Laboratory Fourier transform spectroscopy for astronomers' special requests

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We have exploited the high resolving power and excellent wavenumber accuracy of our visible/ultraviolet Fourier transform (FT) spectrometers not only for systematic studies to update the old, inaccurate and incomplete database for the astrophysically important transition element spectra (see [1] for the most recent summary of this work) but also to provide answers to specific questions posed by astronomers on a 'one-off' basis. This activity started a decade ago with a refutation of suspicions that measurements of the solar boron abundance were affected by a weak iron line [2] . It continued with two separate sets of measurements on weak Fe, Ni, Co and V lines blended with the Th II line used in the thorium-neodymium stellar chronometer. In the second set the hyperfine structure of the Co line was evaluated, and the gf-value of the weak intercombination V line was measured and shown to be significantly higher than predicted [3]. In recent years our laboratory spectra have been used in conjunction with GHRS spectra from Hubble Space Telescope to determine isotopic abundances in chemically peculiar stars for Pt [4] and Pb. FT spectra of Au, Tl and Hg from our colleagues in Lund have been used for the same purpose. Our most recent specifically requested measurements, on the resonance lines of Mg I and II, have had the entirely different purpose of establishing very accurate rest wavelengths for comparison with high quality ground-based recordings of quasar spectra with high red shifts; the object of this comparison is to establish whether there are significant space-time variations of the fine-structure constant.

Although not all of our efforts to provide data for specific problems have been successful, we are open to requests of limited scope that do not diverge too far from our main programme and that match the capabilities of our FT spectrometers. These may be summarised as follows: resolving power of up to 1.5 million from the visible region into the VUV (present limit about 1400 Å), wavenumber accuracy 0.001 to 0.005 cm^{-1} (10-50 m s^{-1}), depending on line strengths, and relative intensities with uncertainties from 5%, again depending on line strengths and spectral region.

References:

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