# UV Photoabsorption Cross Sections of CO, $N_2$, and $SO_2$ for Studies of the ISM and Planetary Atmospheres

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We report on high-resolution laboratory measurements of photoabsorption cross sections of simple molecules in the wavelength range 80 to 320 nm. The motivation is to provide the quantitative data that are needed to analyze observations of absorption by, and to model photochemical processes in, the interstellar medium and a number of planetary atmospheres. Because of the high resolution of the spectrometers used, *viz.*, the UV Fourier transform spectrometer at Imperial College, London, and the 6.65-m grating spectrometer at the Photon Factory in Tsukuba, Japan, we can minimize distortion of the spectrum that results when instrument widths are greater that the widths of spectral features being measured. In many cases, we can determine oscillator strengths of individual rotational lines – a unique feature of our work. We also have the ability to study molecules cooled to ~20 K.

**CO**: We have measured band $f$-values for the $A(v')$-$X(v''=0)$ bands of CO with $11 \leq v' \leq 21$ and for the $B(0)$-, $B(1)$-, $E(0)$-, and $E(1)$-$X(0)$ bands. Individual line $f$-values for the $d(7)$-$X(0)$ and $e(4)$-$X(0)$ bands have also been measured. All are seen in FUSE or HST spectra of interstellar clouds in the wavelength range 100 to 160 nm.

**$N_2$**: The strongest band of $N_2$, $c_4'(0) - X(0)$ at 95.9 nm, is also in the FUSE wavelength range and is not blended with CO or $H_2$ features. We measured individual line $f$-values for the lines of this band that could be used to determine column densities, or upper limits, for $N_2$. We have also measured band $f$-values and line widths for a number of the $\sim 100$ bands of $N_2$ in the 80 to 100 nm wavelength region. These bands are important for understanding the temperature density profiles of the atmospheres of Titan and Triton.

**$SO_2$**: Analysis of the UV spectrum of Io and modelling of the chemical composition of, and photochemical processes in, its atmosphere require knowledge of the photoabsorption cross section of $SO_2$ over a wide wavelength range at temperatures from 110 to ~500 K. Our laboratory program is producing such data over the wavelength range 190 to 325 nm with orders of magnituge higher resolving power than previous work.

Our data are available at http://cfa-www.harvard.edu/amdata/ampdata/cfamols.html.

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