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Progress on the lattice QCD calculation of the rare kaon decays: $K^+ \rightarrow \pi^+ \nu \bar{\nu}$

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The rare kaon decays $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ are highly suppressed in the standard model and thus provide an ideal place to search for new physics beyond the standard model. These decays are the principal objective of a new experiment, NA62 at CERN. Another new experiment to search for $K_L \rightarrow \pi^0 \nu \bar{\nu}$ is now underway at J-PARC. Given the goal of 10% precision by NA62, it is important to determine the long-distance contributions to the $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ amplitude with a controlled uncertainty. In this talk I will report the progress on the lattice QCD calculation of the long-distance contributions to the $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ decay amplitude, with an emphasis on the treatment of the short-distance divergence in the bilocal operator system.

Authors: Prof. CHRIST, Norman (Columbia University); Dr FENG, Xu (Peking University)

Co-authors: Dr JUETTNER, Andreas (University of Southampton); Mr LAWSON, Andrew (University of Southampton); Dr PORTELLI, Antonin (The University of Edinburgh); Prof. SACHRAJDA, Christopher (University of Southampton)

Presenter: Prof. CHRIST, Norman (Columbia University)

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