国立研究開発法人理化学研究所　仁科加速器研究センター
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Precision measurement of the gluon polarization inside the proton

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The spin of the proton was originally expected to be determined with a sum of the quark polarization which explains the proton's magnetic property. But this idea was denied when the quark structure of the proton was investigated with lepton beams in 1980's. The quark polarization inside the proton was found not to explain the proton spin. This is a big problem of the nuclear physics called "proton's spin puzzle".

In order to solve the problem, the gluon inside the proton has been investigated with the RHIC collider at Brookhaven National Laboratory (BNL) by colliding polarized proton beams at high energies. The gluons inside the protons collide by colliding the protons, and neutral pi mesons are produced. The gluon inside the proton can be investigated by measuring the neutral pi mesons.

We have measured the asymmetry of the neutral pi mesons depending on the orientation of the colliding polarized protons in the PHENIX experiment at RHIC. From 2003 to 2009, we performed experiments at 200 GeV collision energy. The gluon polarization inside the proton can be calculated by using a theory called perturbative QCD (Quantum Chromodynamics), but the measurement cannot give us all the information of all the energy fraction (x) of the gluons. From 2012 to 2013, we performed experiments at 510 GeV collision energy which is the highest energy of the RHIC collider with the largest beam intensity and 55% proton polarization.

Since sensitivity to the lower-x gluons inside the proton can be obtained by using the higher energy, this experiment gave us a measurement of the gluons with the lowest x ever. The experimental data at 510 GeV showed a larger positive asymmetry than that at 200 GeV as predicted by the perturbative QCD calculation. It indicates the perturbative QCD is effective for the low-x gluon and can be utilized for the precision determination of the gluon polarization. This is a great achievement for solving the proton's spin puzzle.

＊ The talk will be given in English language..

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RIBF Hall (rm.201), RIBF bldg., RIKEN

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