High-resolution anion momentum imaging study of the threshold dynamics of dissociative electron attachment to NO_2

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Dynamics near the molecular dissociation threshold can be complicated, if several close-lying electronic states or nuclear motions in multiple freedoms are involved. Experimental studies on this issue are frequently frustrated, due to low cross sections and demanding a high energy resolution to distinguish the manifold internal-energy distributions. Using the high-resolution anion velocity map imaging technique, here we report a dynamics study of the dissociations of anionic nitrogen dioxide in the low-lying resonant states formed by electron attachment [$e^- + NO_2$ (X^2A_1) $\rightarrow NO_2^- \rightarrow$ NO($X^2\Pi$) + O^-(^{2}P)]. The long-term puzzling issues about near-threshold dissociations of NO_2^- are settled in the present work. With help of theoretical computations, we suggest that three low-lying resonant states ($^1B_1$, $^3B_1$, $^3B_2$) of NO_2^- contribute to the O^- productions for the electron attachment energies less than 5 eV. Furthermore, B_1 and B_2 symmetries of the resonant states lead to different anisotropies of the O^- angular distribution. At the relatively high electron attachment energies, a prompt fragmentation in the molecular bent conformation competes with an indirect dissociation in the straightened conformation.

References:

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