

Pedersen current carried by electrons in auroral D-region

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We present, for the first time, an appearance of Pedersen current layer carried by the electrons in the auroral D-region. Such a layer was detected by the EISCAT radar VHF system in Tromsø, Norway when an intense pulsating aurora occurred. In association with the high-energy electron precipitation during the pulsating aurora, a significant ionization was observed not only in the E-region but also in the upper part of the D-region (80-95 km). An altitude profile of the Pedersen conductance derived from EISCAT exhibited two distinct layers of enhanced conductance. The upper one occurred around 120 km altitude which corresponded to the normal Pedersen current layer carried by the ions. The lower one appeared as a thin layer between 80 and 95 km in altitude. A detailed analysis demonstrates that the thin Pedersen layer in the D-region was mainly carried by the collisional motion of electrons. It is also suggested that such an electron Pedersen layer is detectable only when the electron density is sufficiently high for allowing an appreciable current to flow in the D-region. The Pedersen conductance at the peak of the electron Pedersen layer was $\sim 8 \times 10^{-5} \text{ S m}^{-1}$, which is only 13% of that at the peak of the ion Pedersen layer ($6 \times 10^{-4} \text{ S m}^{-1}$). However, the electron Pedersen current flows exactly in the altitudes where the pulsating ionization occurs; thus, it would play more important role in the closure of FAC associated with the patch of pulsating aurora.