STUDIES OF IRON MONODEUTERIDE, FeD, VIA LASER EXCITATION SPECTROSCOPY AND DISPERSED FLUORESCENCE SPECTROSCOPY

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Iron monohydride, FeH, is an important astrophysical molecule observed in the cool outer layers of stellar atmospheres. It has a strong magnetic response, which leads to pronounced Zeeman splitting of its spectral lines. Such splitting is observed in spectra of FeH taken above sunspots on the Sun, where magnetic fields are strong. Therefore, a thorough understanding of the structure of FeH and of its Zeeman response provides a way to make excellent measurements of the Sun's magnetic field in the region of sunspots.

The parent isotopologue FeH has been extensively studied, notably by the group of J. M. Brown (see J. Chem. Phys. **121** (2004) 7335 and references therein). However, the deuterated isotopologue, FeD, has received scant attention. We have undertaken a series of experiments on FeD, which we create from the reaction of Ar+D_2 discharge products with iron pentacarbonyl, $Fe(CO)_5$. The FeD molecules are probed with light from a scanning cw ring dye laser with laser excitation spectroscopy. Furthermore, with the laser frequency fixed to excite a single upper-state level we also dispersed the fluorescence at high resolution with a Bomem Fourier transform spectrometer. We have been able to characterize 5 excited electronic states of FeD for the first time. The new data greatly extend our understanding the FeH/FeD system as a whole.