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## HiPACE++: GPU-accelerated modeling of plasma wakefield accelerators

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Modeling plasma wakefield accelerators is computationally challenging. Using cost-reducing algorithms like the quasi-static approximation allows for efficient modeling of demanding plasma wakefield accelerator scenarios. In this work, the latest highlights of the performance-portable, 3D quasi-static particle-in-cell (PIC) code HiPACE++ [1] are presented. The code applies modern HPC practices like a performance-portability layer, standard I/O formats, continuous integration, and is open-source (<https://github.com/Hi-PACE/hipace>). HiPACE++ demonstrates orders of magnitude speed-up on modern GPU-equipped supercomputers in comparison to its CPU-only predecessor HiPACE. Therefore, HiPACE++ enables fast and accurate modeling of challenging simulation settings, including the proton-beam-driven accelerator AWAKE [2] or certain positron acceleration schemes.

[1] S. Diederichs, et al. "HiPACE++: A portable, 3D quasi-static particle-in-cell code", *Computer Physics Communications* 278 (2022): 108421.

[2] E. Gschwendtner (AWAKE Collaboration), "AWAKE, The advanced proton driven plasma wake-field acceleration experiment at CERN", *Nucl. Instrum. Methods Phys. Res., Sect. A* 829 (2016), 76.

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