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Precision measurements with Kaons at CERN

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The NA62 experiment at CERN collected the world's largest dataset of charged kaon decays in 2016-2018, leading to the first measurement of the Branching Fraction of the ultra-rare $K^+ \to \pi^+\nu^-\nu$ decay, based on 20 candidates. This provides evidence for the very rare $K^+ \to \pi^+\nu^-\nu$ decay, observed with a significance of 3.4σ. This measurement is also used to set limits on BR($K^+ \to \pi^+$X), where X is a scalar or pseudo-scalar particle. The analysis of the full 2016-2018 data sample and future NA62 plans and prospects are reviewed.
More recent results from NA62 analyses of $K^+ \to \pi^0 e^+ \nu\gamma$, $K^+ \to \pi^+\mu^+\mu^-$ and $K^+ \to \pi^+\gamma\gamma$ decays, using data samples recorded in 2017–2018, are also reported. The radiative kaon decay $K^+ \to \pi^0 e^+ \nu\gamma$ (Ke3g) is studied with a data sample of O(100k) Ke3g candidates with sub-percent background contaminations. Preliminary results with the most precise measurements of the Ke3g branching ratios and T-asymmetry are presented. The $K^+ \to \pi^+\mu^+\mu^-$ sample comprises about 27k signal events with negligible background contamination, and the presented analysis results include the most precise determination of the branching ratio and the form factor. The $K^+ \to \pi^+\gamma\gamma$ sample contains about 4k signal events with 10% background contamination, and the analysis improves the precision of the branching ratio measurement by a factor of 3 with respect to the previous measurements. An overview of the latest NA62 results and the future prospect of the experiment are presented.
The first observation of the decay $K^\pm \to \pi^0\pi^0\mu^\pm\nu$ (K00μ4) by the NA48/2 experiment at the CERN and the preliminary measurement of the branching ratio are also presented. The result is converted into a first measurement of the R form factor in Kl4 decays and compared with the prediction from 1-loop Chiral Perturbation Theory.

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