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The K+ scattering on nucleons and nuclei at DAFNE

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Spontaneous breaking of chiral symmetry in the QCD vacuum is thought to be one of the causes of hadron masses. Many experimental challenges have been made to elucidate the mechanism by precisely measuring the hadron mass in nuclear matter, which is expected to be reduced by the partial restoration of chiral symmetry, known as the nuclear matter effect. To date, however, the mechanism has not been clearly identified. Because there is no nuclear resonance state near the K+ and nucleon threshold, K+ can penetrate deeply inside the nucleus. Thus, K+ on nucleon and nucleus scattering data might contain information about the interior of the nucleus, specifically, interactions occurring under the conditions of partially restored chiral symmetry. We are currently preparing a new experimental program with the aim of measuring K+ and nucleon and nucleus scattering to detect evidence of partial restoration of chiral symmetry in nuclear matter. Since low-energy K+ scattering might be sensitive and effective for accessing information inside the nucleus, and furthermore, low-energy K+ scattering data is currently missing, we are proposing to conduct the experiment at the DAFNE facility.
The proposed experiment consists of a Time-Projection Chamber (TPC) as a tracking detector and a Kaon detector to identify the K+ particles. A prototype TPC has been constructed and tested with a positron beam at the Research Center for Electron Photon Science (ELPH), Tohoku University. For the K+ detector, we plan to use almost the same one that is already installed and operational in the SIDDHARTA2 experiment at DAFNE. During the presentation, we will provide detailed information about the physics motivation, the current state of experiment preparation, and the future prospects of the project.

Primary author: OHNISHI, Hiroaki (ELPH, Tohoku University)

Co-authors: Mr TOHO, Kairo (ELPH, Tohoku University); Dr SADA, Yuta (ELPH, Tohoku University)

Presenter: OHNISHI, Hiroaki (ELPH, Tohoku University)

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