Atomic Oscillator Strengths by Emission Spectroscopy and Lifetime Measurements

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Over the last ten years, we have carried out numerous oscillator strength measurements for light elements, such as C, N, O, and Ne [1], as well as heavy elements, such as members of the Fe-group. Most recently we have determined numerous transitions of Mn II [2] and are re-analyzing our earlier Fe II data. For the emission measurements, we have applied a high-current wall-stabilized arc, a high-current hollow cathode and a Penning discharge. The latter two sources were used for branching ratio measurements from common upper levels, while the wall-stabilized arc was operated at atmospheric pressure under the condition of partial local thermodynamic equilibrium, which allows the measurement of relative transition probabilities. Absolute data were obtained by combining the emission results with lifetime data measured by other research groups, especially the University of Hannover, with which we have closely collaborated. This group uses the laser induced fluorescence (LIF) technique. The emission spectra were recorded with the FT 700 vacuum ultraviolet Fourier transform spectrometer at NIST, or for the light elements, with a 2.25m grating spectrometer. The radiometric calibration was carried out with a tungsten strip lamp for the visible part of the spectrum and with a deuterium lamp for the ultraviolet. All measurements were made under optically thin conditions, which were checked by doubling the path length with a mirror-setup [1]. Typical uncertainties of the oscillator strengths are in the range from 15% to 20% (one standard deviation).

References:

See for example,
[1] J. Musielok, J. M. Bridges, J. R. Fuhr and W. L. Wiese, Phys. Rev. A **61,** 044502 (2000); and J. Musielok, E. Pawelec, U. Griesmann and W. L. Wiese, *Phys. Rev. A* **60,** 947 (1999).
[2] R. Kling, R. Schnabel and U. Griesmann, *Ap. J. Suppl.* **134,** 173 (2001).