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**Conjunction observations of energetic oxygen ions O<sup>+</sup> accumulated in the sequential flux ropes in the high-altitude cusp**

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Conjunction observations of the magnetic field and plasma by Cluster and TC-1 at the dayside magnetosphere are presented to investigate the sequential flux ropes transferred from the low latitude boundary layer (LLBL) to the high altitude cusp on 10 March 2004. Three sequential flux ropes originating from the dayside low latitude magnetopause are first detected by TC-1. After ~ 6 min, three sequential flux ropes accumulated with energetic oxygen ions are also detected by Cluster in the high altitude cusp. The recurrence period of these flux ropes is ~ 3 min. The number density of energetic oxygen ions in the cusp flux rope is ~ 0.25 cm<sup>-3</sup> detected from CIS/CODF instrument on Cluster. It is found that oxygen ions with energy larger than 10 keV have a narrow pitch angle (less than 90 degree) distribution in the southern high altitude cusp. While oxygen ions with energy less than 10 keV are distributed in a wide pitch angle from 0 to 180 degree. Counter-streaming energetic oxygen ions are found in these flux ropes in the high altitude cusp. This result suggests that the oxygen ions with energy less than 10 keV in the high altitude cusp have two source regions. One is from the dayside magnetopause and the other is from the low altitude cusp. Our investigations first

provide evidence that flux ropes at dayside low latitude magnetopause can carry energetic oxygen ions into the high altitude cusp region.

#### References

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