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Computing spin-polarization in electron storage rings by solving the Stochastic ODE system of the bunch particles

Wednesday 4 June 2025 16:00 (2 hours)

Our work focuses on estimating the spin-polarization in high-energy electron/positron storage rings in machines like EIC, FCC-ee and CEPC.
We report on an approach to this problem where spin and orbit motion are modeled by the recently discovered system of stochastic ODEs (*) in the Lab Frame. This captures key effects like radiative depolarization, Sokolov-Ternov effect, Baier-Katkov effect, kinetic polarization effect and intrabeam scattering effect. This work is focused on analyzing the poorly understood correction terms to the Derbenev-Kondratenko formula for the radiative depolarization time. These correction terms describe the so-called uncorrelated resonance crossings which were proposed by Derbenev and Kondratenko in the early 1970s shortly after they proposed the Derbenev-Kondratenko formula. They are of special interest for circular colliders with very high electron energies like the FCC-ee and the CEPC.
This work includes transforming the system of stochastic ODEs in* from the Cartesian lab frame coordinates to accelerator coordinates as summarized for the orbital motion in the Handbook article by Ellison, Heinemann and Mais **.

Footnotes

- K. Heinemann, D. Appelo, D.P. Barber, O. Beznosov, J.A. Ellison, Int. Journal of Mod. Phys. A, Vol. 34, 1942032 (2019). See also: arXiv:2101.08955 [physics.acc-ph] ** Jim Ellison, K. Heinemann, H. Mais. Handbook of Accelerator Physics and Engineering (Third Edition, 2023), pp. 109-113.

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Author: HEINEMANN, Klaus (University of New Mexico)

Co-authors: BARBER, Desmond (Deutsches Elektronen-Synchrotron); ELLISON, James (University of New Mexico); AGUDELO, Jose (University of New Mexico); BEZNOSOV, Oleksii (Los Alamos National Laboratory)

Presenter: HEINEMANN, Klaus (University of New Mexico)

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