MODE-CONVERSION RADIATION IN THE EARTH'S IONOSPHERE

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Both linear and nonlinear types of mode-conversion radiation occur commonly in space plasmas: examples include some solar bursts, auroral radio emissions, and terrestrial continuum radiations. The high-latitude ionosphere serves as a laboratory for studying these processes, because it is relatively nearby and subject to both direct and remote sensing techniques, it is penetrated by auroral electron beams which excite the radiation on a regular basis, and it has the full complexity of normal modes associated with a multi-component, inhomogeneous, magnetized plasma. Experiments reveal at least two types of radiations probably attributable to mode-conversion: auroral roar, which consists of relatively narrow-band emissions near two and three times the electron cyclotron frequency; and auroral MF-burst, which consists of broadband impulsive emissions in the range 1.5-4.5 MHz correlated with lower frequency impulsive whistler mode radiation at the expansion phase of the auroral substorm. Recently, high resolution remote sensing data have revealed different types of frequency and temporal fine structures associated with each of these types of radiation. Furthermore, use of multiple antennas has provided information about the source regions of the radiations, to within uncertainties due to ionospheric refraction. Because auroral roar typically lasts for up to an hour, it has been effectively investigated in situ. Satellite and rocket experiments have measured the radiation characteristics, causative electrostatic waves and electron distributions. As a result the source mechanism is fairly well understood. On the other hand, the short duration of auroral MF burst makes it hard to measure in situ, although the FAST satellite wave receivers occasionally detect waves with similar characteristics. Observations so far are inadequate to distinguish several candidate generation mechanisms. The relevance of these auroral emissions to a broad range of space plasma physics wave phenomena motivates planned and proposed experiments using high-resolution sounding-rocket measurements of wave-wave and wave-particle correlations.