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Non-destructive spin tune measurement of polarized protons in a storage ring

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To maintain polarization in a polarized proton collider, it is important to know the spin tune of the polarized proton beam, which is defined as the number of full spin precessions per revolution. A nine-magnet spin flipper has demonstrated high spin-flip efficiency in the presence
of two Siberian snakes. The spin flipper drives a spin resonance with a given frequency (or tune) and strength. When the drive tune is close to the spin tune, the proton spin direction is not vertical anymore, but precesses around the vertical direction. By measuring the precession frequency of the horizontal component, the spin tune can be precisely measured. A driven coherent spin motion and fast turn-by-turn polarization measurement are keys to the measurement. The vertical spin direction is restored after turning the spin flipper off. The fact that this manipulation preserves the polarization makes it possible to measure the spin tune during the operation of a polarized collider
such as RHIC and EIC.

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Footnotes

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Yes

Primary author: HUANG, Haixin (Brookhaven National Laboratory)

Co-authors: KEWISCH, Jorg (Brookhaven National Laboratory); LIU, Chuyu (Brookhaven National Laboratory); MEOT, Francois (Brookhaven National Laboratory); PTITSYN, Vadim (Brookhaven National Laboratory (BNL)); ODDO, Peter (Brookhaven National Laboratory); RANJBAR, Vahid (Brookhaven National Laboratory); ROSER, Thomas (Brookhaven National Laboratory); SCHMIDKE, William (Brookhaven National Laboratory)

Presenters: HUANG, Haixin (Brookhaven National Laboratory); PTITSYN, Vadim (Brookhaven National Laboratory (BNL))

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