ELECTRON INDUCED REACTIVITY OF MOLECULAR CATIONS: FROM MECHANISMS TO NEW STATE-TO-STATE CROSS SECTIONS AND RATE COEFFICIENTS

J. Zs. Mezei[a,b]1, E. Djuissi[b], A. Abdoulanziz[b], C. Argentin[b], F. Iacob[c], N. Pop[d], A. Orban[a], K. Chakrabarti[e], D. Talbi[f] and I. F. Schneider[b]

[a] *Institute for Nuclear Research, Hungarian Academy of Sciences, H-4001 Debrecen, Hungary*

[b] *LOMC, CNRS, Normandie Université, Le Havre, 76056 Le Havre, France*

[c] *West University of Timisoara, 300223 Timisoara, Romania*

[d] *Politehnica University of Timisoara, 300223 Timisoara, Romania*

[e] *Dept. Of Mathematics, Scottish Church Collage, 700006 Kolkata, India*

[f] *LUPM, CNRS, Université de Montpellier, 34095 Montpellier, France*

Electron-impact dissociative recombination, ro-vibrational (de)excitation and dissociative excitation of molecular cations are at the heart of molecular reactivity in the cold ionised media [1], being major molecular ion destruction reactions, and producing often atomic species in metastable states, inaccessible through optical excitation.

$$AB^+ + e^- \rightarrow AB^{*,**} \rightarrow \begin{cases} A + B \\ AB'^+ + e^- \\ A + B^+ + e^- \end{cases}, \quad (1)$$

These processes involve super-excited molecular states undergoing pre-dissociation and autoionization, having thus strong resonant character. We use methods based on Multichannel Quantum Defect Theory and R-Matrix Theory [2],

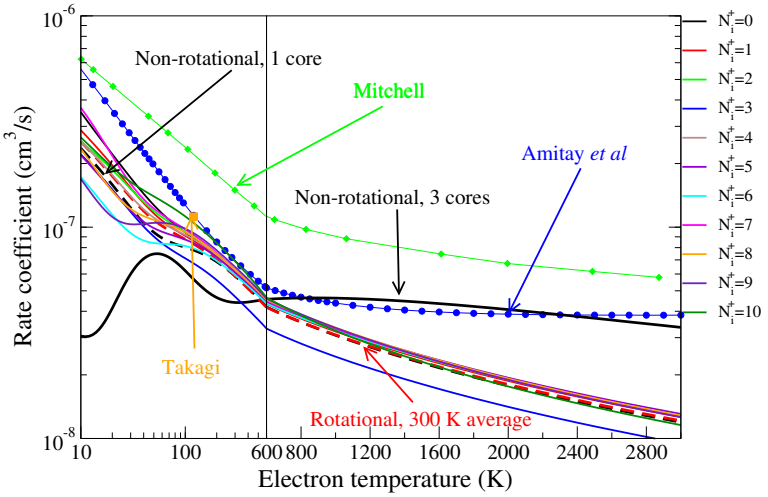

Figure 1: Maxwellian rate coefficients for dissociative recombination of vibrationally relaxed $CH^+(N_i^+)$ with electrons as functions of the kinetic temperature. Our results are compared with the experimental results of Amitay *et al* [8] and Mitchell [9] and with the theoretical results of Takagi [10].

capable to account for the strong mixing between ionization and dissociative channels, open - direct mechanism - and closed - indirect mechanism, via capture into prominent Rydberg resonances [3]

[1] mezei.zsolt@atomki.hu

correlating to the ground and excited ionic states, and for rotational effects. These features as well as isotopic effects will be illustrated for several cations of high astrophysical and planetary relevance such as H_2^+ and HD^+ [3], CO^+ [4], SH^+ [5], CH^+ [2,6], N_2^+ [7], N_2H^+. Comparisons with other existing theoretical and experimental results will be also given.

Acknowledgement: This work was supported by the National Research, Development and Innovation Fund of Hungary, under the project no. FK132989.

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