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Electron-driven reactivity of molecular cations in cold plasmas

Zsolt J. Mezei[1], Jeoffrey Boffelli[2], Riyad Hassaine[2], Fréderic Gauchet[2], Nicolina Pop[3], Felix Iacob[4], Sebastian Niyonzima[5], Michel Douglas Epée Epée[6], Kalyan Chakrabarti[7], Ousmanou Motapon[6], Jonathan Tennyson[8], Ioan F. Schneider[2]

[1] *Institute for Nuclear Research (ATOMKI), Hungary*
[2] *Université Le Havre Normandie, France*
[3] *Politehnica University Timisoara, Romania*
[4] *West University of Timisoara, Romania*
[5] *Université du Burundi, Bujumbura, Burundi*
[6] *University of Douala, Cameroon*
[7] *Scottish Church College, Kolkata, India*
[8] *University College London, UK*

Electron impact recombination, (ro-)vibrational, electronic and dissociative excitation of molecular cations:

$$AB^+ + e^- \to AB \to \begin{array}{l} A + B \\ AB^+ + e- \\ A + B^+ + e^- \end{array}$$

are in the heart of the molecular reactivity in the cold ionized media [1], being major charged particles destruction reactions and producing often atomic species in metastable states, inaccessible through optical excitations. They involve super-excited molecular states undergoing predissociation and autoionization, having thus strong resonant character.

The methods based on the Multichannel Quantum Defect Theory (MQDT) [1,2] are the most suitable for modeling these processes, since they account the strong mixing between ionization and dissociative channels, open – direct mechanism – and closed – indirect mechanism, via capture into prominent Rydberg resonances correlating to the ground and excited ionic states - and the rotational effects. These features will be illustrated for several cations of high astrophysical, planetary atmosphere and fusion edge plasma relevance, such as H_2^+ [3], BeH^+ [4-6], SH^+ [7], N_2^+ [8], NeH^+, NS^+ [9], N_2H^+ [10], C_2H^+, etc.

Comparisons with other existing theoretical and experimental results, as well as the isotopic effects, will be displayed.

References

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Presenting Author Email Address: *mezei.zsolt@atomki.hu*