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Fine structure of Jupiter's decametric modulation lanes observed by LWA1

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The Long Wavelength Array (LWA) is a low-frequency radio telescope designed to produce high-sensitivity, high-resolution images in the frequency range of 10-88 MHz. The Long Wavelength Array Station 1 (LWA1) is the first LWA station completed in April 2011, and is located near the VLA site in New Mexico, USA. LWA1 consists of a 256 element array, operating as a single-station telescope.

The sensitivity of the LWA1 combined with the low radio frequency interference environment allow us to observe the fine structure of Jupiter's decametric modulation lanes. At frequencies in the vicinity of 22 MHz, most modulation lane patterns have frequency-time slopes between +100 and +180 kHz/sec for Io-B storms and between -90 and -200 kHz/sec for Io-A and Io-C storms. The lanes generally display a strong periodicity in time, with periods ranging from about 1 to 5 sec and an average of about 2 sec.

We refer to the modulation lanes possessing frequency-time slopes and periodicity within the above ranges as the major component. There is a minor modulation lane component, representing a considerably smaller fraction of the total number observed, for which the frequency-time slopes are of opposite sign than for the major component or are of the same sign but of smaller absolute value. For these cases the lanes are usually broader and their separations in time are longer.

There are significant differences of characteristics between the major and the minor components of modulation lanes. Minor component lanes are apparently of somewhat different origin from major component lanes. We show the fine structure of the major and minor modulation lanes observed by the LWA1. The origin of minor modulation lanes is discussed.

Keywords: Jupiter radio, decametric wave, modulation lane, fine structure