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Radiative lifetimes of the $4^1\Sigma_g^+$ state of Na_2 NADEEPA JAYASUNDARA, LUTZ HWEL, Wesleyan University, SETH ASHMAN, Providence College — We present both experimental and calculation results for lifetimes of some ro-vibrational levels of the Na_2 $4^1\Sigma_g^+$ shelf state. Ground state Na_2 molecules in a mild supersonic molecular beam are excited to populate the selected ro-vibrational levels in the $4^1\Sigma_g^+$ state using double resonance excitation via the intermediate $A^1\Sigma_u^+$ state. Then, the excited molecules are ionized from a delayed Nd:YAG laser and the generated ions are detected in a linear time-of-flight mass spectrometer. By changing the probe laser delay, lifetimes are extracted for individual ro-vibrational levels. The lifetimes of each ro-vibrational level were calculated using the LEVEL 8.2 and BCONT programs by Robert Le Roy, the latter in a version modified by Brett McGeehan. We find that radiative lifetimes of the $4^1\Sigma_g^+$ state vary with vibrational level, mainly around the shelf region. Furthermore, we observe a strong oscillatory radiative lifetime variation with rotational levels for fixed vibrational levels. We also offer an explanation for the unusual rotational level dependence which might exist, according to our reasoning, in other electronic states with a shelf or double wells.

Nadeepa Jayasundara
Wesleyan University

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