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Theoretical and computational predictions for the upcoming SMART experiment[1] ALEX FLETCHER, GURUDAS GANGULI, CHRIS CRABTREE, ANDREW RICHARDSON, JOSEPH HUBA, CARL SIEFRING, WILLIAM AMATUCCI, ERIK TEJERO, United States Naval Research Laboratory
— The SMART (Space Measurement of A Rocket-released Turbulence) experiment will demonstrate the production of electromagnetic waves in the space environment via a cascade of plasma physics processes. A sounding rocket will release heavy atoms into the upper ionosphere at high speed (˜10 km/s) across the magnetic field. These atoms photoionize and the magnetic field traps them, leading to a ring distribution in velocity space. An ion ring distribution is unstable to electrostatic lower hybrid waves with perpendicular wavelengths much shorter than the electron skin depth. Nonlinear induced scattering of lower hybrid waves produces electromagnetic magnetosonic and whistler waves with wavelengths large compared to the skin depth. Due to their large group velocities, these electromagnetic waves rapidly escape the experimental (or source) region and propagate into the radiation belts where the amplitude is expected to be similar to large lightning generated whistlers. In this talk, we will describe these plasma processes, the experimental design of SMART, the theoretical and computational work underway to quantitatively predict the results of the experiment, and the ways in which these processes are expected to play important roles in the near-Earth space environment.

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