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An analytical model of Faraday rotation in hot alkali metal vapours

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We report a thorough investigation into the absorptive and dispersive properties of hot caesium vapour, culminating in the development of a simple analytical model for off-resonant Faraday rotation. The model, applicable to all hot alkali metal vapours, is seen to predict the rotation observed in caesium, at temperatures as high as 115 $^{\circ}$C, to within 1% accuracy for probe light detuned by greater than 2 GHz from the D_{2} lines. We also demonstrate the existence of a weak probe intensity limit, below which the effect of hyperfine pumping is negligible. Following the identification of this regime we validate a more comprehensive model for the absorption and dispersion in the vicinity of the D_{2} lines, implemented in the form of a computer code. We demonstrate the ability of this model to predict Doppler-broadened spectra to within 0.5% rms deviation for temperatures up to 50 $^{\circ}$C.

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