ACCELERATOR SEMINAR

Discussion of Phase Space and Emittances

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Generation and transport of magnetized beams are crucial components of the electron cooler design for JLEIC, and are subjects of active research at Jefferson Lab. It turns out that using magnetized beam is just one example of a larger class of schemes of phase space manipulation, including round-to-flat transformation and emittance exchanges. These recent developments of beam phase space manipulation have significantly extended the conventional understanding of beam emittances, and brought about many new possibilities of machine design and new challenges. The goal of this tutorial is to introduce these new advances, by showing how they were built upon the fundamental phase space concepts and properties.

The tutorial begins with the origin of phase space concept in Hamiltonian mechanics, and its application in single particle dynamics in accelerators. The discussion then moves on from dynamics for a single particle to that for a bunch of particles, and the characterization of the phase space distribution and the corresponding symplectic transport properties. Notions of canonical emittance and its relation with the normalized and geometric emittances are highlighted. With a brief sketch of mechanisms for emittance dilution and mitigation method, we show that electron cooling is one of the advanced mitigation method for emittance dilution, and using magnetized beam for electron cooling has many advantages. This is followed by discussion of many non-conventional features of a magnetized beam, the challenges brought about for computer simulations, and the relation of magnetized beam to a larger class of phase space manipulation.

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10:00 a.m.
CEBAF Center, Room F113

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For further info, please contact Carlos Hernandez-Garcia at x6862.