Contribution ID: **141** Contribution code: **THPT44** Type: **Poster Presentation**

On Fluid Modelling of Beam Instabilities with Wakefields and Direct Space Charge

Thursday, October 23, 2025 5:10 PM (20 minutes)

In absence of direct space charge, the indirect electromagnetic self-interaction of particle beams via surrounding materials is typically described by wakefields. Beam stability can then readily be assessed in terms of absolute stability of the dipole moment density using linear stability analysis via eigenfunctions, where small density perturbations either decay (stable regime) or exponentially amplify in time and space (unstable regime). Direct space charge is now known to modify these stability conditions by shifting stable parameter regions and providing additional intrinsic Landau damping. Interestingly, direct space charge is observed to add a third type of behaviour with amplified perturbations in space which decay over time (meta-stable regime). Due to the selfconsistent nature of the space charge problem in contrast to the pure wakefield problem, this beam behaviour cannot be captured by absolute linear stability analysis. Fluid dynamics can capture this behaviour, with some explanation provided by Burov in PRAB 2019. We review the details of the hydrodynamic model as a basis to investigate mitigation measures.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Authors: OEFTIGER, Adrian (John Adams Institute); PETERSEN, Kasper Juel (University of Oxford)

Presenter: OEFTIGER, Adrian (John Adams Institute)

Session Classification: THPT poster session

Track Classification: WGA:Beam Dynamics in Rings