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# MicPIC perspectives on light-matter interactions in strongly-coupled systems

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A key challenge in modelling laser-driven strongly-coupled plasmas is to properly resolve both microscopic and macroscopic phenomena. Atomic collision processes require angstrom spatial resolution, whereas the macroscopic length scale is determined by the wavelength of the incident light. For example, modelling the complete dynamics of a near-infrared laser pulse driving a solid-density plasma requires to resolve about four orders of magnitude in space (from angstrom to micron) and to trace about $10^{10}$ classical particles, in combination with radiation and laser propagation. In this talk, I present an overview of the microscopic particle-in-cell (MicPIC) approach whose parallel implementation, designed for large-scale distributed computations, can fulfill all of these demands. Parallel MicPIC is an important step toward a better understanding of the links between the atomic-scale origin of optical phenomena and their observable manifestations. Our ultimate goal is to bring a complete description of light-matter interactions in strongly-coupled systems that includes all the relevant physics, from atomic dynamics to wavelength-scale phenomena, like scattering and diffraction.

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