

Low Resource Technique for Measurement of H⁺ and O⁺ in the Terrestrial Magnetosphere

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Additional Supporting Information (Files uploaded separately)

Single Microsoft Excel file containing Data Set S1, Data Set S2, Data Set S3

Introduction

All of the supplemental data are located in a single Microsoft Excel file. The three data sets are located in three sheets within this Excel file; the sheets are titled: Data Set S1, Data Set S2, Data Set S3.

Data Set S1 is simulation data of the estimated range of H⁺ and O⁺ in carbon using Stopping Range of Ions in Matter (SRIM) software. SRIM is publicly available software (see <http://www.srim.org>). Column A is the input energy range of the simulated ions ranging from 0.1 to 100 keV. Columns B–G are outputs from SRIM, with columns B, C, and D pertaining to H⁺ while columns E, F, and G pertain to O⁺. Column B shows the stopping power (dE/dx) for H⁺ in carbon in units of keV/μg cm². Column C shows the range in Angstroms of H⁺ ions in carbon. Column D is calculated from Column C: it is the range in units of μg/cm² of H⁺ in carbon assuming a carbon density of 2.253 g/cm³. Columns E, F, and G are the Oxygen equivalents of columns B, C, and D, respectively. These data are shown graphically in Figure 1.

Data Set S2 is a table of laboratory measurement data of the scattering half-angle of protons through eight ultrathin carbon foils. Column A is the energy of the incident proton beam in keV. Row 1 is the manufacturer-reported nominal thickness ($\mu\text{g}\cdot\text{cm}^{-2}$) of the 8 foils tested. The entries in this table (rows 3–10, columns B–I) are the measured scattering half-angle in degrees.

Data Set S3 is laboratory measurements of the transmission of H^+ and O^+ through ultrathin carbon foils using the apparatus described in Figure 5 of the paper. Column A is the foil used for each measurement for the O^+ transmission study. Column B is the energy of the incident O^+ beam in keV. Column C is the foil constant calculated as described in the paper using Equation 2. Column D is the measured ratio R of counts in detector D1 relative to detector D2. Columns F–M are the fits of the data to a sigmoid function; Column F is the energy range from 1–100 keV, and Columns G, H, I, J, K, L, and M are the fits for Foil numbers 2, 3, 4, 5, 6, 7, and 8, respectively.

This repeats for H^+ within Data Set S3. Column O is the foil used for each measurement for the H^+ transmission study. Column P is the energy of the incident H^+ beam in keV. Column Q is the foil constant calculated as described in the paper using Equation 2. Column R is the measured ratio R of counts in detector D1 relative to detector D2. Columns T–Y are the fits of the data to a sigmoid function; Column T is the energy range from 0.4–100 keV, and Columns U, V, W, X, and Y are the fits for Foil numbers 2, 3, 4, 7, and 8, respectively.

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Captions

Data Set S1. Simulation data of the estimated range of H^+ and O^+ in carbon using Stopping Range of Ions in Matter (SRIM) software. These data are shown graphically in Figure 1.

Data Set S2. The measured angular scattering halfwidth at half maximum of H^+ transmitted through carbon foils of various nominal thickness as a function of the incident ion energy. These data are shown graphically in Figure 3.

Data Set S3. Transmission data for H^+ and O^+ beam of various energies through all carbon foils, displayed as the ratio of counts in detector D1 relative to detector D2. These data are shown graphically in Figure 6.