Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **1964** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Kinetic simulations of needle probes on cubeSats

Monday 11 June 2018 12:15 (15 minutes)

CubeSats are increasingly popular among the space physics commuinty, as an afordable means of deploying large numbers of instruments in space, thus providing better monitoring and coverage of space environment. Needle probes consisting of thin cylindrical probes of length ranging from a few to several centimeters, have been used on a number of cubeSats, because of the relative simplicity with which they can be used to infer plasma density. The interest in this type of probes is motivated by the dependence of their characteristic on plasma density and temperature, whereby the collected current in the electron saturation region is approximately proportional to the density and the square root of the potential, with only a week dependence on temperature. As a result, when operated in fixed-bias mode, these probes can provide the electron density from the slope of the current square as a function of bias voltage. One concern with the use of such probes on cubeSats, however, has to do with their impact on the satellite bus (the ground) potential. Indeed with probes mounted on larger spacecraft, the probe bias and collected current generally has negligible effect on the bus floating potential. With the much smaller CubeSats, however, the ion collection capacity of the bus is limited. The relatively large positive biases and resulting collection of negative current, have to be balanced with an equal positive collected current from the rest of the satellite. The concern that this may only be possible by reducing the spacecraft potential to the point that positively biased probes with respect to the bus, may have a potential comparable to, or less than that of surrounding plasma. In this talk simulation results are presented, showing the effect on the bus floating potential, associated with needle probes operating in the electron saturation region. It is shown that under certain conditions, the bus floating potential can become significantly more negative than it would be in the absence of probes, and that active means of controlling the bus floating potential may be required.

Author: Prof. MARCHAND, Richard (University of Alberta)

Presenter: Prof. MARCHAND, Richard (University of Alberta)

Session Classification: M1-3 Theory, Modelling, and Forecasting I (DASP) I Théorie, modélisation et prévisions I (DPAE)

Track Classification: Atmospheric and Space Physics / Physique atmosphérique et de l'espace (DASP-DPAE)