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FITTING OF ELECTRON COLLISION CROSS SECTIONS FROM SWARM DATA USING A GENETIC ALGORITHM

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Abstract. The fitting of cross sections to swarm data has a central role in obtaining complete and consistent sets of cross sections (cs) needed in plasma physics modelling. While this method allows obtaining complete and consistent cs sets, the solution is not univocal and the fitting process is tedious and time-consuming. For these reasons, several authors have tested automated methods for this problem, with a particular emphasis on neural networks (Morgan 1991, Stokes 2020). In the present work, we follow a different approach, combining a *genetic algorithm* (GA) algorithm complemented with an *evolution strategy* (Beyer 2002), with the solution of the electron Boltzmann equation using a finite elements method and assuming a density gradient expansion. The validity of this method is studied for a model gas, and we find a very good agreement between the model transport coefficients and those from the optimized cs set, confirming the suitability of genetic algorithms to this problem. Additionally, the method can estimate a statistical uncertainty for the cs fitting parameters. The method is then applied to a real case: The fitting of methane cross sections considering vibrational polyad levels.

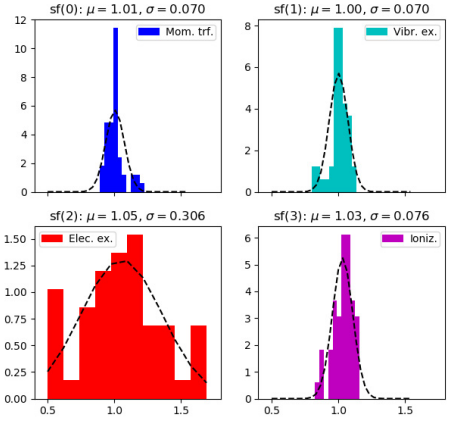

Figure 1: Distribution of fitting parameters for the four cs obtained in several iterations.

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