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Femtosecond Dynamics of Non-Resonant Dissociative Ionization

ROY ANUNCIADO, LUTZ HUWEL, Wesleyan University — With the aid of molecular beam and a linear time-of-flight (TOF) spectrometer, we have studied Na^+ production in non-resonant multi-photon ionization of Na_2 using 355 nm and 532 nm photons. Flight time spectra reveal several processes from our spectra with photofragment energies of Na^+ ranging from 0-1.32eV. Three processes were identified: (i) 3-photon ionization followed by 1-photon dissociation; (ii) 2-photon dissociative excitation followed by 1-photon ionization of electronically excited fragments (4s, 3d, 4p), and (iii) dissociative autoionization along doubly excited state converging to the repulsive $1^2\sum_u^+$ state of Na_2^+. Dynamics in case (iii) involves competition between electronic (autoionizing) and nuclear (dissociative) degrees of freedom. We were able to generate model Rydberg potential curves and utilize it in our simulation to fit our experimental data since the shape of these Rydberg potentials are not known. Position dependent autoionization lifetimes, $1/\,\Gamma(R)$, are parametrically incorporated in our model, as are appropriate fragment angular distributions[1] for the various processes, and laser polarization and power dependence. Results of our modeling based on our analysis and experimental approach will be presented.

[1]Dixon, R., J.Chem.Phys. 122, 194302 (2005)

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