Generation mechanism of auroral roar observed in Iceland

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Ground based observation of MF auroral radio emissions has successfully detected as auroral roar and MF burst. It has been believed that the auroral roar is originated from strong excitation of upper hybrid wave in the auroral ionosphere when f_{uh}=nf_{ce} (n=2, 3) is satisfied and propagates to the ground after the mode conversion into the L-O mode electromagnetic wave [e.g. Weatherwax et al., 2002]. The evidence supporting the mechanism has been obtained by recent observations; for example, wave frequency referring harmonics of the electron cyclotron frequency, polarization characteristics, and so on. In order to understand physical processes of the MF auroral radio emissions, a radio spectrograph system was installed at Husafell in Iceland (invariant latitude: 65.3deg) in 2005. The polarization character of the $3f_{ce}$ roar was verified as L-O mode by our observation. Most of the observation results support the previous theory; however, the auroral roar event detected on May 23, 2007 was significantly unmatched with it. When we take the hypothesis that the frequency of auroral roar coincides with harmonics of fce in the source region, the observed roar's frequency of 3.1-3.5 MHz indicates the source's altitude range of 550-880 km. However, the emission generated in this altitude range must encounter Z mode cutoff, and it cannot arrive on the ground. Thus, the generation mechanism of auroral roar should be re-examined on the basis of the observation result. To solve this problem, an alternative hypothesis should be proposed: The ESCH (electrostatic electron cyclotron harmonic) wave generated by plasma instability near (n+1/2)f_{ce} is converted into L-O mode via upper hybrid wave. In this case, the estimated altitude of the source region is located at 250-350 km in the bottomside ionosphere. In this presentation, we discuss the generation mechanism of auroral roar on the basis of results by both the observation and numerical calculation.