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Rare strange decays at LHCb: Observation of the $\Sigma^+ \rightarrow p\mu^+\mu^-$ rare decay and searches for K_S rare decays

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In recent years the LHCb experiment has expanded its physics reach to searches for K_S and hyperon rare decays, and is currently the experiment with the highest yields of reconstructed decays of these particles. Particularly, searches for flavour changing neutral currents have been performed, sensitive to physics beyond the Standard Model. The $K_S \rightarrow \mu^+\mu^-$ and $K_S \rightarrow 4\mu$ have been searched and limits have been put orders of magnitude lower than previous experiments, tightening the space of possible new physics. With Run 2 data the $\Sigma^+ \rightarrow p\mu^+\mu^-$ decay is observed for the first time at the LHCb experiment. The HyperCP experiment years ago presented evidence of this decay with a hint of a possible unknown intermediate particle. This was excluded by LHCb already in 2018. This new measurement presents a highly significant observation, a measurement of the integrated branching fraction and of the dimuon spectrum. This is the rarest baryon decay ever observed. Additionally, the sensitivity of these observables to Chiral Perturbation Theory parameters will be discussed. Finally prospects for additional observables, such as a CP violation measurement, and additional rare strange hadron decays will also be presented.

Secondary track

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