New Measurements of Doubly Ionized Iron Group Spectra by Fourier Transform and Grating Spectroscopy

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Abstract

We use the unique high resolution vacuum–UV Imperial College Fourier transform spectrometer (FTS) to measure spectra of astrophysically important ions. The IC FTS combines high wavelength resolution (1:10^8) with a broad spectral range from the visible to 135 nm. The new high resolution laboratory spectra are required to fully interpret new astrophysical spectra obtained by the latest generation of spectrographs such as HST/STIS and FUSE. Astronomers urgently require accurate wavelengths, energy levels, line broadening effects and oscillator strengths.

Our measurement program has included many neutral and singly ionized iron group elements (e.g. Cr I, V I & II, Co I & II and Mn I). Difficulties in measuring doubly ionized spectra using an FTS have recently been overcome by a Penning discharge lamp. These ions are particularly important in the analysis of B-type (hot) stars whose spectra they dominate, however existing measurements are in many cases incomplete or inaccurate.

We report new measurements of Co III and Cr III taken with the Imperial College VUV FTS and measurements of Co III taken with the normal incidence vacuum (grating) spectrograph at the National Institute of Standards and Technology, below 135 nm. We report the completion of measurements of Fe III, with new grating spectra to complement our FT spectra. Work towards transition wavelengths, energy levels and branching ratios (which, combined with lifetimes, produce oscillator strengths) for these and other doubly ionized iron group elements is presented.

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