



Electron densities derived from Cluster spacecraft potential measurements

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The potential of a spacecraft in the magnetosphere will come to a positive potential determined by a current balance between attracted electrons and photoelectrons escaping to the plasma. Ion currents are very small in comparison. With an approximate knowledge of the energy of ambient electrons it is possible to relate measurements of the spacecraft potential to electron density. The electric field probes on Cluster, controlled to be close to the ambient plasma potential, are used as reference for these potential measurements. This technique cannot compete with particle or active wave experiments in regions where they give reliable results. However the method may be the only source of information in the following situations. A major part of the ions can be repelled by the positive spacecraft. The electron measurements can be disturbed by returning photoelectrons. A particular situation appears when the plasma is so tenuous that particle and active wave experiments do not yield data. Furthermore the method offers electron density information with a much higher time resolution than other experiments. This has been used on the four Cluster spacecraft for determination of velocity of boundaries. The technique has been updated with new data from several Cluster experiments. Examples of its use in different plasma environments will be given.