Oscillator Strengths for Ultraviolet Lines of Interstellar Atoms and Molecules

S.R. Federman, R.M. Schectman, J. Zsargó, W. Lee, H. S. Polvony, and L.J. Curtis
University of Toledo
J.A. Cardelli
Villanova University
K.L. Menningen and J.B. Stoll
University of Wisconsin - Whitewater

In order to obtain precise oscillator strengths for ultraviolet transitions in atoms and molecules of interest to interstellar studies, several techniques are employed at the University of Toledo. Radiative lifetimes and branching fractions for transitions in S I and Si II were measured using the Toledo Heavy Ion Accelerator [1,2]. The laboratory results for S I [1] were used as the basis for a self-consistent set of f-values for the suite of lines seen in spectra acquired with the Goddard High Resolution Spectrograph on the *Hubble Space Telescope* [3,4]. Our measurements on the Si II multiplet at 1531 Å [2] resolve the discrepancies among earlier f-value determinations. In another set of experiments at the Synchrotron Radiation Center of the University of Wisconsin-Madison, band oscillator strengths for transitions involving the $A\ ^1\Pi$ and $X\ ^1\Sigma^+$ states for CO clarified the situation regarding the appropriate values to use in interstellar work [5].

Our determination of a self-consistent set of f-values for S I lines was based on curves of growth. Accurate laboratory f-values yielded the column density and broadening parameter for S I, and the f-values for other lines were made self consistent by insuring that the results for all lines fell on the curve of growth. This technique was also applied to UV lines in C I [6] and Ni II [7]. For Ni II, because no laboratory data exist for the lines of interest, only relative f-values were obtained. Experiments are now being carried out to rectify this situation. Branching fractions are measured at the University of Toledo and Denison University and lifetimes are obtained at the University of Wisconsin-Madison (see poster of Lawler, Mullman, and Fedchak). In a similar vein, laboratory measurements at the University of Wisconsin were used to provide an absolute calibration of interstellar Co II observations obtained with the *HST* by the University of Toledo[8].

References:

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