Fast numerical tools and methods for plasma accelerator design

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Developed by experts of laser-plasma interaction and high performance computing, the Particle-in-Cell code Smilei [1] is used by a rapidly growing international community.

The code is used as a platform for plasma physics research, including plasma acceleration, to develop advanced parallel computing techniques [2, 3, 4] and to teach plasma and plasma acceleration physics.

Figure 1: Laser Wakefield Acceleration with ionization injection.

Recent developments and projects in progress with the code towards increasingly faster and accurate plasma acceleration simulations will be described. In particular, the averaged tunnel ionization module for relativistic regimes [5], the Perfectly Matched Layer boundary conditions and the task programming parallelization [4] integrated also in the code's envelope module will be presented.

An overview and recent applications of faster plasma acceleration simulations performed with Smilei will be presented as well, as data-driven accelerator optimization and analysis.
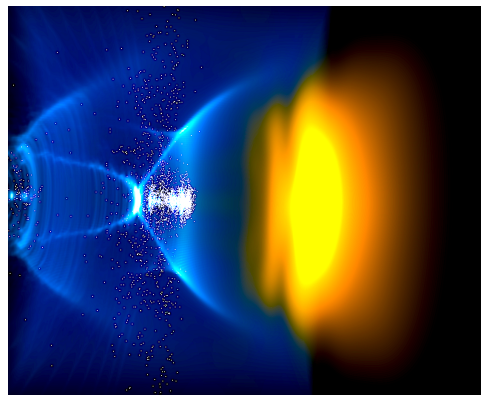
References

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