L_μ − L_τ and Nondecoupling SUSY
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Introduction
The radiative contribution of charged sleptons to the γ-Z' kinetic mixing is nondecoupling in the presence of a gauged L_μ − L_τ symmetry.

This striking feature, arising out of the breaking of the enhanced symmetry in the limit of degenerate (s)leptons, can be tested at the BELLE-II e^+e^- collider.

We propose that the γ + E signal at BELLE-II will be a smoking gun for supersymmetry (SUSY). Any significant excess in any but the highest photon energy bin would be a telltale sign of such heavy charged scalars coupling to Z'.

Kinetic Mixing
\[ \epsilon \equiv II(q^2) = \frac{8g_{2Y}}{(4\pi)^2} \int_0^1 x(1-x) \ln \left( \frac{m_{\mu}^2 - x(1-x)q^2}{m_{\mu}^2 - x(1-x)q'^2} \right) dx \]

\[ + \frac{2g_{2Y}}{(4\pi)^2} \int_0^1 (1-2x)^2 \ln \left( \frac{m_{\mu}^2 - x(1-x)q^2}{m_{\mu}^2 - x(1-x)q'^2} \right) dx \]

The Cross Section
The signal process e^+e^- → γZ' with Z' decaying to pp, leading to the final state e^+e^- → γpp,

\[ \gamma = \frac{m_\mu}{m_\mu} \]

3σ exclusions on the hitherto free slepton mass ratio vs. gχ plane

3σ exclusions on the M_{2L} - g_χ plane

Conclusions
Any significant excess in all but the highest photon energy bin would be an undeniable signature of such heavy charged scalars in SUSY coupling to Z'.

The number of signal events depends crucially on the logarithm of the ratio of tau to sneuino mass in the presence of SUSY. In addition, the number is also inversely proportional to the e^+e^- collision energy, making a low-energy, high-luminosity collider like Belle-II an ideal testing ground for this channel.

This process can probe large swathes of the slepton mass ratio vs the additional gauge couplings (g_χ) parameter space. More importantly, it can explore the narrow slice of M_{2L} - g_χ parameter space still allowed in gauged L_μ − L_τ models for superheavy sparticles.