LIFETIMES OF THE $\tilde{A}$ STATES OF C_3

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Fluorescence lifetimes have been measured for 66 Π_u and 16 Σ_u^+ vibronic levels of the $\tilde{A}^1\Pi_u$ state of C_3 under nearly collision-free conditions. The vibrational levels studied were v_1=0−5, v_2=0−22, and v_3=0−4, covering the energy range up to 6000 cm^{-1}, and for most of them only the R(0) line was investigated. The measurements are estimated to be accurate to better than ±3 ns. General features of the lifetimes are as follows: Pure bending levels with Π_u-symmetry have shorter lifetimes (as short as 190 ns). With increasing excitation of the stretching vibrations, the lifetimes increase. Bending excitation generally reduces the lifetimes, though exceptions occur for v_1=1. Levels with $v_1+v_3 \geq 3$ or with vibrational energy greater than 4000 cm^{-1} have lifetimes longer than 300 ns; some of these levels even have a long-lived component with a lifetime of up to several microseconds. This implies that the predicted dark states, ($\tilde{B}^1\Sigma_u^-$ and $\tilde{B}'^{\,1}\Delta_u$), lie at least 4000 cm^{-1} above the 0 0 0 level of the $\tilde{A}$ state. It is interesting to note that most of the Σ_u^+-symmetry levels lying above 4000 cm^{-1} also have lifetimes longer than 300 ns.