9th Asia-Pacific Conference on Plasma Physics, 21-26 Sep, 2025 at Fukuoka

Electromagnetic Waves and Their Effects on Energetic Electrons in the Inner-magnetosphere

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Electromagnetic waves play a crucial role in the dynamics of energetic electrons in the inner magnetosphere, influencing their acceleration and loss processes. These wave-particle interactions are fundamental to understanding space weather phenomena, including radiation belt and ring current variability. In this presentation, we show our recent studies which examine the dominant types of electromagnetic waves—such as whistler-mode chorus waves [1,2], hiss waves [3], exohiss waves [4], and electromagnetic ion cyclotron (EMIC) waves [5,6,7], electrostatic cyclotron harmonic (ECH) waves [8]—and their effects on energetic electron populations. By combining observational data and simulation results, we explore how these waves contribute to electron precipitation into the atmosphere or their enhancement in the radiation belts and ring current. The findings highlight the complex interplay between wave characteristics (frequency, amplitude, propagation) and electron dynamics, providing insights into predictive modeling of electron fluxes in the inner magnetosphere. Understanding these mechanisms is essential for mitigating risks to satellite operations and improving space weather forecasting. Dedong Wang will also present his project WIRE (Waves in the Inner-magnetosphere and Their Effects on Radiation Belt Electrons) recently funded by the European Research Council (ERC) Consolidator Grant. The structure, timeline and connections between different work packages (WPs) of the project is outlined in Figure 1.

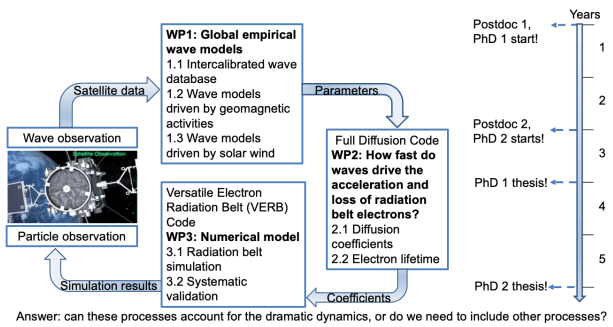

Figure 1. Diagram showing the structure, timeline and connections between different WPs of the project WIRE supported by the ERC Consolidator Grant. We will start developing wave models using wave observations from multiple satellite. Wave model parameters will be fed into our state-ot-the-art codes to simulate radiation belt dynamics. In the end, simulation results will be validated against satellite particle observations.

References

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