IDENTIFICATION OF PHOTOFRAGMENTS FROM ONE-COLOR RESONANTLY-ENHANCED (\(\tilde{A} - \tilde{X}\)) MULTI-PHOTON PHOTODISSOCIATION OF ACETYLENE

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One-color (212-220 nm) multi-photon photodissociation of acetylene, resonantly enhanced by the \(\tilde{A}(S_1) - \tilde{X}\) transition, gives rise to strong photofragment fluorescence signals in the visible and near UV regions. In this work, fluorescence signals from the photofragments, generated with three intermediate \(S_1\) levels (\(\text{trans} 3^1\), \(\text{trans} 5^1\), and \(\text{cis} 3^1\)), are studied, both in the flow cell and supersonic jet conditions. In the flow cell (\(\sim 3\) torr), the dispersed fluorescence (DF) spectra of the photofragments are obtained. For all three \(S_1\) levels, we observe \(C_2\) Swan band (\(d^3\Pi_g - a^3\Pi_u\)) and \(C_2\) Deslandres-d’Azambuja band (\(C^1\Pi_g - A^1\Pi_u\)) emissions, with the former approximately four times more intense than the latter. In the supersonic jet condition (collision-free), fluorescence time-traces at selected wavelength regions are analyzed. We confirm the presence of the two \(C_2\) emission bands and their relative intensity observed in the DF spectra. In the supersonic jet condition, we also observe long lifetime visible fluorescence signal (>3 \(\mu\)s lifetime), which is likely due to emissions from \(C_2\) fragment, based on previous vacuum UV photolysis studies of acetylene. The photodissociation mechanism is inferred, based on our analysis of the flow cell DF spectra and the fluorescence time-traces obtained in the supersonic jet condition. The \(C_2\) fragment is likely generated from one-photon photodissociation of \(S_1\) acetylene, and an additional photon dissociates the \(C_2\) fragment into the \(C_2\) \(C\) and \(d\) states.