

The polarization of $4f_{ce}$ auroral roar emissions

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This is a report on the first polarization measurements of auroral radio emissions near 4 times the electron cyclotron frequency (f_{ce}) in the Earth's polar ionosphere. Sato et al. [2012] discovered auroral roar emissions near ionospheric $4f_{ce}$, which were detected with a passive receiver installed in Svalbard, Norway (Invariant LAT 75.1N). The initial observations, performed for about a year, showed that $4f_{ce}$ roar emissions were detected from 5.27 to 5.70 MHz during moderate geomagnetic disturbances in 22 days between May and September 2011 only from noon to evening, while no event occurred during the 2010-2011 winter season. Examination of 2011-2012 polarization measurement data in Iceland (Invariant LAT 65.3N) reveals four events of $4f_{ce}$ roar emissions. $4f_{ce}$ roar in two events was observed to be left elliptically polarized with respect to the local magnetic field during daylight hours. This polarization is consistent with the idea supported by the observation in Svalbard; the origin of $4f_{ce}$ roar is mode conversion to the L-O mode of upper hybrid waves favorably generated under the condition of $f_{UH} \sim 4f_{ce}$. The other two events showed that $4f_{ce}$ roar was right elliptically polarized during darkness hours. This polarization indicates that nonlinear coupling of two upper hybrid waves may also works in the bottomside auroral ionosphere to generate R-X mode $4f_{ce}$ roar.

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