PROBING THE ZEEMAN EFFECT IN LOW-Ω $F^4\Delta \leftarrow X^4\Delta$ TRANSITIONS IN FeH

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This work targets laboratory studies of the Zeeman effects in selected transitions of the FeH radical, observed in the atmospheres of dwarf stars. The $F \leftarrow X$ electronic system falls around 1 μm, and matches observation windows of the high-resolution spectropolarimeters SPIRou (brought into service in 2019) and ESPaDOnS mounted at the Canada-France-Hawaii Telescope. Many field-free line positions have already been reported for this radical from laboratory studies, notably from high-temperature sources[ab].

Our earlier work with a sputter source[c] yielded information on magnetic response for just a few transitions between the two lowest spin components of the F and X states. We report here some preliminary results obtained from FeH formed in reaction between hydrogen atoms (generated in a microwave discharge of H_2 in argon) and traces of iron pentacarbonyl vapour, at pressures around 1 Torr. This source[d] seems to produce more population in the $X\,^4\Delta_{3/2}$ and $X\,^4\Delta_{1/2}$ components of the ground state. Laser excitation of [1-0] transitions, with lock-in detection of fluorescence in the [1-1] band to eliminate laser scatter, has allowed some Zeeman-broadened profiles to be measured.

[a] Line intensities and molecular opacities of the FeH $F^4\Delta_i \leftarrow X\,^4\Delta_i$ transition; Dulick *et al*; Astrophys. J., 594, 651-63, (2003)

[b] The near-Infrared Spectrum of the FeH Molecule; Phillips *et al*; Astrophys. J. Supp. Ser., 65, 721-78, (1987)

[c] Determination of Landé factors in the $F\,^4\Delta_{\frac{5}{2},\frac{7}{2}}$ state of FeH by laser excitation spectroscopy; Crozet *et al.*; J. Mol. Spectrosc., 303, 46-53, (2014)

[d] Detection of the free radicals FeH, CoH and NiH by far IR laser magnetic resonance; Beaton *et al.*; J. Chem. Phys. 89, 4446-48, (1988)