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Higher-order spin depolarization analysis

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Current and historic tracking studies of the RHIC accelerator lattice find difficulty in explaining the transmission efficiency of spin polarization from the AGS extraction to
RHIC storage energies. In this paper, we discuss mechanisms that result in resonant depolarizing behavior, beyond the usual intrinsic and imperfection resonance structures. In particular, the focus of this paper will be on higher-order resonances that become apparent in the presence of snakes. The set of conditions that identify higher-order spin-orbit resonances are = + ·for integers (,) ∈ ℤ^4, where is the spin tune and contains the orbit tunes. Note that we do not use the closed-orbit spin tune but rather the amplitude-dependent spin tune (, ,) that depends on the phase-space amplitudes. While Sibrian snakes keep at 1/2, the amplitude-dependent spin tune can deviate from 1/2 and can cross resonances during acceleration.

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Footnotes

- D. P. Barber, J. A. Ellison, and K. Heinemann. Phys. Rev. Spec. Top. Accel. Beams, vol. 7, p. 124 002, 2004. ** G. H. Hoffstaetter, H. S. Dumas, and J. A. Ellison. Phys. Rev. Spec. Top. Accel. Beams, vol. 9, p. 014 001, 2006. *** G. H. Hoffstaetter and M. Vogt. Phys. Rev. E, vol. 70, p. 056 501, 2004. * ***E. D. Courant and R. D. Ruth. Rep. BNL-51270, Sep. 1980.***** T. Roser, et al. Rep. BNL-73650-2005-IR, Mar. 2001.

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