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Beaming cone of Io-controlled Jovian decameter radio emission derived from occurrence probability

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Two essential parameters govern the occurrence probability of the Jovian decameter radio emissions: the central meridian longitude (CML) and the orbital phase of Io. In the CML-Io phase diagram where the occurrence probability is plotted versus these two parameters, four zones of enhanced probability emerge: the so-called Io-controlled sources Io-A, Io-B (emitted from the northern hemisphere), and Io-C, Io-D (emitted from the south). We make the hypothesis that this radio emission is generated (by the cyclotron maser instability), near the local gyrofrequency, along a magnetic field line carried away by Io (with a lead angle δ) along its revolution around Jupiter. The magnetic field intensity gradient is supposed to play the role of an optical axis for the wave propagation. We study the occurrence probabily and in particular the location of the previous four sources, in a polar diagram, as a function of the colatitude angle θ relative to the gradient of the magnetic field (radial coordinate) and an azimuth angle ψ linked to the direction of magnetic field vector. The angular distribution of the sources clearly shows that the angle θ is not constant and that the jovian decameter emission controlled by Io is radiated in a hollow cone which is not axi-symmetrical around the magnetic field gradient but flattened in the direction of the magnetic field vector. This new result about the beaming cone is compatible with the existence of a range of active longitude favouring the radiation in regions of the CML-Io phase diagram in good agreement with the observations.