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Conceptual Design of the Muonium-to-Antimuonium Conversion Experiment (MACE)

The spontaneous conversion of muonium to antimuonium is one of the most interesting charged lepton flavor violating processes, offering a sensitive probe of potential new physics and serving as a tool to constrain the parameter space beyond the Standard Model. The Muonium-to-Antimuonium Conversion Experiment (MACE) is designed to utilize a high-intensity muon beam, a Michel electron magnetic spectrometer, a positron transport system, and a positron detection system, to either discover or constrain this rare process with a conversion probability of $\mathcal{O}(10^{-13})$. In this talk, we will present the physics motivation, the conceptual design, recent progress in detector prototyping and validation, as well as the proposal of MACE Phase-I, which enables broader searches for other muon cLFV decay channels with high precision.

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