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Generation of the jovian radio emission by the maser cyclotron instability: first lessons from JUNO

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Using JUNO plasma and wave observations (JADE and Waves instruments), the scenario for the generation of jovian auroral radio emissions are analyzed. The sources of radiation are identified by localized intensifications of the radio flux at frequencies close to the electron gyrofrequency. Not surprisingly, it is shown that the cyclotron maser instability is perfectly adapted to the plasma conditions prevailing in the radio sources. However, it appears that different forms of activation of the cyclotron maser are observed. For radiation at hectometric wavelengths (one of the main emissions), pronounced loss-cones in the electron distribution functions are likely the source of free energy. The sources would be extended over several thousand km in directions traverse to the magnetic field. The applications of the theory reveals that sufficient growth rates are obtained from the distributions functions that are actually measured by JADE. This differs from the Earth scenario for which 'trapped' distribution functions drive the maser. More localized sources are also observed, possibly linked to local acceleration process. These examples may present analogies with the 'Earth' scenario, with other forms of free energy than the loss-cone. A first lesson of these direct in-situ JADE and RPWS observations is thus to confirm the maser cyclotron scenario with, however, conditions for the wave amplification and detailed maser processes that appear to be different than at Earth.