Electron-driven reactivity of molecular cations in cold plasmas

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

\[
AB^+ + e^- \rightarrow AB \rightarrow AB^+ + e^- \rightarrow A + B^+ + e^- 
\]

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$_2$H$^+$ [10], C$_2$H$^+$, etc.

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

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