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Benchmarking of particle-in-cell simulations with Monte Carlo collisions using LXcat data M.M. TURNER, N. HANZLIKOVA, Dublin City University, Ireland, D. EREMIN, T. MUSSENBROCK, Ruhr University, Bochum, Germany, A. DERZSI, Z. DONKO, Hungarian Academy of Sciences, Budapest, Hungary — As a direct solution of the Boltzmann equation, particle-in-cell simulation potentially yields highly accurate descriptions of low-temperature plasma. However, this accuracy is realised only with correct implementation and appropriately chosen numerical parameters. Particle-in-cell simulation is a computationally intensive procedure. Consequently, efficient implementations that take full advantage of the resources of modern computer hardware are highly desirable. Such hardware typically offers some degree of parallelisation, such as is found in multi-cored processors and graphical processing units. Implementations exploiting these facilities can be orders of magnitude faster than traditional serialized approaches. However, parallelisation introduces a great increase in algorithmic complexity, and thereby intensifies concerns about correct implementation. In this report we describe a suite of benchmark calculations for particle-in-cell simulations, making use of LXcat cross section data. These bench marks have three aims: (1) to demonstrate correct implementation (2) to facilitate performance comparisons of different implementations and (3) to provide a baseline for other simulation methods. We will discuss the benchmarks, which include measurements of plasma kinetic properties, transport coefficients and discharge simulations, together with the results obtained from a variety of particle-in-cell implementations.

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