CALDER: a versatile PIC code suite
for high-intensity laser-plasma interaction

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CALDER is a multi-dimensional, relativistic Particle-In-Cell code [1] developed for more than a decade at CEA, DAM, DIF to model laser-plasma interactions and particle acceleration at high laser irradiance [2]. Specifically written for massively parallel platforms, it is routinely used for large 2D and 3D simulations on hundreds to thousands of cores. The code versatility is constantly increased and this presentation will first focus on recent numerical - such as the accommodation of irregular domain decomposition, high-order form factors, and improved test-particle handling - and physical developments - including elastic collisions and field ionization. Reduced models derived from CALDER, and coupling to particle- and radiation-transport (MCNP, CMC) and hydrodynamic (ESTHER) codes have also been developed over the years. Together, they form a powerful suite of tools that has been validated by comparison to a large experimental database.

We will next illustrate the capabilities of these numerical codes with examples borrowed to:
- electron wakefield acceleration to multi-GeV energies and X-ray radiation from these particle beams,
- laser propagation through long coronal plasmas, in situations relevant to fast ignition and to multi-MeV particle and radiation source production,
- interaction with and heating of mass-limited targets under variable contrast conditions,
- ion acceleration in laser - thin-foil interaction, and the prospect of isochoric heating with these laminar ion beams.

References

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