Search for New Physics in Hyperon Decays

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The *HyperCP* collaboration is making high-statistics searches for New Physics in charged hyperon decays using 231 billion events taken at the Fermilab Tevatron. With data samples many orders of magnitude larger than any previously taken, sensitive searches have been made for: exotic sources of CP violation in charged-Ξ and Ω decays; charged lepton-number violation; $\Delta S = 2$ decays; and pentaquarks. We have observed three isolated events consistent with the $\Sigma^+ \to p\mu^+\mu^-$ decay, the rarest yet observed of a baryon. The dimuon mass distribution is unexpectedly narrow, suggesting the decay may proceed via an intermediate state of mass $214 \pm 0.5\,\mathrm{MeV}/c^2$. This state is consistent with a pseudoscalar sgoldstino with parity-conserving interactions decaying into two unlike-sign muons.