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Searching for long-lived light neutralinos at future lepton colliders

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Future lepton colliders such as the Circular Electron Positron Collider (CEPC) and FCC (Future Circular Collider)-ee would run as high-luminosity Z-boson factories, which offer a unique opportunity to study long-lived particles which couple to Z-bosons. We consider the long-lived lightest neutralinos in the R-parity-violating supersymmetry, produced from Z-boson decays, and show the sensitivity limits of not only the near detectors at the CEPC and FCC-ee but also proposed far-detector experiments at these colliders. We find the near detectors at the future Z-factories can outperform the ATLAS experiment at the high-luminosity Large Hadron Collider (LHC) and the proposed LHC experiments with far detectors (AL3X, CODEX-b, FASER, and MATHUSLA), and that new experiments with far detectors at future lepton colliders may extend and complement the sensitivity reaches of the default near detectors.

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