## SPARC Water Vapor Assessment: Measurement methodology of the Harvard Water Vapor (HWV) Lyman-alpha Hygrometer

<u>Jessica Smith</u><sup>†</sup>; Maryann Sargent; David Sayres; Elliot Weinstock; James Anderson <sup>†</sup> Harvard University, USA Leading author: <u>jsmith@huarp.harvard.edu</u>

Versions of the Harvard Water Vapor (HWV) instrument have flown aboard NASA ER-2 and WB-57 research aircraft since 1994. The instrument utilizes the highly selective and sensitive Lyman-alpha photo-fragment fluorescence detection method for acquiring in situ measurements of the low water vapor mixing ratios typically observed in the upper troposphere and lower stratosphere. The accuracy of the measurements is determined though rigorous laboratory calibrations and in situ diagnostic procedures. However, the results of in situ comparisons between HWV and other instruments have shown a great degree of variability over the past two decades, and revealed differences outside the envelope of combined instrument uncertainties. In order to provide context for an informed discussion of the magnitude of these differences and their variability, we provide 1) a description of the detection technique, including a discussion of the optical configurations of the different versions of the primary detection axis, and 2) a guide to the calibration and validation methodology of the in situ measurement, with an emphasis on the estimation of measurement uncertainty.