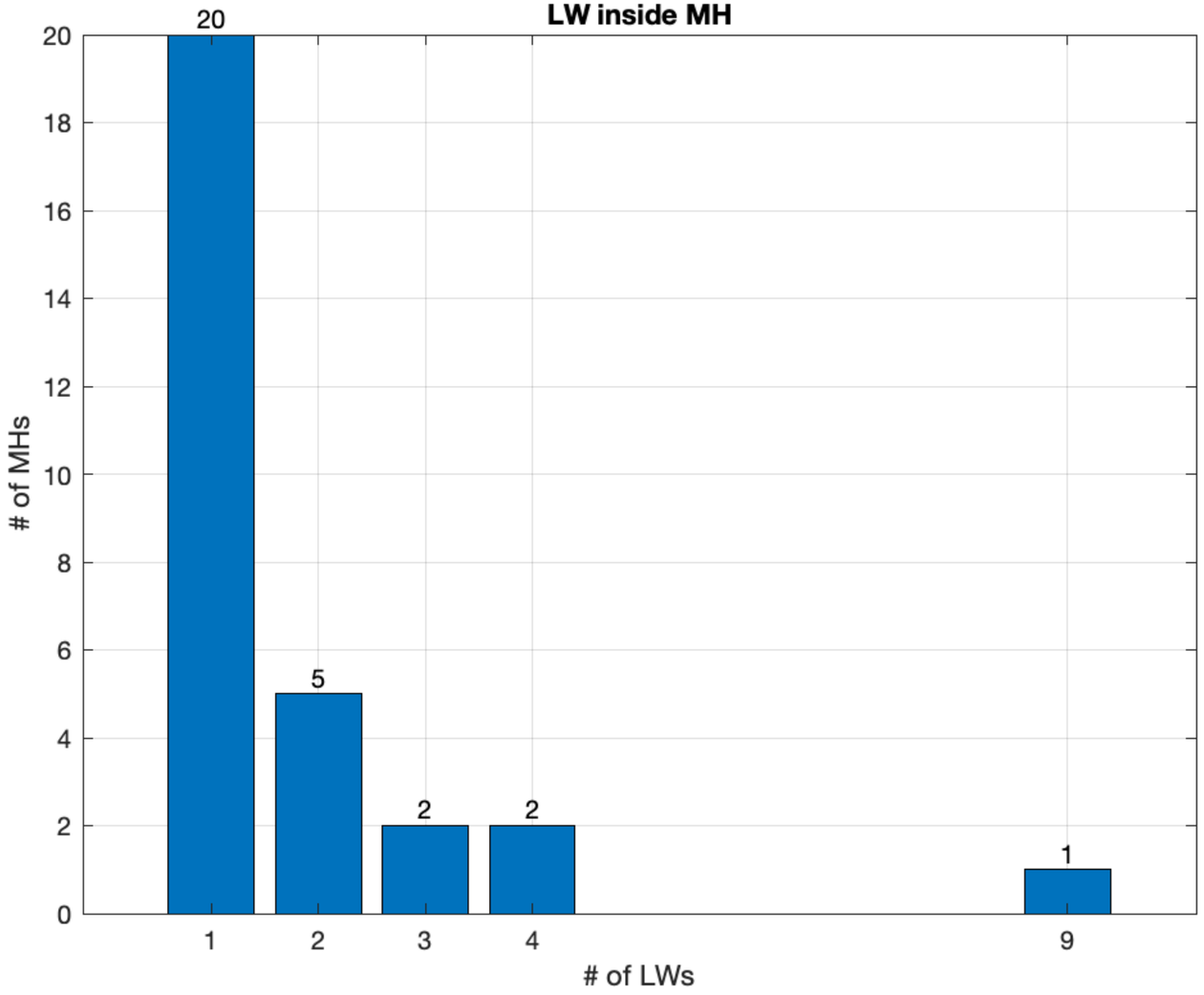


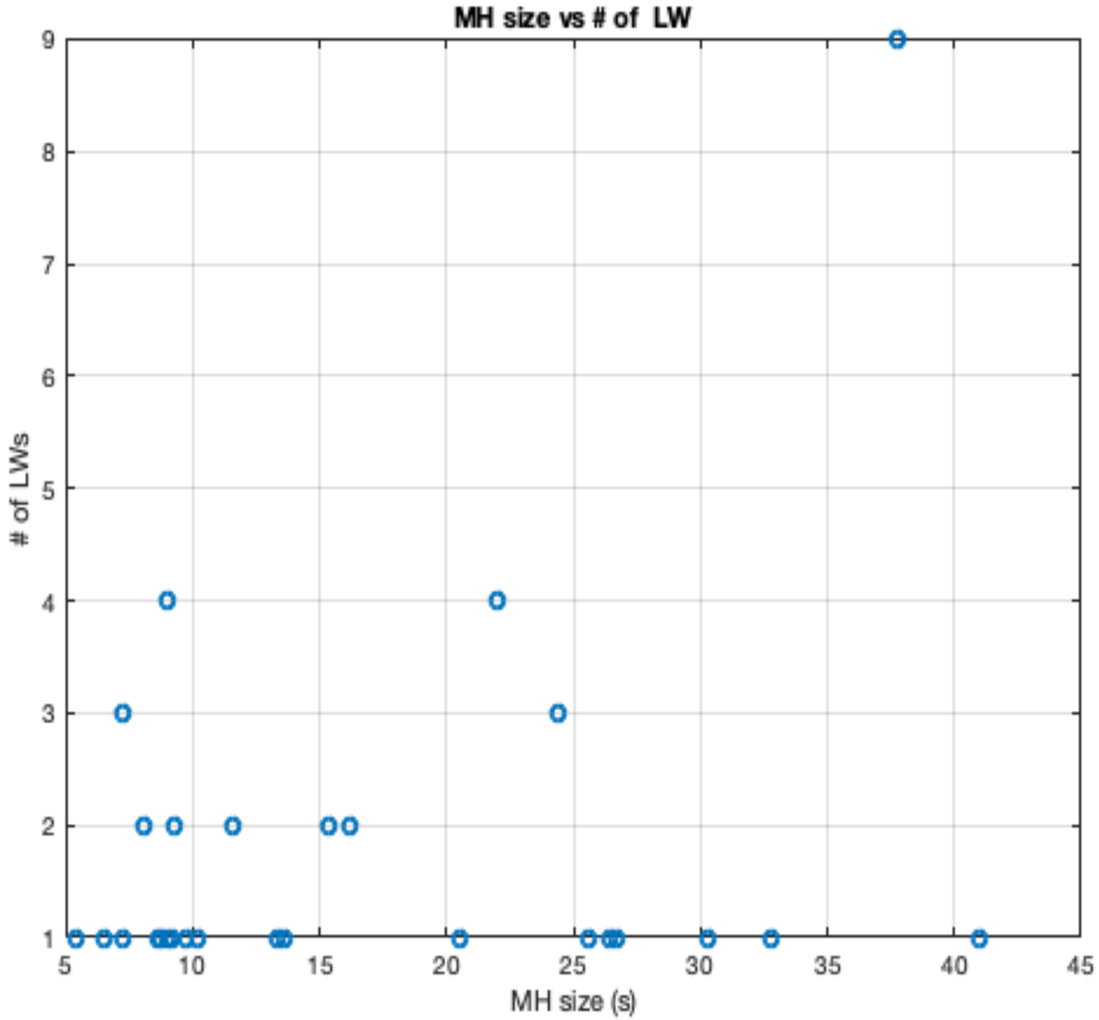
Magnetic Holes Overview



