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The Cabibbo angle from inclusive τ decays

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The inclusive hadronic decays of the τ lepton provide an alternative avenue for determining the CKM matrix elements V_{ud} and V_{us} . In this talk, I will present recent results from the ETM Collaboration for the inclusive hadronic τ decay rate, obtained in $N_f = 2 + 1 + 1$ QCD using the novel HLT method. This approach circumvents the well-known inverse Laplace transform problem that hinders this calculation, allowing to obtain first-principles results without relying on the operator-product expansion (OPE) or perturbative QCD. Except for isospin-breaking (IB) effects, all systematic uncertainties are under control. In the $\bar{u}s$ channel we obtain $|V_{us}|_{\tau\text{-latt-incl}} = 0.2189(7)_{\text{th}}(18)_{\text{exp}}$, which reveals a 3σ tension with purely hadronic determinations of $|V_{us}|$. Since this tension can no longer be attributed to the OPE approximation, it prompts a closer examination of experimental uncertainties and highlights the importance of determining IB corrections from first principles. I will briefly present an update on the ongoing status of our calculation of these corrections.

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