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Four unique features of dynamical friction for magnetized and unmagnetized cooling of relativistic hadron beams

Thursday 14 August 2025 16:00 (2 hours)

At energies relevant to electron cooling of future electron-hadron collider designs, the beam-frame interaction time in the cooler becomes short compared to the plasma period. In this regime, the interaction time cannot be taken as infinite for analytic calculations of dynamical friction, and the details of strong scattering with small impact parameter cannot be neglected. Three significant results from previous work (see Refs. *,** and ∗ ∗ *) are presented. In the limit of strongly magnetized beams, dynamical friction depends on the sign of the charge. In this same limit, widely used parametric and semi-analytic formulas break down. For unmagnetized cooling, the impact parameters follow a modified Pareto distribution, such that the central limit theorem does not apply. At early times, the friction force is time-dependent in ways that can be surprising.

Please consider my poster for contributed oral presentation

Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

- G.I. Bell, D.L. Bruhwiler et al., J. Comput. Phys. 227, 8714 (2008). ** A.V. Sobol, D.L. Bruhwiler et al., New Journal of Phys. 12, 093038 (2010). *** I.V. Pogorelov and D.L. Bruhwiler, 13th Workshop on Beam Cooling and Related Topics, 28 (2021).

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