Simultaneous Extreme Ultraviolet and Far Ultraviolet Observations of Jupiter Aurora By Galileo Orbiter

Joseph Ajello, Wayne Pryor, Donald Shemansky, Kent Tobiska, Charles Herd, Stuart Stephens, Ian Stewart, John Clarke, Jeremy Gebben, Karen Simmons, William McClintock, Charles Barth and Bill Sandel

In 1996 during the first four orbits of the satellite tour the Galileo Ultraviolet Spectrometer (UVS) (1100-4300 Angstroms) and Extreme Ultraviolet Spectrometer (EUVS) (550-1300 Angstroms performed near-simultaneous observations of the Jupiter aurora in both the north and south polar regions. These observations can be modeled to provide absolute radiance of the aurora from the H2 Rydberg Systems (B, B', B", C, D, D' -->X band systems) and altitude structure of the aurora. The EUVS, which is located on the spinning portion of the spacecraft, has an intrinsically small duty cycle on the aurora oval of approximately 12s per encounter. Nonetheless, the EUVS acquired highly sensitive S/N spectral distribution of the aurora because of the smaller than expected radiation environment, The regression analysis of the emission model employed indicate that the EUV aurora is produced over a range of altitudes corresponding to vertical column abundances of H2 from 10^18 to 10^20 cm-2 (400-800 km altitude above 1 bar level). The UVS spectrum of the far ultraviolet spectrum (FUV), on the other hand, is optically thin in H2 abundance, but highly sensitive to the CH4 column abundance over the wavelength range 1100 -1400 Angstrom. It has been shown by previous spacecraft that the primary auroral particles penetrate to at least the homopause (H2 column abundance - 10^20 cm-2). The vertical column abundance of CH4 absorbers found from a model of the FUV spectrum is found to be near 1x10^ 16 cm-2. The modeled emitted intensity of the auroral source of the EUV and FUV spectra of the H2 Rydberg Systems indicates a spectral radiance of 1 to 4 MR and of H Lyman-alpha of about 200 kR. The total power output at the aurora source of either north or south aurora is - 1 x 10^13 watts. EUV images of Jupiter will be shown in wavelengths of the H2 Rydberg Systems and H Lyman-alpha revealing structure from both the dayglow and aurora. Detailed auroral structure is shown in Hubble Space Telescope support imaging. The Galileo EUV spectra are highly variable from orbit to orbit. The first astronomical observation of the H2(a-b) triplet system in emission is found to define the spectral content of the MUV(middle ultraviolet from 2000-3000 A) aurora. Darkside Jupiter aurora shows an intense spectrum from the H2(a-b continuum). This emission is exclusively excited by low energy electrons and can be used with the H2 Rydberg systems to estimate the energy dependence of the secondary electron distribution. The remainder of the tour will allow a careful study of the secular variation of the UV aurora.