

## **MMS Observations of Harmonic Electromagnetic Ion Cyclotron Waves**

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Harmonically related electromagnetic ion cyclotron waves with the fundamental frequency near the double oxygen cyclotron frequency were observed by the MMS spacecraft on May 18-20, 2016. The wave activity lasted for three days, detected by the spacecraft on their consecutive inbound passages through the Earth's plasma sheet boundary layer. The waves were seen in both magnetic and electric fields, formed by over ten higher order harmonics. Simultaneous ion flux measurements show the presence of ion ring distributions suggesting the energy source for the observed waves. The ion cyclotron harmonics were observed together with broad-band waves extending from  $\sim$ Hz to  $\sim$ kHz frequency range, ion and electron phase space holes, and chorus waves. During some intervals, there is a clear modulation of chorus wave packets at the ion cyclotron fundamental harmonic frequency. These observations are particularly interesting since they suggest cross-frequency and cross-species coupling between processes happening on ion and electron scales.