Fourier transform spectra of collisionally induced fluorescence following isotopically selective laser excitation of NiH at ∼550 nm has allowed us to locate an exited $\Omega' = 1/2$ state of NiH lying 17900 cm$^{-1}$ above the electronic ground state. We identify this as $v = 0$ of a $^2\Pi_{1/2}$ state, originating from the Ni$^+$ 3$d^8$4$s^1$ 2$^F$ configuration, from the ab initio studies published by Zou and Liu in 2007$^b$. Emission from the [17.9]0.5 state occurs to $v'' = 0$ and 1 of the $^2\Sigma^+$ and $^2\Pi_{1/2}$ low-lying ligand field states, locating hitherto elusive $^2\Pi_{1/2}$ f parity levels to within 0.01 cm$^{-1}$.

Collisionally induced fluorescence following laser excitation at lower energies has been recorded in the presence of a magnetic field (0.7 − 1 Tesla), at Doppler resolution. The partially resolved Zeeman patterns have been used to derive effective Landé factors $g_J$ for the $v = 0$ and 1 levels of the low-lying $\Omega'' = 5/2$ and 3/2 states ($^2\Delta$ and $^2\Pi$ states from Ni$^+$ 3$d^9$). These are compared with predictions from a revised fit of zero-field energy levels, now including the new observations concerning the $\Omega'' = 1/2$ states.

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