Abstract Submitted
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Hamiltonian and Lagrangian dynamics of charged particles including the effects of radiation damping[1] HONG QIN, Princeton University and University of Science and Technology of China, JOSHUA BURBY, RONALD DAVIDSON, NATHANIEL FISCH, Princeton University, MOSES CHUNG, Ulsan National Institute of Science and Technology — The effects of radiation damping (radiation reaction) on accelerating charged particles in modern high-intensity accelerators and high-intensity laser beams have becoming increasingly important. Especially for electron accelerators and storage rings, radiation damping is an effective mechanism and technique to achieve high beam luminosity. We develop Hamiltonian and Lagrangian descriptions of the classical dynamics of a charged particle including the effects of radiation damping in the general electromagnetic focusing channels encountered in accelerators. The direct connection between the classical Hamiltonian and Lagrangian theories and the more fundamental QED description of the synchrotron radiation process is also addressed. In addition to their theoretical importance, the classical Hamiltonian and Lagrangian theories of the radiation damping also enable us to numerically integrate the dynamics using advanced structure-preserving geometric algorithms. These theoretical developments can also be applied to runaway electrons and positrons generated during the disruption or startup of tokamak discharges.

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