MEASURING ELECTRON TEMPERATURE USING A PLANAR LANGMUIR PROBE

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The Planar Langmuir Probe, PLP, is a simple device generally consisting of a flat plate and guard ring placed on the ram side of a spacecraft such that it can intersect an uninterrupted flow of plasma. The probe area needs to be sufficiently large as to intersect a measureable current of ions when biased to a small negative potential, thus providing a relatively unambiguous measure of the ion density. When the PLP is swept in voltage through the plasma potential to a small positive potential, the current–voltage curve contains information about the electron temperature. Unlike the ion density which can be understood with a very simple model, the electron temperature must be interpreted using a more complex probe theory. One element of this theory is the response of the spacecraft potential to the changing potential of the non-negligible probe area. Failure to account for this interaction with the spacecraft potential can lead to error, and in general a bias towards an elevated electron temperature measurement. A theory for PLP electron temperature analysis will be presented and demonstrated using data from the CHAMP and C/NOFS satellites.

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