LGT4HEP Unit 13 Day 01 Discussion

April 8th, 2025

Briefly read through the following paper on D-meson decays: `https://arxiv.org/abs/2212.12648`. Answer the following questions in your groups.

1. In the Standard Model, the coupling to the W-boson has a $V - A$ structure. Why does only the vector component contribute to pseudoscalar to pseudoscalar decays? Is this also true for a purely leptonic decay, i.e. $\pi \to \ell\nu$? What about in the case for pseudoscalar to vector?

2. The entire analysis, in principle, could be performed by just computing the vector current correlator, which gives us $f_\parallel$ and $f_\perp$. What is the benefit of also computing the scalar current correlator?

3. Figure 10 shows a comparison between ratios constructed from two- and three- point functions to the form factor coming from fits of the spectral decomposition. Why is the result of the fit always higher than the plateau of the ratio?

4. How are each of the chiral expansion parameters in Equation 5.1 defined? What effects do they capture?

5. What are the benefits of using Hard SU(2) χPT?

6. Take a look at the error budget for the continuum form factors. What is the largest source of error?

7. View Figure 31. The determination of $|V_{cd}|$ from $D \to \pi$ and $D_s \to K$ seem to be quite different. What is the source of this?