

“Negative Hydrogen Ion Production/Destruction Reaction Study through Measurement and Analysis of the Photo-Emission Spectrum from the Source Plasma”

The University of Auckland - Physics - Ph.D. Project Proposal

The University of Auckland Student: To be determined

The University of Auckland Joint Supervisors: Dr. Neil Broderick & Dr. Cather Simpson

Industrial Supervisor: Dr. M.P. Dehnel, CSIO, Buckley Systems Ltd.

Location of Research: Ion Source Test Facility at Buckley Systems Ltd in Auckland, New Zealand

The student would be permitted to utilize D-Pace’s volume-cusp ion sources with filament based or RF-based plasma heating techniques under various operational scenarios, and would measure the photo-emission spectrum from the source plasma. The student would review state-of-the-art (which is still in a developing and unclear state) technical papers regarding the underlying vibrational and rotational excited states of the various molecular ions, and neutral molecules present in plasma’s of volume-cusp ion sources (for a sub-set of reactions believed to be important, see below). The student would correlate the measured negative ion beam current output from the source with the reactions present as determined by the photo-emission spectrum under a variety of operational scenarios. In addition, the student would build and utilize a Langmuir probe to measure plasma characteristics for each of the scenarios studied. With this approach the student should be able to determine which production reactions are dominant and optimized for higher output beam current scenarios, and which negative ion destruction reactions are minimized. Similarly, for low current operational scenarios the student should be able to identify which other production/destruction reactions are either dominant or minimized. This is an area where there is disagreement amongst experts in the field as to which reactions dominate, which do not, and which reactions should be encouraged and optimized. Also, the student would be in a position to determine a relationship between system parameter changes and the optimization of the reactions for higher production. This information will be extremely useful for developing better, higher-current and higher powered sources in future.

Prospective students: Please contact Dr. Morgan Dehnel at morgan@d-pace.com

