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Interatomic Coulombic decay in ion-impact collisions: a theoretical perspective

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Interatomic Coulombic decay (ICD) is a non-local, radiationless de-excitation process that has garnered widespread interest owing to its ubiquity, its intriguing nature, and its relevance for applications. Predicted in 1997 [1], it was first observed in photoexcited neon clusters and has, over the course of the years, been demonstrated in a large number of systems, including atomic and molecular clusters, liquids, and quantum dots, and in different variants [2]. In its simplest form, ICD is initiated by the removal of an electron from an inner valence shell, provided the excited state created has insufficient energy for a fast Auger-Meitner decay process. In an isolated atom, such a state decays by photon emission, but in a cluster the excitation energy can be transferred to a neighbour where it is used to remove an electron. The latter is the reason for the applied interest in ICD, since (low-energy) electrons are able molecular bond breakers, i.e., adept at inflicting damage to surrounding matter.

In this talk, I will focus on ion-impact-induced ICD in ostensibly simple systems such as neon and argon dimers. I will provide an overview of the experimental evidence for ICD in theses systems and discuss our recent theoretical work [3] aimed at shedding light on the existing data and providing clues for worthwhile future studies.

[1] L. S. Cederbaum et al., Phys. Rev. Lett. 79, 4778 (1997).
[2] T. Jahnke et al., Chem. Rev. 120, 11295 (2020).
[3] T. Kirchner, J. Phys. B 54, 205201 (2021); D. Starko and T. Kirchner, submitted.

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Keyword-2

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Keyword-3

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