

Status of the ultra-slow muon beamline at J-PARC MUSE

Tuesday 22 August 2023 17:30 (20 minutes)

The ultra-slow muon (USM) beamline at J-PARC MLF MUSE provides a low-energy muon beam through laser ionization of thermal muonium in a vacuum. When a muon beam irradiates a hot tungsten foil at 2000 K, muonium atoms are emitted with an energy of 0.2 eV. The atoms can be ionized by two synchronized laser beams with wavelengths of 122 nm and 355 nm [1]. Low-energy muons with adjustable energies are valuable for materials science of surface and interface. Furthermore, USM is essential for applications requiring low-emittance muons, such as the muon g-2/EDM experiment at J-PARC [2] and transmission muon microscope [3]. The facility consists of an intense surface muon beamline, muonium production target, ionization laser, and transport optics. The commissioning of the USM beamline is in progress and has achieved sufficient beam specifications for muon spin spectroscopy with thin film samples [4]. In this contribution, we will report on an overview of the facility, its present status, and the results obtained from recent commissioning.

[1] K. Nagamine et al., Phys. Rev. Lett. 74, 4811 (1995).

[2] M. Abe et al., PTEP 053C02 (2019).

[3] Y. Miyake et al., Microscopy 67, i3 (2018).

[4] S. Kanda et al., J. Phys. Conf. Ser. 2462, 012030 (2023).

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Session Classification: parallel (room#101)

Track Classification: WG4: Muon Physics