Elastic and electronically inelastic scattering of electrons by methane

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Methane is an important molecule since is used in manufacturing techniques that involve low-temperature plasma processing and was observed in the interstellar medium. Therefore, its interactions with low-energy electrons are relevant both from the technological and astrophysical points of view. Although these interactions have been extensively studied throughout the years, there still is a gap in the literature regarding electronically inelastic electron scattering cross sections for methane. Here, we present the integral and differential cross sections for the elastic channel and for the excitation from the ground state to the 1^3T_2 and 1^1T_2 electronically excited states of methane. These cross sections were calculated with the Schwinger multichannel method implemented with *norm-conserving* pseudopotentials within the scope of the minimal orbital basis for single configuration interaction approach. We considered a total of 181 open channels and 9464 configuration state functions in the scattering calculations. To evaluate if this configuration space was describing the polarization effects of the target in a proper manner we also perform an elastic calculation where the target is described at a full single configuration interaction level. The influence of the multichannel coupling effect is observed in all cross sections, that is, as the number of open channels increases in the scattering calculations the magnitude of the cross sections decreases, as expected, due to flux competition between the accessible channels. In our results for the elastic channel, we observe that the inclusion of channel coupling in the scattering calculations improves the agreement with the experimental data, specially for higher impact energies.

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