

## $4f_{ce}$ auroral roar –地上で観測される MF/HF 帯オーロラ電波の新たな側面–

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### $4f_{ce}$ auroral roar: New aspects pertaining to MF/HF auroral radio emissions observed at ground level

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Recently, *Sato et al.* [2012] discovered auroral roar emissions near ionospheric 4 times the electron cyclotron frequency ( $f_{ce}$ ) in the Earth's polar ionosphere, which were detected with a passive receiver installed in Svalbard, Norway (Invariant LAT 75.1N). In addition, *LaBelle* [2012 (in press)] confirmed the existence of  $4f_{ce}$  auroral roar and also discovered  $5f_{ce}$  auroral roar by re-examining historical data recorded in Antarctica during 1996–1999. These observational works opened a new door to understanding auroral radio generation; auroral roar can be generated under a broader range of conditions than previously considered. This is a report on further observations during an extended period in Svalbard and the first polarization measurements of  $4f_{ce}$  auroral roar in Iceland (Invariant LAT 65.3N). The observation in Svalbard, performed for about two years, showed that  $4f_{ce}$  roar emissions were detected from 5.27 to 5.70 MHz during moderate geomagnetic disturbances in 33 days between May 2011 and May 2012 only from noon to evening, while no event occurred during the winter season. Examination of 2011–2012 polarization measurement data in Iceland 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 work in the bottomside auroral ionosphere to generate R-X mode  $4f_{ce}$  roar.

#### References

Sato, Y., T. Ono, N. Sato, and Y. Ogawa, First observations of  $4f_{ce}$  auroral roar emissions, *Geophys. Res. Lett.*, 39, L07101, doi:10.1029/2012GL051205, 2012.

LaBelle, J., First Observations of  $5f_{ce}$  Auroral Roars, *Geophys. Res. Lett.*, doi:10.1029/2012GL053551, in press.