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## Symplectic Particle-in-Mode Algorithms for Modeling Plasma Accelerators

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Conventional particle-in-cell methods for modeling plasma accelerators are prone to a variety of numerical instabilities and artifacts which can make them unreliable for long simulations. This is due to two issues: a lack of fidelity in the dispersion of the electromagnetic field update, and grid heating. We present a new class of algorithms, symplectic particle-in-mode (sympIM) algorithms, which are not subject to either of these artifacts. This makes sympIMs suitable for modeling long plasma stages with high fidelity.

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