HIGH RESOLUTION LASER SPECTROSCOPY OF THE [15.45]0 – \( \alpha^3\Delta_1 \) TRANSITION OF TANTALUM MONONITRIDE, TaN

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Heavy polar molecules have been used for some time in experiments designed to measure the permanent molecular electric dipole moment, EDM, that is induced by the electron electric dipole moment, eEDM. More recently, \(^{181}\)TaN has been proposed\(^b\) as a prime candidate for experiments to measure the EDM induced by the magnetic quadrupole moment, MQM, of the nucleus. There have been a number of calculations to predict these quantities and hyperfine structure parameters are useful indicators of the quality of the electronic wavefunctions used in these calculations with the low-lying \( \alpha^3\Delta_1 \) state being of particular interest\(^cd\). High resolution Laser Induced Fluorescence (LIF) spectra of the 0-0 band of the [15.45]0 – \( \alpha^3\Delta_1 \) transition of TaN have been obtained using the laser ablation source at Arizona State University. Tantalum hyperfine structure was completely resolved and magnetic and quadrupole hyperfine parameters were determined and, where available, have been compared with predicted values. Calculations of the molecular hyperfine constants using atomic hyperfine parameters have been used to determine the nature and configurations of the electronic states.

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