Contribution ID: **543** Contribution code: **SUP036** Type: **Poster Presentation**

Computing spin-polarization in electron storage rings by machine learning via randomized Fourier neural networks

Sunday 10 August 2025 15:00 (3 hours)

Our work addresses the challenge of estimating spin polarization in high-energy electron and positron storage rings, such as the Electron Storage Ring (ESR) of the Electron-Ion Collider (EIC) at Brookhaven National Lab (BNL) and those in the electron/positron Future Circular Collider (FCC-ee) at CERN. We model the spin and orbital motion of particle bunches using the recently introduced spin-orbit Fokker-Planck (SOFP) equation, *a linear time-evolution partial differential equation (PDE). In this paper, we propose a novel machine learning (ML) approach leveraging a randomized Fourier neural network (rFNN) framework**, specifically designed to solve linear PDEs. We will discuss the SOFP highlight its relevance to spin polarization studies, and share preliminary results demonstrating the network's performance on the Poisson problem.

Please consider my poster for contributed oral presentation

No

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

Yes

Footnotes

K. Heinemann, D. Appelo, D. P. Barber, O. Beznosov, and J. A. Ellison. Int. Journal of Mod. Phys. A, Vol. 34, 1942032 (2019). See also: arXiv:2101.08955 [physics.acc-ph] ** O. Davis, G. Geraci, and M. Motamed. To appear in SIAM J. Sci. Comp. (2025). See also: arXiv:2407.11894 [cs.LG].

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I have read and accept the Privacy Policy Statement

Yes

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Track Classification: MC5 –Beam Dynamics and EM Fields