Spin in Hypernuclear Physics

Hirokazu Tamura

Department of Physics, Tohoku University, Sendai 980-8578, Japan

Recent experimental progress in hypernuclear physics allows us to investigate physical processes and phenomena related to hyperon spin in hypernuclei. In this talk, three subjects will be discussed.

Structure of hypernuclei provides invaluable information on hyperon-nucleon interactions. In order to study spin-dependence of the ΛN interaction, we have been studying precise structure of Λ hypernuclei by means of γ spectroscopy technique employing a Ge detector array (Hyperball). Using pion and kaon beams at KEK-PS and BNL-AGS, we have investigated most of the p-shell hypernuclei and extracted strengths of each spin-dependent (spin-spin, spin-orbit and tensor) component of the ΛN interaction. The results provide constraints and guidance to theoretical models of baryon-baryon interactions. For example, the very small value of the Λ-spin-dependent spin-orbit interaction strength established by hypernuclear γ spectroscopy data seems to support a quark model rather than meson exchange models

Another interesting subject is the magnetic moment of a Λ in a nucleus, which may be modified from the free-space value. We can measure B(M1) values of Λ-spin-flip M1 transitions in Λ hypernuclei and derive g-factor of a Λ in a nucleus. An experiment of B(M1) measurement in $^{7}{}_{\Lambda}$Li is planned at J-PARC as one of the “Day 1” experiments.

Asymmetry of proton emission from a polarized Λ hypernuclei in the non-mesonic weak decay process (Λp->np) is a key observable to test our understanding of baryon-baryon weak interaction. Improved asymmetry data recently measured at KEK by detecting both neutrons and protons disagree with theoretical predictions, although other observables in the non-mesonic weak decay are reproduced well.