PERTURBATIONS OF THE FINE AND HYPERFINE STRUCTURE IN THE PURE ROTATIONAL SPECTRUM OF VCl ($X^5\Delta_r$)

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The pure rotational spectrum of the VCl ($X^5\Delta_r$) radical has been measured using millimeter/sub-mm-wave direct absorption methods. This work is the first pure rotational study of this molecule. Vanadium chloride was produced in a plasma created by an AC discharge of gas-phase VCl_4 and argon. Ten rotational transitions each of the ^{35}Cl and ^{37}Cl isotopomers have been measured for all five spin-orbit components, confirming the $^5\Delta_r$ ground state. Lambda doubling is observed in four of the five Ω ladders, including the Ω = 0 ladder, which had not been observed previously. Each fine structure component was found to exhibit hyperfine splittings due to the ^{51}V nuclear spin (I = 7/2). The fine structure pattern of the spin-orbit ladders suggests that the ground state is perturbed with the Ω = 1 ladder significantly shifted with respect to the overall pattern. In addition, the hyperfine structure of the Ω = 1 and 2 ladders becomes highly irregular for certain rotational transitions. Rotational, spin-orbit, spin-spin, lambda-doubling, and hyperfine parameters have been determined from the spectra, and the results will be discussed.