Kondratenko Crossing and Chao Formalism Tests*

R.S. Raymond[1], A.W. Chao[1], A.D. Krisch[1], M.A. Leonova[1], V.S. Morozov[1], D.W. Sivers[1], V.K. Wong[1]; R. Gebel[2], A. Lehrach[2], B. Lorentz[2], R. Maier[2], D. Prasuhn[2], A. Schnase[2], H. Stockhorst[2]; F. Hinterberger[3], K. Ulbrich[3]; A.M. Kondratenko[4]

[1] Spin Physics Center, University of Michigan, Ann Arbor, MI 48109-1120 USA
[2] Forschungszentrum Jülich Institut für Kernphysik, Postfach 1913, D-52425 Jülich
[3] Helmholtz Institut für Strahlen- und Kernphysik, Universität Bonn, Nussallee 14-16, D-53115 Bonn
[4] GOO Zaryad, Russkaya Str.41 Novosibirsk, 630058 Russia

We started investigating Kondratenko's proposed new method to preserve beam polarization during a spin resonance crossing[1]. The method uses 3 rapid changes of the crossing rate near the resonance. Our prediction indicates that, with a proper choice of crossing parameters, Kondratenko crossing may better preserve the polarization than simple fast crossing. We tested Kondratenko's idea using 2.1 GeV/c polarized protons stored in the COSY cooler synchrotron. We swept the frequency of a ferrite rf dipole though an rf-induced spin resonance using the Kondratenko crossing shape. So far, we did not observe any clear advantage of Kondratenko crossing over simple fast crossing. We plan to further study and improve the Kondratenko crossing technique by using a better choice of the crossing parameters and taking into account the beam momentum spread.

We also recently started testing Chao's proposed new matrix formalism for describing the spin dynamics due to a single spin resonance[2]; this seems to be the first generalization of the Froissart-Stora equation since it was published in 1960[3]. The Chao formalism allows one to calculate the polarization's behavior inside a resonance, which is not possible using the Froissart-Stora equation. We tested some Chao formalism predictions using a 1.85 GeV/c polarized deuteron beam stored in COSY. We swept an rf dipole's frequency through 200 Hz while varying the distance from the sweep's end frequency to an rf-induced spin resonance's central frequency. While the Froissart-Stora formula can make no prediction in this case, the data seem to be well-described by the Chao formalism.

---

* This research was supported by grants from the German BMBF Science Ministry.
[1] A.M. Kondratenko et al., Physics of Particles and Nuclei Letters 1, No.5, 266 (2004)
[2] A.W. Chao, Phys. Rev. ST Accel. Beams 8, 104001 (2005)
[3] M. Froissart and R. Stora, Nucl. Instr. Methods 7, 297 (1960)