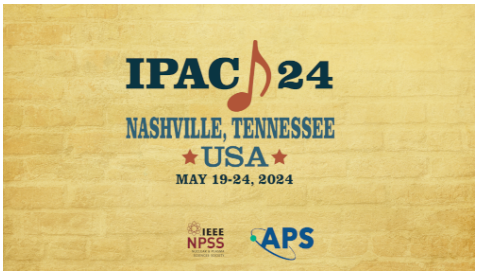

Contribution ID: **478** Contribution code: **MOPS12** Type: **Poster Presentation**

Axially symmetric McMillan map based on e-lens

Monday, 20 May 2024 16:00 (2 hours)

In this work, we investigate the transverse dynamics of a single particle in a model integrable accelerator lattice, based on a McMillan axially symmetric electron lens. Although the McMillan e-lens has been considered as a device potentially capable of mitigating collective space charge forces, some of its fundamental properties have not been described yet. The main goal of our work is to close this gap and understand the limitations and potential of this device. It is worth mentioning that the McMillan axially symmetric map provides the first-order approximations of dynamics for a general linear lattice plus an arbitrary thin lens with motion separable in polar coordinates. Therefore, advancements in its understanding should give us a better picture of more generic and not necessarily integrable round beams. We classify all possible regimes with stable trajectories and provide set of canonical action-angle variables, along with an evaluation of the dynamical aperture, Poincare rotation numbers as functions of amplitudes, and spread in nonlinear tunes. We show that there are three fundamentally different configurations of the accelerator optics causing different modes of nonlinear oscillations. Each regime is considered in great detail, including the limiting cases of large and small amplitudes. In addition, we analyze the dynamics in Cartesian coordinates and provide a description of observable variables and corresponding spectra.

Footnotes

Funding Agency

Paper preparation format

Region represented

North America

Primary author: ZOLKIN, Timofey (Fermi National Accelerator Laboratory)

Co-authors: CATHEY, Brandon (Fermi National Accelerator Laboratory); NAGAITSEV, Sergei (Brookhaven National Laboratory (BNL))

Presenter: ZOLKIN, Timofey (Fermi National Accelerator Laboratory)

Session Classification: Monday Poster Session

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D02 Nonlinear Single Particle Dynamics Resonances, Tracking, Higher Order, Dynamic Aperture, Code Developments