

Contribution ID: **38** Type: **Oral**

Coupling Between Complex Solar Wind Structures and Outer Radiation Belt Dynamics

Tuesday, August 18, 2026 4:10 PM (40 minutes)

The solar photosphere produces various solar structures, such as Coronal Mass Ejections (CMEs) and High-Speed Solar Wind Streams (HSSs), which can propagate toward Earth and interact in the interplanetary medium, forming complex solar wind structures. In this study, we focus on events composed of two identical solar wind structures, specifically those formed by two CMEs or by two HSSs. While the coupling between a single ICME or HSS and the Earth's magnetosphere, as well as its impact on electron flux variability in the outer radiation belt, is relatively well understood, the effects of complex solar wind structures remain insufficiently explored, particularly regarding outer radiation belt dynamics. This work uses the solar wind parameters measured at L1 Lagrangian point to identify the main characteristics of each complex solar wind structure, especially in terms of velocity components and the energy transport, which exhibit markedly different behaviors. In the inner magnetosphere, in situ measurements of high-energy electron flux and magnetospheric waves, such as ultra-low frequency (ULF) and whistler-mode chorus waves, together with calculations of radial and pitch angle diffusion coefficients, indicate that these processes respond differently during electron flux enhancements driven by each type of complex structure. We explicitly compare how the different solar wind drivers modulate energy transfer, wave activity, and diffusion processes, thereby governing the dynamic response of the outer radiation belt. These results demonstrate that the coupling between complex solar wind structures and outer radiation belt dynamics depends on the specific type of solar structures composing the event, as their intrinsic properties differ substantially. Furthermore, our findings suggest that empirical models used to calculate radial and pitch angle diffusion coefficient may require refinement to account for the distinct characteristics of different complex solar wind drivers.

Author: Dr ALVES DA SILVA, Ligia (Instituto Nacional de Pesquisas Espaciais - INPE)

Co-authors: Dr SIBECK, David (NASA Goddard Space Flight Center); Dr WANG, Dedong (GFZ Helmholtz Centre for Geosciences); Mr ROKENBACH, Edu (Instituto Nacional de Pesquisas Espaciais); Dr MARCHEZI, José Paulo (Instituto Nacional de Pesquisas Espaciais); Dr ALVES, Livia (Instituto Nacional de Pesquisas Espaciais); Dr VIEIRA, Luis Eduardo (Instituto Nacional de Pesquisas Espaciais); Dr AGAPITOV, Oleksiy (Space Science Laboratory, the University of California)

Presenter: Dr ALVES DA SILVA, Ligia (Instituto Nacional de Pesquisas Espaciais - INPE)

Session Classification: Invited Talks

Track Classification: Machine Learning and AI: Heliophysics & Space Weather