FULLY STATE-RESOLVED PHOTODISSOCIATION OF FORMALDEHYDE: $H_2CO \rightarrow H + HCO$. $K$-CONSERVATION AND A RIGOROUS TEST OF STATISTICAL THEORIES

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The photodissociation dynamics of the reaction $H_2CO + h\nu \rightarrow H + HCO$ have been investigated in the range 60-400 $cm^{-1}$ above the reaction threshold. Supersonically-cooled formaldehyde was excited into 15 specific $J$, $K_a$, $K_c$ rotational states in two vibrational levels $2^1 4^1 6^1$ and $2^2 4^1$ in the $\tilde{A}(^1A_2)$ state. The laser induced fluorescence spectra of the nascent HCO fragment provided detailed product state distributions (PSDs), resolved by $N$, $K_a$, $K_c$ and $J$. When just the overall molecular rotation, $N$, is considered the PSDs are in remarkable agreement with calculations based on phase space theory (PST). However, when the projection of $N$ onto the molecular frame ($K_a$, $K_c$) is included the distributions show consistent deviations from PST. In particular, there is a tendency to preserve the initial parent rotational motion about the $a$ and $b$ axes. The effect is that states with higher initial $K_a$ in $H_2CO$ produce higher final $K_a$ in the HCO fragment. There is also a tendency for the upper/lower members of the asymmetry doublets in $H_2CO$ to map onto the same upper/lower set of product state asymmetry doublets. Finally, there are oscillations in some of the detailed PSDs that remain unexplained.