Spectropolarimetry of the FeH molecule in the near-IR

G. Dobrev[1,2], A. Pashov[1], P. Crozet[2], and A. Ross[2]

[1] *Faculty of Physics, Sofia University, 5 J. Bourchier Blvd, 1164 Sofia, Bulgaria*
[2] *Institut Lumière Matière, UMR5306 Université Lyon 1 – CNRS, Université de Lyon, 69622 Villeurbanne CEDEX, Farnce*

Presenting Author: g_dobrev@phys.uni-sofia.bg

We present experimental data for the $F^4\Delta$–$X^4\Delta$ transition frequencies and effective Landé factors of the FeH molecule in the near-infrared, prompted by the interest in transition metal monohydrides arising from the identification of such molecules in the spectra of cool stars and sunspots[1–4]. Iron hydride is good remote magnetic field probe due to its strong Zeeman response[5] and its relatively high abundance in the cold stellar atmosphere layers. The complex electronic structure resulting from mixing between sextet and quartet states makes theoretical work very difficult, so that accurate predictions of spectral signatures is impossible. Whence the need for laboratory measurements. FeH molecules are produced in a hollow cathode sputtering source in a H_2 + Ar gas mixture discharge. A tunable cw Ti:sapphire laser is used to excite the 0-0 band near 989 nm and 1-0 band near 890 nm of the $F^4\Delta$–$X^4\Delta$ system in FeH and the laser-induced fluorescence signal is recorded. A permanent magnet introduced into the source provides a homogenous magnetic field where the laser and molecules interact. The magnetic field is calibrated to 0.5% accuracy from the Zeeman response of metasable Ar atomic lines. The measurements without magnetic field allow us to refine wavenumbers for low J transitions predicted in the FeH atlas[2]. We have also recorded Zeeman patterns extending the previous laboratory investigations [6,7].

References

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