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Constable, DA; Ray, Licia C; Gunell, Herbert

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D. A. Constable[1], L. C. Ray[1], H. Gunell[2,3]
[1] *Physics Department, Lancaster University, Lancaster, United Kingdom.*
[2] *Belgian Institute for Space Aeronomy, Brussels, Belgium.*
[3] *Department of Physics, Umea University, Umea, Sweden.*

Auroral emissions are generated through the acceleration of current carriers along magnetic field lines, with particles precipitating into the atmosphere of a planet. The distribution of plasma within the planetary magnetosphere determines the potential structure along the field lines and is therefore influenced by the characteristics of magnetospheric and ionospheric particle sources. This in turn, influences the generated aurora.

At the Jovian system, the particle dynamics are complex. Heavy ions are confined to the centrifugal equator of the planet due to strong centrifugal forces; magnetospheric electrons are unable to reach high magnetic latitudes due to the magnetic mirror effect; ionospheric plasma cannot reach high latitudes due to large gravitational forces. Due to these restrictions, a field-aligned accelerating potential will be generated, occurring close to the minimum of the sum of the centrifugal and gravitational potentials. This will result in precipitating electrons and ions being accelerated, resulting in auroral emission in the UV and X-ray regimes, respectively.

To gain understanding of the dynamics of the Jovian magnetosphere and auroral generation, work is underway on adapting an existing terrestrial model. This numeric code is a parallelised, kinetic Vlasov solver, which models the evolution of plasma species along magnetic field lines, and thus determining the structure of auroral acceleration regions at Earth. Through the use of a non-uniform spatial grid, the model allows fine resolution in specific regions of interest (e.g. at the ionosphere). Efforts are currently underway to introduce centrifugal forces to the model, allowing it to accurately model the rapidly rotating Jovian system. In addition, species will have the option of be treated as a fluid, improving computational time. The refined model will quantify the energy transferred to Jupiter's atmosphere through auroral precipitation, thus allowing comparison and interpretation of in-situ measurements made by the Juno spacecraft.