

# Proton-proton and electron-positron colliders in a 100 km ring at Fermilab

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Extending the energy frontier beyond the LHC would be vital to elucidate the nature of electroweak symmetry breaking and whatever new physics that might be found at the LHC. We propose here a proton-proton (pp) collider in a 100 km ring, with center of mass (CM) energy of  $\sim 100$  TeV which would have substantial discovery potential for new heavy

particles and new physics beyond the Standard Model. In the case that LHC experiments have already found exotic resonances or heavy “partner” particles, this collider could fill out the “tower” of resonances (thus e.g. confirming an extra dimension) or the full suite of partner particles (e.g. for supersymmetry). The high luminosity of the new collider would enable unique precision studies of the Higgs boson (including Higgs self coupling and rare Higgs decays), and its higher energy would allow more complete measurements of vector boson scattering to help elucidate electroweak symmetry breaking. We also discuss an  $e^+e^-$  collider in the same 100 km ring with CM energies from 90 to 350 GeV, which would enable precision electroweak measurements up to the  $t\bar{t}$  threshold, and serve as a Higgs factory.

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