Frequency dependence on the beaming angle of Jupiter's decametric radio emissions based on LWA1 data analysis

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The beaming angle of Jupiter's decametric radio emissions is very important to elucidate the emission mechanism of Jupiter's decametric radio emissions. This beaming angle can be estimated by the modulation lane method [Imai et al., 2017]. The modulation lane method is based on the measurements of the slope of modulation lanes on the dynamic spectrum of Jupiter's decametric radio emissions. We usually measure the slope with a 1 MHz bandwidth and determine the most probable value of the lead angle to fit the value of the slope. The longitudinal location of the magnetic field line of the radio emitting sources can be calculated by the lead angle. Once the location of the source is found, we determine the beaming angle (so-called cone half-angle) as the angle between the direction tangent to the magnetic field line at the source and the direction to the Earth as seen from the source.
The Long Wavelength Array station 1 (LWA1) is a low-frequency radio telescope designed to produce high-sensitivity, high-resolution spectra in the frequency range of 10-88 MHz. The sensitivity of the LWA1, combined with the low radio frequency interference environment, allows us to observe the wide band modulation lanes of Jupiter's decametric radio emissions [Clarke et al., 2014]. We have analyzed the data including the wide band Io-B modulation lanes observed by LWA1. We found a unique event showing curved modulation lanes over a 22 MHz frequency bandwidth from 12 MHz to 34 MHz. By using our modulation lane method we calculated beaming angles of 57 degrees for 12 MHz and 63 degrees for 34 MHz. The difference of the beaming angles is 6 degrees over a 22 MHz frequency range. This means the value of beaming angle is gradually increasing toward the higher emitting frequency. We will discuss this frequency dependence on the beaming angle of Jupiter's decametric radio emissions based on the archived LWA1 data.

References:
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