Radio emissions of auroral origin, Latest Results

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Ground-level observations of auroral waves at frequencies 0.1-10.0 MHz not only provide insight into wave generation and propagation processes that are parallel to similar processes in magnetospheric or heliospheric plasmas, but also open a window on magnetospheric physics and magnetosphere-ionosphere coupling. The aurora is characterized by highly non-equilibrium electron distributions that excite a variety of plasma waves, some of which result in radio emissions that can be detected at ground-level. Five distinct types have been identified: auroral hiss, auroral kilometric radiation (AKR), auroral roar (electron cyclotron harmonic emissions), auroral medium frequency burst (MFB), and recently discovered auroral emissions just above the electron cyclotron frequency. The last few years have seen new developments in all of these emissions. For example, recent discovery of emissions at relatively high harmonics of the electron cyclotron frequency has opened up new avenues of research. Polarization studies reveal the emissions to be sometimes left, sometimes right polarized, with polarization and frequency distribution related to whether the emissions occur under daylit or darkness conditions. Studies of the fine structure of multiple harmonics reveal the emissions to sometimes be harmonically related, sometimes not, again with a relation to daylit or darkness conditions. These studies suggest that two different mechanisms act to generate two distinct types of cyclotron harmonic radiation, one involving linear excitation and mode conversion of upper hybrid waves, and the other involving nonlinear wave-wave interactions. These results are interesting because they identify a naturally occurring nonlinear process in the near-Earth environment. Recent experiments have led to similar significant advances concerning the other radio emissions such as auroral hiss, MFB, and AKR.