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Electron acceleration processes in the vicinity of radio planets

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Recent works on the interpretation of decametric emission have shown evidence of magnetic-field-aligned electric fields in the close vicinity of Jupiter. The acceleration structures are found along the Jupiter-Io flux tube and they have common points with those occurring above Earth's auroras. In this short review, I will underline a few features of the theoretical models of the Earth auroral acceleration that might be of interest in the more general context of the radio planets. Many models exist; they usually put the emphasis on a peculiar length and time scale. Considering the high variety of auroral structures, we can expect that many of them are relevant, even if the real acceleration process (out of reach of our computational abilities) is probably a complicated mixture of the effects described in each model. In all the models of auroral acceleration considered nowadays, the source of free energy is situated in the magnetosphere. It generally results in a forced current along the magnetic field line. This can be a direct current, or a time dependent current induced by processes occuring in the outer magnetosphere, or by magnetic field line oscillations, or by propagating Alfvén/Magnetosonic waves... The large scale acceleration models generally invoke the mirror effect induced by the increase of the magnetic field near the planet : to maintain a downward current against the repulsive mirror force, a small population of electrons must gain a high velocity, generally acquired through acceleration by a magnetic-field-aligned electric field. In the models based on propagating MHD waves, the accelerating parallel electric field is induced by a distorsion of the wave front. Each of these acceleration mecanisms have a different signature that could be analysed, for radio planets, through the study of the associated auroral display, through diagnostics of the radio-emissions, and when auroral probes will pass closer to the radio-planets, through in situ measurements.