



Why the microscale physics of wave-particle interactions are important for macroscale space plasmas

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In this presentation, I will discuss the many ways in which wave-particle interactions in collisionless space plasma are important for the macroscale physics of magnetospheres. A large range of electromagnetic waves exist in natural plasma systems, and their interactions with energetic plasma particles are often more important than collisions as a way of redistributing plasma in space and in energy. I will use three different examples to illustrate the importance to wave-particle interactions in macroscale plasma dynamics, all chosen because of my own interests and career path. First, I will discuss the role of wave-particle interactions at the magnetopause, and in magnetic reconnection, contrasting our knowledge of 25 years ago with the advances made since. We will then move onto the role of wave-particle interactions in auroral acceleration, where I will focus almost exclusively on Landau damping and what it means in an auroral context. Finally, I will discuss the key importance of gyroresonant wave-particle interactions in radiation belt physics. A running theme of my presentation will be the benefit of borrowing ideas from other fields to use in space plasma physics. In my opinion, terrestrial space plasma physics lies at the intersection of astronomy, plasma physics and meteorology, and there are many contributions each of these sciences can make to our progress. As I move through each of my three examples, I hope to illustrate the talk with my own personal experiences and describe how my perspectives have evolved as I have spent more time in our fascinating field of research.