

MICROWAVE REMOTE SENSING OF PLANETARY ATMOSPHERES FROM SPACECRAFT: THE 50 YEARS FROM MARINER 2 TO NASA-JUNO

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In November 2012, the world celebrated the 50th anniversary of spacecraft-based exploration of planets and satellites other our own. The first successful interplanetary mission (Mariner 2) included the first spaceborne microwave radiometer for studying planetary atmospheres which measured the 1.3 and 2.0 cm emission spectrum of Venus (also known as the Cytherean spectrum), These measurements, plus accompanying earth-based observations of the centimeter-wavelength spectrum were used to establish early models of the composition and structure of Venus. Shortly thereafter, earth-based measurements of the microwave emission spectrum of Jupiter (also known as the Jovian spectrum) from 1.18 to 1.58 cm were conducted. In both sets of observations, wavelengths near the 1.35 cm water-vapor resonance were selected in hope of detecting the spectral signature of water vapor, but none was found. Thus the question remained, “where’s the water?” The NASA-Juno mission is the first mission since Mariner 2 to carry a microwave radiometer instrument designed specifically for atmospheric sensing. It is expected to finally detect or place limits on the abundance of water in the Jovian atmosphere. An extensive program of laboratory spectroscopic measurements has been conducted to support these studies, and will be also be described.

SPEAKER BIOGRAPHY:

Dr. Steffes received the S.B. and S.M. degrees in Electrical Engineering from the Massachusetts Institute of Technology (MIT), Cambridge, MA in 1977, and the Ph.D. degree in Electrical Engineering from Stanford University, CA, in 1982. His work at Stanford University concentrated on microwave radio occultation experiments using the Voyager and Mariner spacecraft, with specific interest in microwave absorption in planetary atmospheres.

In 1982, Dr. Steffes joined the faculty of Georgia Tech and is currently a Professor of Electrical and Computer Engineering. His research focuses on microwave and millimeter-wave remote sensing of planetary atmospheres and radio astronomy, and has been sponsored by NASA, the NSF, the SETI Institute and by industry. He has been involved with numerous NASA missions, including Pioneer-Venus, Magellan, the Advanced Communications Technology Satellite (ACTS), the High Resolution Microwave Survey (HRMS), and Juno (Jupiter Polar Orbiter), in addition to conducting a 30-year long atmospheric laboratory measurements program supported by the NASA Planetary Atmospheres Program.