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## Investigating Rare Kaon Decays with the All-to-All Method

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The rare kaon decay  $K \rightarrow \pi \ell^+ \ell^-$  is a flavor changing neutral current process which is forbidden at tree level in the Standard Model. The amplitude that describes the long distance part of this decay is given in terms of the form factor  $V(z) = a + bz + V_{\pi\pi}(z)$ , where  $z$  is the dilepton invariant mass in unit of the kaon mass and  $V_{\pi\pi}$  is the long distance two-pion contribution. This decay is currently being measured at the NA62 experiment in CERN. The values of  $a$  and  $b$  are known only through experimental results, though there are large uncertainties associated with them and only the absolute values are known.

I will present preliminary results of a lattice QCD calculation of  $V(z)$  at the physical point using the “All-to-All” method. This method, which has been implemented in the open source C++ framework, Hadrons, can generate arbitrary solutions to the Dirac equation by decomposing propagators into exact low modes of the operator and a stochastically sample high mode contribution.

**Author:** O HOGAIN, Fionn

**Presenter:** O HOGAIN, Fionn

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