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Modelling Quark-Hadron Duality Violation in Inclusive $B \to X_c \ell \bar{\nu}$

The Heavy Quark Expansion (HQE) is the main tool for calculating decay rates and kinematic moments of inclusive semi-leptonic B meson decays. The HQE manifests as an Operator Product Expansion (OPE) in terms of powers of the inverse heavy bottom quark mass ($1/m_b$). Using the HQE, the CKM matrix element V_{cb} has been extracted at percent-level precision from moments of inclusive $B \to X_c \ell \bar{\nu}$ decays. The calculations upon which the theoretical estimates rely are done in terms of quarks and gluons, which are not accessible for experiments. Quark Hadron Duality (QHD) allows for a translation of theoretical predictions at the quark-level to experimental observables at the hadron-level. Due to the increased accuracy in HQE predictions up to $\mathcal{O}(1/m_b^5)$, violation of the QHD may start to become a relevant limit to the achievable precision. When QHD is violated, the OPE stops being a valid expansion. In my talk, I will show how we can derive a model for the Quark Hadron Duality Violation and how it can enter different kinematic moments of the $B \to X_c \ell \bar{\nu}$ decays and consequently affect the inclusive determination of V_{cb}.

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