SIMULATING ELECTRON-ION DYNAMICS IN RELATIVISTIC ELECTRON COOLERS

D.L. Bruhwiler, Tech-X, Boulder, Colorado

Abstract

Novel electron-ion collider (EIC) concepts are a high priority for the long-term plans of the international nuclear physics community. Orders of magnitude higher luminosity will be required for the relativistic ion beams in such accelerators. Electron cooling is a promising approach to achieve the necessary luminosity. The coherent electron cooling (CEC) concept proposes to combine the best features of electron cooling and stochastic cooling, via free-electron laser technology, to cool high-energy hadron beams on orders-of-magnitude shorter time scales*. In a standard electron cooler, the key physical process is dynamical friction on the ions. The modulator section of a coherent cooler would be very similar to a standard cooler, but in this case dynamical friction becomes irrelevant and the key physics is the shape of the density wake imprinted on the electron distribution by each ion. We will present results using the massively parallel VORPAL framework for both particle-in-cell (PIC) and molecular dynamics (MD) simulations of electron-ion collisions in relativistic coolers and CEC modulators.

* V.N. Litvinenko, I. Ben-Zvi, M. Blaskiewicz, Y. Hao, D. Kayran, E. Pozdeyev, G. Wang, G.I. Bell, D.L. Bruhwiler, A.V. Sobol *et al.*, FEL Conf. Proc. (2008), in press.

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