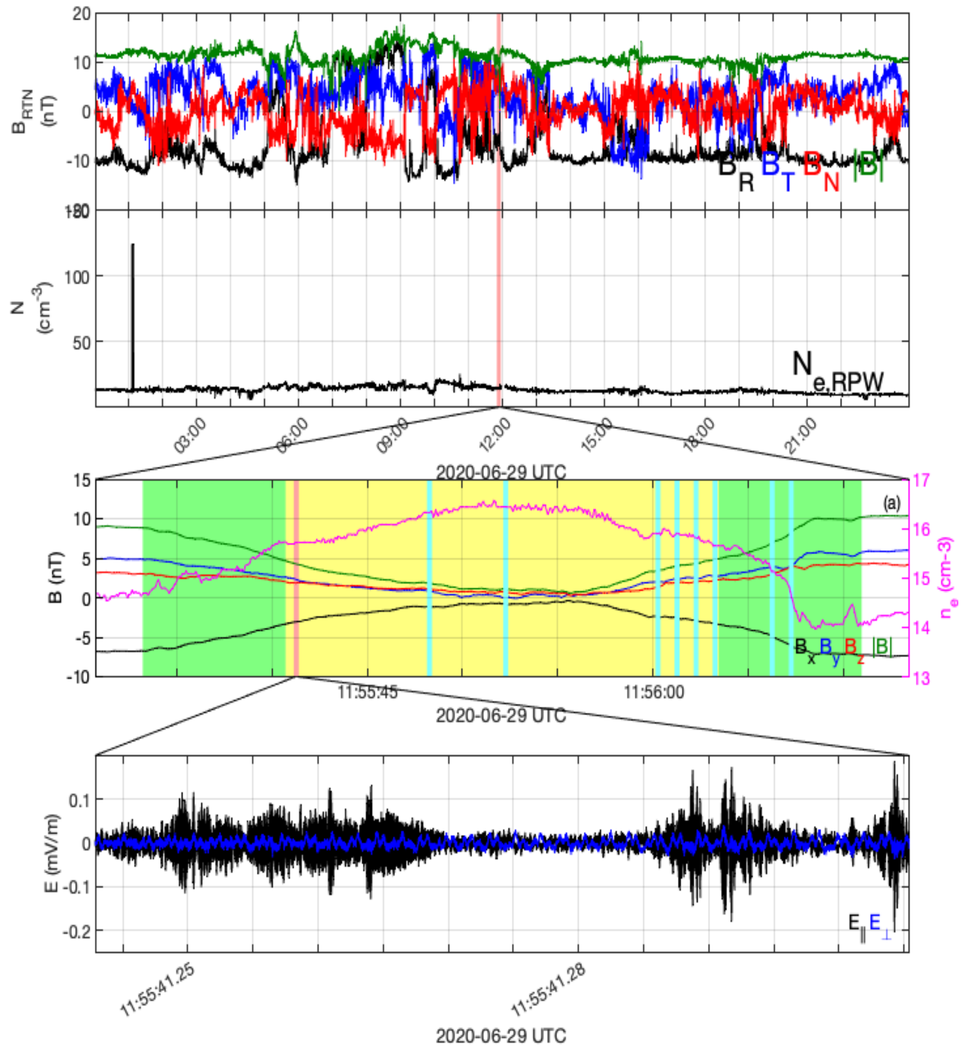
2020 data	
Langmuir Waves detected	759
Magnetic Holes	633
Langmuir waves inside Magnetic holes	53 (7%)

