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In-flight muon spin resonance and muonium interferometer

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The muon and muonium play a unique role in materials science as a tiny magnetometer and an emulator of hydrogen in matter. However, there are few examples of their application as matter waves. This is because the surface muon and its simple slowing-down in a degrader cannot keep sufficient coherence. Low-energy muons from laser ionization of muonium can be used to obtain slow muonium with small temporal and spatial spread. Like an ordinary atomic interferometer, a muonium interferometer has a variety of potential applications. For example, muonium spectroscopy using interference effects, studies of quantum interference effects such as a measurement of Berry phase, and precise measurements of fundamental constants will be possible using muonium interferometry. In this contribution, we discuss the in-flight spectroscopy of muonium and the potential of muonium interferometry.

Primary author: KANDA, Sohtaro (KEK)

Presenter: KANDA, Sohtaro (KEK)

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