Delta zone effect on Jupiter's decametric non-Io-A source

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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. Garcia[1996] showed the high CML edge of the non-Io-A source at 18 MHz has very strong dependence on De, but the low CML edge has no change with De. This means the parameters of the effective width and the peak-point of the non-Io-A source have a relationship with De. This non-uniform effect along the longitude can be explained by the delta zone effect which is caused by the magnetic anomaly of Jupiter's polar region, because Jupiter's magnetic field has non-dipolar terms of much higher order. This delta zone effect is shown by the triangular shape of white lines in the figure below. The effective area of the shape of the triangle depends on the De. The nonlinearity of Jupiter's magnetic field parameters, the so-called magnetic anomaly, along the longitudinal direction can be considered. If we take into account the extension of the radio emitting region along the latitudinal direction, the two dimensional effective area of the radio emitting region seen from the observer may be changed by the geometrical effect. The shapes of the triangle, corresponding to the effective area, indicate the dependence on De. The vertical dimension of the triangular shape corresponds to the number of radio sources which have the same beaming direction. This delta zone effect is one candidate to explain the cyclic changes of CML and the effective width of the non-Io-A source.