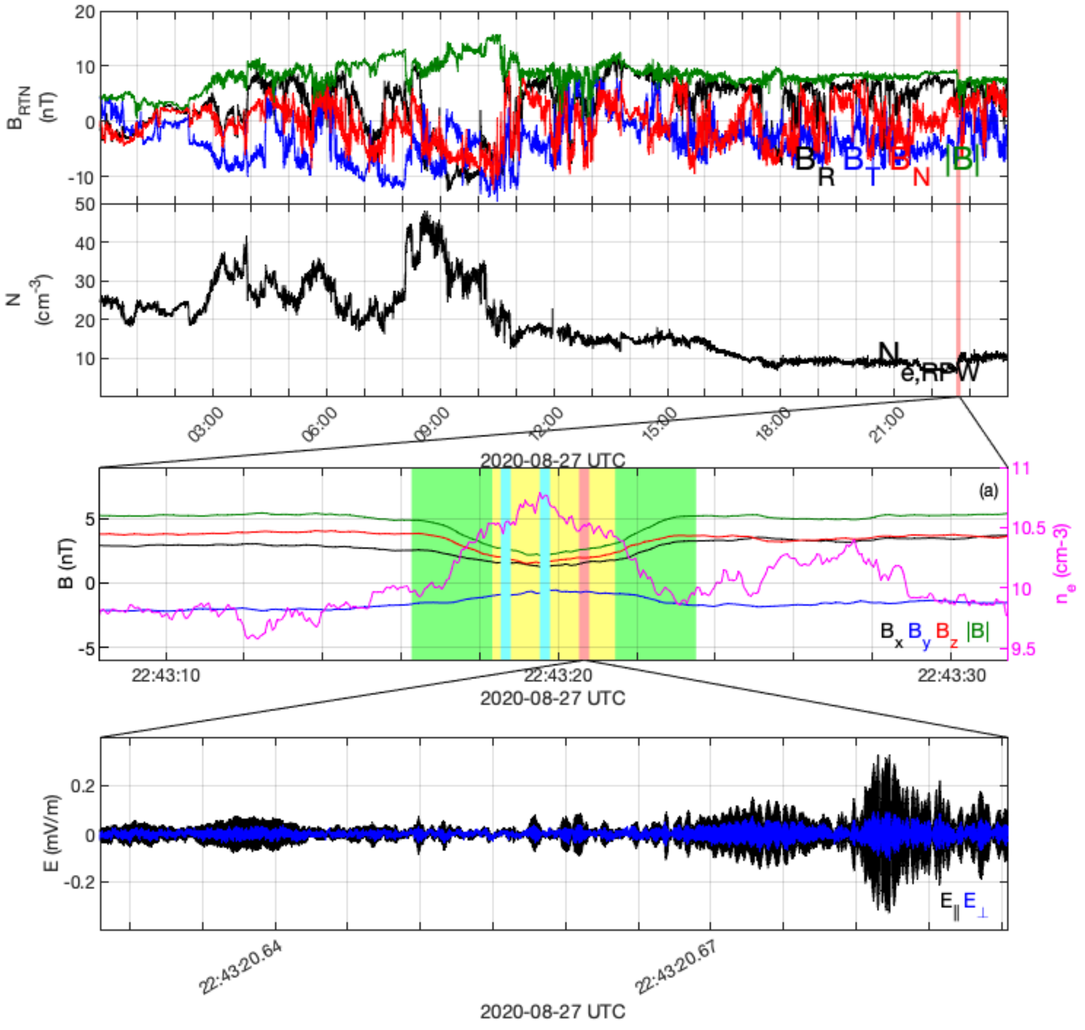
Langmuir Waves inside Magnetic Holes





Langmuir Waves associated with Magnetic Holes





Conclusions

- 7% of the snapshot-triggered Langmuir waves found inside magnetic holes.
- ~5% of the magnetic holes present at least one Langmuir wave.
- Magnetic holes of different sizes with more than one snapshot-triggered Langmuir wave have been found.
- Langmuir waves found both, at the edges and centre of magnetic holes.