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Simulation of Io-Jupiter radio arcs

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The interaction of Jupiter with its moon Io generates intense decametric radio emissions. These emissions have an arc-shaped structure on the dynamic spectra (2D images of the intensity versus time and frequency) recorded from the ground. Since they only appear in four domains (A, B, C, D) of the CML-Φ_{Io} plane (with CML the observer's central meridian longitude and Φ_{Io} the orbital phase of Io from anti-observer's direction), their occurrence has been related to the moon-planet-observer geometry. Queinnec and Zarka [1998] proposed that the complex arc shapes are simply due to a combination the geometry of the magnetic field, the beaming angle and its variations with the frequency, and the shift between the actually radio-emitting field line and the instantaneous Io field line (so-called " lead angle "). They checked that observed arcs were generally consistent with these assumptions, but did not demonstrate that these assumptions were necessary and sufficient to produce only the observed radio arcs.

We have built a simulation that allows to compute theoretical dynamic spectra from a set of assumptions on the above parameters. Our simulation reproduces well the shape of the differents Io-related arcs assuming a magnetic field and an emission model, and allows us to discriminate between several emission scenarii, namely a shell-driven and a losscone driven cyclotron maser, favouring the latter. We also put constraints on the lead angle and the radio beaming angle.