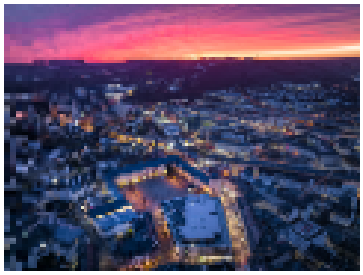

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A look into the $f_0(980)$ through the lens of rare B meson decays

Wednesday 2 October 2024 17:20 (20 minutes)

The nature of many experimentally observed hadronic resonances has been a topic of debate ever since the 1960's. In this work, we focus on studying the $f_0(980)$, the second lightest unflavoured scalar resonance. We comment on the different descriptions for it in the quark model, and focus specifically on the pure $s\bar{s}$ picture. We mainly explore the $B_s^0 \to f_0(980)\mu^+\mu^-$ decay. We analyse the impact of the form factors, which are difficult to determine theoretically. They come from the hadronic matrix element and contain the hadronic information of the decay. Using the framework of the Weak Effective Theory, we utilize Wilson coefficients derived from observables of rare decays with the same quark-level transition, like $B \to K^{(*)}\mu^+\mu^-$, to probe the hadronic nature of the $f_0(980)$, even in the presence of possible New Physics. The effect of different theoretical form factor calculations on several observables is explored in detail. A range for the experimental untagged branching ratio integrated in the $[1, 6]$ q^2 bin (where q^2 is the square of the 4-momenta of the muon pair) is found to be $\mathcal{BR}_{\text{exp}} \in [0.04, 2.11] \times 10^{-7}$, according to the current form factor calculations, which all assume a pure $s\bar{s}$ state. The viability of extracting the form factors from experimental data is also studied, finding that determining one of them from the branching ratio would be possible with good precision.

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