Jovian decametric searchlight beam model

Kazumasa Imai[1]; Masato Okazaki[1]; Masafumi Imai[1]

[1] Department of Electrical Engineering, Kochi National College of Technology

http://jupiter.kochi-ct.jp/cg/

Jupiter is one of the most powerful radio sources at decametric wavelengths. The radio emitting frequency range is from about a few MHz to 40 MHz. Jupiter's decametric radiation is considered to be the result of a highly complex interaction between Jupiter's plasma and its magnetic field. This emission is generally believed to be produced by a mechanism related to cyclotron maser plasma instability. Although there is a long history of Jupiter's radio observations since its discovery in 1955, the emission mechanism of Jupiter's decametric radiation has not yet been completely understood.

It has long been recognized that there is a marked long-term periodic variation in Jupiter's integrated radio occurrence probability. The period of the variation is on the order of a decade. Carr et al. [1970] showed that such variations are much more closely correlated with Jovicentric declination of the Earth (De). The range of the smoothed variation is from approximately +3.3 to -3.3 degrees. This De effect was extensively studied and confirmed by Garcia [1996]. It shows that the occurrence probability of the non-Io-A source is clearly controlled by De at 18 MHz during the 1957-1994 apparitions.

We developed a new model to explain the De effect. This new model shows that the beam structure of Jupiter radio emissions, which has been thought of like a cone, has narrow beam like a searchlight, which can be explained by assuming that the three dimensional shape of the radio source expands along the line of the magnetic field. Various computer graphics have been drawn for general understanding of the image of this searchlight beam model.