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Electron beams in the Enceladus interaction: Remote sensing using RPWS observations

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Enceladus' southern plume ejects water vapor and dust that fill the Saturnian system, a small percentage of which are ionized near the moon. These ionized particles slow the local plasma and perturb the magnetic field near the moon. This kind of interaction is well understood from studies at comets and Jupiter's moon Io, but Enceladus differs from these examples due to the importance of the dust and the physical separation between the center of the perturbation and the solid moon. It is not possible to make in situ observations at all points around Enceladus, however Cassini's Radio and Plasma Wave Science (RPWS) can remotely sense aspects of the interaction. If the thermal plasma cannot provide the currents required by the magnetic perturbations, electron beams can be accelerated to carry them. These beams are able to generate a plasma wave called "auroral hiss" that RPWS can observe far from the source particles. Using ray tracing techniques, we combine all of the RPWS auroral hiss observations to map out where their generating electron beams can be located. We use ray tracing techniques with the auroral hiss observed across all of Cassini's Enceladus flybys to probe these beams. Electron beams, both parallel and anti-parallel to the magnetic field, are located around the interaction region, but are primarily near the edge of the moon. We use the observed frequencies to estimate the electron energies and discuss the currents that they may carry.