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Solar Coronal Plumes: Theroretical Concepts and Results

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This talk is aimed at reviewing the status of theoretical research on solar coronal plumes. This includes a detailed analysis of the energy and momentum budget of the dominant time-dependent flow patterns. Emphasis will be placed on the relevance of slow magnetosonic waves, considering results from 1-D, 2-D, as well as analytical magnetohydrodynamic modeling, in addition to results from empirical models and observations. Theoretical models, considering the combined effects of plume spreading, heat conduction, and radiative damping, have shown that the waves nonlinearly steepen as they propagate into the wind, resulting in the formation of shocks at relatively low coronal heights (i.e., within 1.3 $R_\odot$). Consequently, slow magnetosonic waves are relevant for the energy budget at most heights, even though they most likely constitute not a solely operating energy supply mechanism.