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14 eV Resonant Processes in e-H_2 scattering

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Domain : Low Energy Electron Molecule Interactions

Extensive cross section calculations and measurements have been devoted in the past decades to the study of the dissociative electron attachment (DEA) and resonant vibrational excitations (RVE) occurring through the formation of the intermediate H_2^- ion in its ground $^2\Sigma_u^+$ or first excited $^2\Sigma_g^+$ state. These two states give rise to the well known 3.75 eV and 10 eV resonance peaks in the measured DEA cross sections. The underlying processes have been well described and the experimental data successfully reproduced by many different models. Quite different is the situation for the so-called 14 eV peak appearing in the experimental observations [1]. The origin of this peak is, to date, not yet understood, and has been attributed to the H_2^{-*} $^2\Sigma_g^+$ excited ion state correlating with $H^-(1s^2)$ and $H(n=2)$ atomic states [1]. In order to contribute to the clarification of the 14 eV process, but also to provide information on resonant processes involving H_2^{-*} ion, which may have some role in plasma systems, we present in this communication local potential cross section calculations for the processes

$$H_2(X^1\Sigma_g^+, v_i = 0, j = 0) + e \rightarrow H_2^{-*}(^2\Sigma_g^+) \rightarrow H^-(1s^2) + H^*(n = 2) \qquad DEA$$
$$H_2(X^1\Sigma_g^+, v_i = 0, j = 0) + e \rightarrow H_2^{-*}(^2\Sigma_g^+) \rightarrow H_2(X^1\Sigma_g^+, v_f, j = 0) + e \qquad RVE$$

Comparison with the experimental data for both processes will be discussed.

[1] G. J. Shultz, Review of Modern Physics, vol. 45, 423 (1973).