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# De effect on Jupiter's decametric non-Io-A source

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One of the unresolved problems of Jupiter's decametric radio emissions is the variation of occurrence probability on the order of a decade. The variation was first thought to be due to changes in solar activity (solar cycle). The Sun can influence the detection of Jovian decametric radiation by changing the local observing conditions, changing the density of plasma in the interplanetary medium and by changing conditions at the Jupiter radio source.

The period of the variation was also close to the orbital period of Jupiter (11.86 years). Carr et al. [1970] showed that such variations are closely correlated with the Jovicentric declination of the Earth (De). The range of the smoothed variation of De is from approximately +3.3 to -3.3 degrees. If this is the case, the observed variation appears to be a purely geometric effect caused by changes in the beam cross section seen from the Earth. The shape and angular dimensions of the part of the emission beam accessible to the Earth is shown in Figure 6a in Carr et al. [1970]. However the detail of the beam model has not been proposed so far.

Garcia [1996] extensively studied and confirmed this De effect. The radio observations used in this study were mainly taken by Yagi antennas located at the University of Florida Radio Observatory (UFRO). The occurrence probability of the non-Io-A source varies in close step with De. Garcia [1996] reports that the changes in source width and location for non-Io-A are very large over the roughly 7 degree range of De. The high CML edge of the non-Io-A source also has a very strong dependence on De.

We show the long-term periodic variation of the occurrence probability of Jupiter's decametric radio emissions is caused by the De effect which is related to the pure geometrical effect of sharp radio beaming. We propose the searchlight beam model which can explain this sharp beaming especially in a latitudinal direction. The three dimensional structure of the radio source is the important key parameter to produce the searchlight beam of Jupiter's decametric radio emissions. We calculate the beam pattern by using the dimensions of the radio coherent region. The calculated results show the existence of sharp beaming in the latitudinal direction. As the searchlight beam is the intensified part of a conical sheet beaming toward the equatorial plane, it does not conflict with the previous idea of the conical sheet model. We also propose the delta zone effect to explain the cyclic changes of CML and the effective width of the non-Io-A source. We believe that the searchlight beam model is very important in understanding the beaming of the planetary radio emissions.

References

Carr, T.D., A.G. Smith, F.F. Donivan, and H.I. Register, The twelve-year periodicities of the decametric radiation of Jupiter, Radio Sci., 5, pp.495-503, 1970.

Imai, K., L. Garcia, F. Reyes, M. Imai, and J.R. Thieman, A Model of Jupiter's decametric Radio emissions as a searchlight beam, Planetary Radio Emissions VII, edited by H.O. Rucker, W.S. Kurth, P. Louarn, and G. Fischer, Austrian Academy of Sciences, Graz, Austria, pp.179-186, 2011.

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