AN AIRBORNE SPECTROPHOTOMETER FOR INVESTIGATING SOLAR ABSORPTION ON VENUS.

J. Gero[1], S. Limaye[1], P. Fry[1], Y. J. Lee[2], G. Petty[3], J. Taylor[1], S. Warwick[4], [1]University of Wisconsin–Madison, Space Science and Engineering Center, Madison, WI, USA, [2]Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science, Sagamihara, Japan, [3]University of Wisconsin–Madison Madison, Department of Atmospheric and Oceanic Sciences, Madison, WI, USA, [4]Northrop Grumman Aerospace Systems, Redondo Beach, CA, USA.

Introduction: It has been known for decades that the chemical species detected to date from in-situ and remote observations of Venus clouds cannot explain the absorption of incident solar radiation at wavelengths below about 600 nm, to at least 330 nm [1,2]. Sulfuric acid, the primary constituent of Venus clouds, does not absorb visible wavelengths; sulfur dioxide absorbs only below 330 nm. Furthermore, Venus cloud cover shows a peculiar dependence of contrast on wavelength and it has been shown that other absorbers must be present in Venus clouds [3,4,5]. A variety of substances from elemental sulfur to $FeCl_3$ crystals have been proposed [1,2,6-8], but the possibility of organic substances or micro-organisms cannot be excluded [9-12].

Mission: In order to understand the nature and identity of the absorbers of solar radiation in the clouds of Venus, measurements from a long lived aerial platform capable of sampling different altitudes and carrying a suite of instruments to sample cloud properties is needed. Venus Atmospheric Mobile Platform (VAMP), [13,14] is one such vehicle which has been recommended as the highest priority contributed to Russia's Venera-D mission [15], and will also be likely considered for a future Venus flagship mission. Measurements of solar radiation from such a platform would provide the ability to relate the spatial and temporal variations in differential UV absorption (365-410 nm), which characterize the contrast features seen in spacecraft images of Venus cloud cover, to environmental and cloud properties.

Instrument: We have proposed to develop a spectrophotometer with integrated meteorological sensors that can provide the required data for these science goals. Our effort will include modeling the solar radiation levels at various altitudes in the Venus atmosphere, and the design of an appropriate sampling and optical system for the observations. The spectrophotometer will be prototyped in the laboratory, including the electronics and the data system, and performance will be tested for requirements for noise, resolution, radiometric accuracy. Algorithms will be developed to identify various UV absorption regimes that can be used to trigger observations by complementary instruments in the payload. The instrument will be designed to integrate into a mobile airborne platform and address constraints imposed on mass, power, observing geometry, and communication with other instruments in the payload.

Summary: We present an overview of this instrument proposal and mission. This work directly addresses the VEXAG goals and objectives [16] to determine the chemical makeup and variability of the Venus clouds, their roles in the atmospheric dynamical and radiative energy balance, and their impact on the Venus climate. Furthermore, it provides a test of whether the habitable zone in the Venus clouds harbors life.

References: [1] Esposito L. W. et al. (1983) The clouds and hazes of Venus. In *Venus*, University of Arizona Press. [2] Krasnopolsky V. A. (2017) Icarus, 286, 134-137. [3] Pollack J. B. (1980) J. Geophys. Res., 85, 8141-8150. [4] Pollack J. B. et al. (1979) Science, 205, 76-79. [5] Travis L. D. (1975) J. Atmosp Sci, 32, 1190-1200. [6] Krasnopolsky V. A. (2006) Planetary and Space Science, 54, 1352-1359. [7] Krasnopolsky V. A. (2016) Sulfur aerosol in the clouds of Venus. Icarus, 274, 33-36. [8] Mills F. P. et al. (2007) Geophys. Monogr. Ser., 176, 73-100. [9] Cockell C. S. (1999) Planetary and Space Science, 47(12), 1487-1501. [10] Limaye S. et al. (2017) EGU General Assembly, 2017EGUGA..19.5913L. [11] Limaye S. S. et al. (2017) Venus Modeling Workshop, 2017LPICo2022.8033L. [12] Schulze-Makuch D. et al. (2004) Astrobiology, 4, 11-18. [13] Lee G. et al. (2016) Lunar and Planetary Science Conference, 2016LPI....47.1688L. [14] Polidan R. S. et al. (2015) AAS/Division for Planetary Sciences Meeting, 2015DPS....4721703P. [15] Venera-D Joint Science Definition Team (2017) Venera-D: Expanding our Horizon of Terrestrial Planet Climate and Geology through the Comprehensive Exploration of Venus, http://www.lpi.usra.edu/vexag/meetings/meetings-of-interest/Venera-D-Report.pdf. [16] Venus Exploration Analysis Group (2016) Goals, Objectives and Investigations for Venus Exploration, http://www.lpi.usra.edu/vexag/reports/GOI-Space-Physics-Update-0816.pdf.