Intermolecular Coulombic decay knows no bounds

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Electronically excited atoms and molecules could relax by emitting photons. An excited atomic ion with an inner-shell vacancy could relax via Auger decay. In many cases, the excess energy in the ions with inner-shell vacancy is insufficient for Auger-electron emission. Even for such excited species an interesting relaxation channel opens up when they are embedded in a weakly-bound environment. Electronically excited molecules in a weakly-bound environment could dispose of the excess energy by ionizing their neighbours. Since the excitation decays via Coulombic interactions between the excited molecules and their neighbours, this non-local analogue of Auger decay is called Intermolecular Coulombic Decay (ICD). Following its prediction in 1997 [1], numerous exciting experiments measured ICD in bound systems, such as Van der Waals and hydrogen bonded clusters [2]. In this talk, we will discuss such studies on ICD in bound systems.

Recently, we observed that ICD is not limited to only bound systems and could be efficient even in unbound environments of a certain class of molecules, namely, \pi-molecules. We discuss our experiments involving excitation of pyridine molecules with photons and electron-impact and see how the results reveal an ICD which is enabled by photoassociation [2]. We will also discuss how this new process could also enable the growth of molecules in the interstellar space. I am grateful to the co-authors of Ref. [3] for their invaluable contributions to this work.

References:

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