# Zeeman spectroscopy of NiH : Landé factors for three Ω =3/2 electronic states

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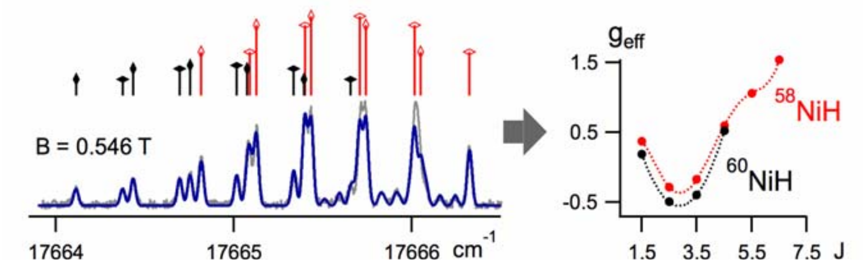
We present some results of laser excitation spectroscopy used to study Zeeman patterns in three excited states of NiH, in the region 17000 – 18000 $cm^{-1}$. The excited states of NiH are difficult to label as $^{2S+1}\Lambda_{\Omega}$ states because of extensive mixing occurring between many close-lying states coming principally from the $Ni^{+}$ $3d^{8}4s^{1}$ configuration [1]. The consequence of this mixing is some irregularity in ro-vibrational levels, seen in zero-field spectra and noted in earlier work (see for example refs. [2-4]). It is also revealed in the magnetic response of the ro-vibrational levels of these states, where the Zeeman response can vary quite sharply for example with vibrational excitation. Working with magnetic fields up to 0.7 Tesla, we have extended earlier work on the Zeeman effect in NiH [5,6] (focused essentially on the stronger transitions to the Ω = 7/2 and 5/2 states in this energy region) to some Ω' = 3/2 states, where we observe some strong variations with J and with parity, and, in one case, a sensitivity to Ni isotope substitution.




*Detail of the $Q_{fe}(2.5)$ 1-0 $D(\Omega=3/2)\leftarrow X_1\,^2\Delta_{5/2}$ line, and the electronic Landé factor, $g_{eff}$ for some J' levels of the D[17.6] electronic state showing variation with J' and Ni isotope.*

Analysis led us to revisit and refine the earlier literature values [5] for the $X_1\,^2\Delta_{5/2}$ ground state Landé factors to determine effective electronic Landé factors for several Ω=3/2 electronic states. These observations provide evidence for extensive mixing between electronic states and deviation from Hund's case (a) coupling.

We also report polarization dependent discrepancies between experimental and theoretical spectral intensities [7]. This raises some questions as to how best to apply parameters derived from this type of laboratory work to the analysis of stellar observations, where line profiles are observed, rather than fully resolved structures.

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