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Experimental quest for the proton spin structure – past, present and future

HIDETO EN'YO, RIKEN Nishina Center

For the last 20 years there have been many great discoveries made experimentally and theoretically, concerning on the spin structure of the nucleons, the fundamental bound states of the strong interaction. Motivated largely from the “Spin Puzzle,” many experimental plans emerged in early 90th to measure the gluon contribution to the proton spin, by hoping to solve the puzzle with gluons. After more than 10 years, the recent experimental outcomes from RHIC and other polarized deep-inelastic interactions set a stringent limit on the gluon polarization. Although further studies must be continued on the gluons, the simplest solution to the spin puzzle seems to be false, i.e., the spin structure of the proton is much richer than we thought. The scientific focus is now moving to the new direction. Keys are in our own findings on the way, namely, discoveries of finite Collins and Sivers effects and progress on deeply virtual Compton scattering both in theoretical and experimental sides. Based on these new discoveries, we now need to rebuild the long range plan toward the complete understanding of the proton spin structure. Discussions are planned to give the general overview of the past, and to hint future experiments utilizing the existing facilities and the electron ion collider.