

## P2.2027 The open-source PIC code SMILEI: Physics modules & HPC capabilities

*Tuesday, 9 July 2019 14:00 (2 hours)*

See the full abstract here

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.2027.pdf>

SMILEI [1] is an open-source, collaborative Particle-In-Cell (PIC) code co-developed by plasma physicists and high-performance computing (HPC) specialists. This poster presents the current status of the project with a special focus on (i) the physics modules available and (ii) the HPC developments and its performance on the latest super-computer architectures.

Used by laser-plasma physicists and astrophysicists, the code benefits from a wide range of physics modules: arbitrary-angle tightly-focused laser injection, binary collisions, field and collisional ionization, QED processes in strong electromagnetic fields (inverse Compton scattering, Breit-Wheeler pair production), etc. Running in 1D, 2D and 3D cartesian geometries, the code also benefits from a quasi-cylindrical geometry with the electromagnetic fields decomposed on azimuthal modes, as well as from an envelope model for the propagation of laser pulses, e.g. for laser-wakefield acceleration.

On the HPC side, strong efforts have been made in terms of hybrid MPI-OpenMP parallelization including dynamic load balancing, and more recently on the development and implementation of an adaptive SIMD (vectorization) strategy [2].

[1] Derouillat et al., SMILEI: A collaborative, open-source, multi-purpose particle-in-cell code for plasma simulation, *Comp. Phys. Comm.* 222, 351 (2018); [www.maisondelasimulation.fr/smilei](http://www.maisondelasimulation.fr/smilei).

[2] Beck et al., Adaptive SIMD optimizations in particle-in-cell codes with fine-grain particle sorting, <https://arxiv.org/abs/1810.03949>.

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**Presenter:** GRECH, M. (EPS 2019)

**Session Classification:** Poster P2

**Track Classification:** BPIF