HIGH RESOLUTION SPECTROSCOPY OF ZrN: THE (0,0) BAND OF THE $A^2\Pi - X^2\Sigma^+$ TRANSITION

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The $A\ ^2\Pi$ - $X\ ^2\Sigma^+$ (0,0) band of ZrN between 5620 and 5890 Å has been studied using laser induced fluorescence, wavelength resolved fluorescence, and laser polarisation spectroscopy. All the 12 branches expected from a $^2\Pi$ - $^2\Sigma$ transition have been observed and assigned. Severe perturbations in the $A\ ^2\Pi_{3/2}$ substate have been found. These perturbations were found at different J values for different isotopes. For ^{90}ZrN, the perturbations at J = 4.5 and 8.5 of the e level and at J = 8.5 and 18.5 of the f level of the Λ-doubling components of the $A\ ^2\Pi_{3/2}$ substate. The most probable perturbing state responsible for giving rise to those perturbations is a non-degenerate $^4\Sigma^-$ state. In addition, other degenerate perturbations found at J = 39.5, 4.5 and 56.5 are consistent with a $^2\Delta$ state being the perturbing state. The vibrational dependence and the negative sign of the spin-rotation parameter γ observed in the ground state could arise from the interaction between the $X\ ^2\Sigma^+$ with unobserved $^2\Pi$ states of open-shell electronic configuration. Least squares fittings have been performed to obtain accurate molecular constants of the $X\ ^2\Sigma^+$ state.