

## Proposal for multi-stage cooling of muon beams

Muons have been widely used as probes in searches for new physics via precision measurements and rare decay searches. Muon sources with a high-intensity proton beam have enabled experiments requiring high statistics. However, techniques for muon cooling with high efficiency are essential for further breakthroughs in searches for physics beyond the Standard Model.

The ultra-slow muon (USM) at J-PARC, the low-energy muon (LEM) at PSI, and the muon ionization cooling experiment (MICE) at RAL are known as muon cooling schemes.

The USM achieves excellent beam quality by laser ionization of muonium, but for high efficiency, it is necessary to improve the spatial overlap between muonium atoms and laser beams. For this purpose, we aim to develop a multi-stage muon cooling technique with LEM as the first stage and USM as the second stage.

In this contribution, we will report on the overview of the project, simulation results, and R&D progress.

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