Electron-driven molecular processes in the edge plasmas of fusion devices: new state-to-state cross sections and rate coefficients

J. Zs. Mezei[1,2], J. Boffelli[2], E. Djuissi[2], A. Abdoulanziz[2], N. Pop[3], F. Iacob[4], S. Niyonzima[5], M. D. Epée Epée[6], V. Laporta[7], K. Chakrabarti[8], O. Motapon[6], D. Reiter[9], J. Tennyson[10], and I. F. Schneider[2,11]

[1] *Institute for Nuclear Research (ATOMKI), Debrecen, Hungary*
[2] *Lab. Ondes et Milieux Complexes, CNRS, Université du Havre, France*
[3] *Dept. of Phys. Foundation of Engineering, Politehnica University Timişoara, Romania*
[4] *Physics Faculty, West University of Timişoara, Romania*
[5] *Dépt. de Physique, Université du Burundi, Bujumbura, Burundi*
[6] *Dept. of Physics, Faculty of Sciences, University of Douala, Cameroon*
[7] *Istituto per la Scienza e Tecnologia dei Plasmi, CNR, Bari, Italy*
[8] *Dept. of Mathematics, Scottish Church College, Calcutta, India*
[9] *Inst. for Laser and Plasma Physics, Heinrich-Heine-University, Düsseldorf, Germany*
[10] *Dept. of Physics and Astronomy, University College London, United Kingdom*
[11] *Lab. Aimé Cotton, CNRS, Université Paris-Saclay, Orsay, France*

Dissociative recombination, elastic scattering, (ro-)vibrational excitation, vibrational de-excitation and dissociative excitation [1]:

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

are dominant elementary processes in numerous cold ionized gases. Here N^+/v^+ stand for the rotational/vibrational quantum numbers of the cation, AB^* for a bound excited (mostly Rydberg) state of the neutral, and AB^{**} for a dissociative (mostly doubly- or multiply-excited) state of the neutral.
The quantum interference between the direct mechanism - capture into the doubly-excited states AB^{**} - and the indirect one - temporary capture into a Rydberg state AB^* - induces resonances in the cross section.
The Multichannel Quantum Defect Theory (MQDT) [1, 2] is the most suitable approach for these processes, efficiently handling channels - open for the direct process and closed for the indirect one - and the corresponding channel mixing via electronic and vibronic interactions. We will provide new cross sections and rate coefficients for H_2^+, and isotopologues [3, 4, 5], BeH^+ and isotopologues [6, 7, 8], and N_2^+ [9].

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