

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

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Contents of this file

Introduction to Data Set S1, Data Set S2, Data Set S3
Captions for Data Set S1, Data Set S2, Data Set S3

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.