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A Simple Model for Reflection-Driven Spectral Evolution of Turbulence in the Corona and Inner Heliosphere

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Dissipation of turbulence is generally considered an important contributor for the heating and acceleration of solar wind from the corona throughout the heliosphere, due to radially evolving dissipation mechanisms and/or cascading of energy to dissipation scales. The cascading is caused by non-linear interactions between the waves, a process which requires the waves to move through each other. Therefore, in order to model the spectral evolution consistently, we must consider the evolution of the cross-helicity of the turbulence when modeling the strength of the cascade. In this study, we present a simple model for non-WKB wave reflection from large-scale gradients, and apply the resulting cross-helicity in modeling of the evolution of the turbulence spectrum in the corona and interplanetary space, using a perpendicular convective cascade model to describe the spectral evolution of the turbulence. We study the dependence of the spectral shape and the cascade strength on the frequency of the excited waves, and the ability of the spectral flux to heat the solar wind. Implications to solar wind modeling are discussed.