



Contribution ID: 1369 Contribution code: WEPL067

Type: **Poster Presentation**

## Field-adapted coordinate transformations for rotating and accelerating beams

*Wednesday, 10 May 2023 16:30 (2 hours)*

Many accelerators employ axisymmetric structures, such as RF cavities, induction cells, and solenoids, to accelerate and transport charged particle beams. To analyze the motion of the beam in solenoids, it is common to make a transformation to the rotating Larmor frame. In the presence of an electric field, this transformation can be modified to obtain further simplifications in the equation of motion. In this paper, we explore the use of a complex Larmor phase to simplify the equations of motion in the presence of simultaneous axial electric and magnetic fields, such as those found in the induction cells of a linear induction accelerator (LIA). We also analyze the corresponding envelope equation and find that the natural emittance in this frame can be expressed in terms of familiar quantities.

### Funding Agency

U.S. Department of Energy, Contract No. DE-AC02-76SF00515

### Footnotes

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Yes

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**Session Classification:** Wednesday Poster Session

**Track Classification:** MC5: Beam Dynamics and EM Fields: MC5.D01: Beam Optics Lattices, Correction Schemes, Transport