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Benchmarking the Kinetic Global Model framework (KGMf): EEDF evaluations in low-temperature argon plasmas*

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Global (volume-averaged) models present valuable tools in predicting macroscopic plasma behavior and giving the ability to evaluate the importance of individual reactions in plasmas, which further helps identify the key reactions for spatial-dependent simulations[1]. The Kinetic Global Model framework (KGMf) was extended and coupled with a Boltzmann equation solver, BOLOS[2] (using two-term spherical approximation) and MultiBolt[3] (multi-term spherical approximation), to self-consistently compute electron energy distribution function (EEDF). By capturing the temporal evolution of EEDF, the KGMf enables fidelity of the results even for dynamic systems at a cost of a higher computational complexity. Adaptive EEDF evaluations are imperative to preserve the advantage of the global model while maintaining the accuracy of the solutions. Using the low-temperature argon plasma chemistry at high pressure, we compared different methods of controlling the EEDF evaluation frequency depending on changes of plasma parameters, e.g. electron density or electron temperature. The impact of individual parameters on the temporal evolution of discharge parameters is presented in terms of selected parameter values and computational time. The results are also compared to the simulation results obtained by ZDPlasKin with BOLSIG+[4].

- [1] G. M. Parsey, Ph.D. thesis, Michigan State University, (2017).
- [2] A. Luque, https://pypi.python.org/pypi/bolos, (2004).
- [3] J. Stephens, J. Phys. D: Appl. Phys. 51, 125203 (2018).
- [4] G. J. M. Hagelaar and L. C. Pitchford, Plasma Sources Sci. Technol. 14, 722-733 (2005).

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