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Longitudinally polarized ZZ scattering at the Muon Collider

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Measuring longitudinally polarized vector boson scattering in, e.g., the ZZ channel is a promising way to investigate the unitarization scheme from the Higgs and possible new physics beyond the Standard Model. However, at the LHC, it demands the end of the HL-LHC lifetime luminosity, 3000/fb, and advanced data analysis technique to reach the discovery threshold due to its small production rates. Instead, there could be great potential for future colliders. In this paper, we perform a Monte Carlo study and examine the projected sensitivity of longitudinally polarized ZZ scattering at a TeV scale muon collider. We conduct studies at 14 TeV and 6 TeV muon colliders respectively and find that a 5 standard deviation discovery can be achieved at a 14 TeV muon collider, with 3000/fb of data collected. While a 6 TeV muon collider can already surpass HL-LHC, reaching 2 standard deviations with around 4000/fb of data. The effect from lepton isolation and detector granularity is also discussed, which may be more obvious at higher energy muon colliders, as the leptons from longitudinally polarized Z decays tend to be closer.

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