Examining Ion-Scale Wave Properties in the Inner Heliosphere Observed by Parker Solar Probe data
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One of the objectives of the Parker Solar Probe mission is to study and understand how the solar wind is heated and accelerated. The plasma in the inner heliosphere is considered to be collisionless due to its low density and, for this reason, the primary way for particles to interact with each other is through wave-particle interactions. Past research has shown that energy can be transferred to ions if they are in a resonant configuration with waves, and previous observations have demonstrated that the solar wind cools more slowly than expected. In this project, we study left-hand polarized ion-cyclotron wave activity, and examine its energy transfer in the inner heliosphere. This is done by analyzing data obtained from the FIELDS and SWEAP instrument suites and identifying regions with left-handed wave power along the trajectory of Parker Solar Probe during its first five encounters. Increased ion-cyclotron wave power is found near the perihelia, indicating wave energy dissipation to their surroundings as they travel farther out from the Sun. By applying a Linear Regression fit routine in the logarithmic space, we find power law slopes steeper than -2 for the individual orbits, implying wave power loss beyond what is expected for a non-interacting wave case. These slopes help us examine the energy dissipation from wave activity to the solar wind, and determine the loss rate of coherent ion-scale wave power. By studying this energy loss, we can estimate the contribution transferred to the solar wind, and so study the amount to which ion-cyclotron waves contribute to its heating and acceleration.

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