



Contribution ID: 209

Type: **Parallel session talk**

Search for K^+ decays to a lepton and invisible particles

Tuesday 11 January 2022 17:30 (20 minutes)

The NA62 experiment at CERN reports searches for $K^+ \rightarrow e^+N$, $K^+ \rightarrow \mu^+N$ and $K^+ \rightarrow \mu^+ \nu X$ decays, where N and X are massive invisible particles, using the 2016-2018 data set. The N particle is assumed to be a heavy neutral lepton, and the results are expressed as upper limits of $O(10^{-9})$ and $O(10^{-8})$ of the neutrino mixing parameter $|U_{e4}|^2$ and $|U_{\mu 4}|^2$, improving on the earlier searches for heavy neutral lepton production and decays in the kinematically accessible mass range. The X particle is considered a scalar or vector hidden sector mediator decaying to an invisible final state, and upper limits of the decay branching fraction for X masses in the range 10-370 MeV/c² are reported for the first time, ranging from $O(10^{-5})$ to $O(10^{-7})$.

An improved upper limit of $1.0 \cdot 10^{-6}$ is established at 90% CL on the $K^+ \rightarrow \mu^+ \nu \nu$ branching fraction.

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Session Classification: Neutrino physics

Track Classification: Neutrinos