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Heavy Higgs boson H production at the future multi-TeV muon collider in the context of the $U(1)_{B-L}$ model

The prospects of the Muon Collider promise an unprecedented potential for exploring the particle-physics energy frontier. Furthermore, the physics program from this future collider could provide both high-precision Higgs and Standard Model (SM) measurements and direct production of new particles predicted by various extensions of the SM. With these motivations, we consider the $\mu^+\mu^- \to (Z, Z') \to ZH \to l^\pm l^\mp W^\pm W^\mp$ signal with the subsequent decay of
Z to pairs of $l^\pm l^\mp$ with $l = e, \mu$ and H to pairs of $W^\pm W^\mp$. The projections of new physics at the future muon collider with the benchmark center-of-mass energies of $\sqrt{s} = 3, 4, 5, 6, 7$ TeV and conservative integrated luminosities of $calL_{\rm con} = 1, 2, 3, 4, 10\ {\rm ab}^{-1}$, is of the order of 684 expected events for $M_{Z'} = 7$ TeV, $g_1' = 0.93$, and $calL = 10\,{\rm ab}^{-1}$. This scenario shows that the possibility of performing measurements for the Z' boson and the heavy Higgs boson H is important at the future muon collider. In another scenario, we incorporate $\mu^+\mu^- \to (Z, Z') \to ZH \to l^\pm l^\mp W^\pm W^\mp$ annihilation and Vector Boson Scattering (VBS) rates of $\mu^+\mu^- \to WWZ$ into our study, as well as the Leptonic, Semi-leptonic, and Hadronic channels of the $W^\pm$ for the signal, significant impact the sensitivity of the process.

Secondary track

T08 - Higgs Physics

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