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Franck-Condon factor of the A-X(0-0) transition of CaF measured by the saturation of laser-induced fluorescence B.E. SAUER, T.E. WALL, J.J. HUDSON, Blackett Laboratory, Imperial College London, D. CHO, Department of Physics, Korea University, M.G. BOSHIER, Physics Division, Los Alamos National Laboratory, E.A. HINDS, M.R. TARBUTT, Blackett Laboratory, Imperial College London — We describe a method[1] for determining the radiative decay properties of a molecule by studying the saturation of laser-induced fluorescence and the associated power broadening of spectral lines. The fluorescence saturates because the molecules decay to states that are not resonant with the laser. The amplitudes and widths of two hyperfine components of a spectral line are measured over a range of laser intensities and the results compared to a model of the laser-molecule interaction. Using this method we measure the lifetime of the A(v'=0) state of CaF to be $\tau = 19.2 \pm 0.7$ ns, and the Franck-Condon factor for the transition to the X(v=0) state to be $Z = 0.987^{+0.013}_{-0.019}$. In addition, our analysis provides a measure of the hyperfine interval in the lowest-lying state of A(v'=0), $\Delta_e = 4.8 \pm 1.1$ MHz. A Franck-Condon factor close to 1 opens the possiblity of implementing a cycling transition with a small number of additional repump frequencies. We discuss possible schemes of laser cooling CaF or other alkaline earth monofluorides.

[1]T. E. Wall et al., Phys. Rev. A **78**, 062509 (2008)

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