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Intrinsic Charm and Higher Order $1/m_b$ corrections in inclusive $B \to X_c \ell \bar{\nu}$

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The Heavy Quark Expansion (HQE) has become the major tool to perform precision calculations for inclusive rates and spectra of heavy hadron decays. With this method, the CKM matrix element V_{cb} has been extracted with incredible percent-level precision from moments of the inclusive semileptonic $B \to X_c \ell \bar{\nu}$. The HQE is an expansion in powers of the inverse mass of the heavy quark $1/m_b$ and introduces HQE matrix elements, containing the nonperturbative long-distance effects, which can be extracted from data.

To further increase precision, we have to include even higher order terms in the expansion and therefore we recently pushed the expansion to $1/m_b^5$. We focused specifically on the reparametrization invariant (RPI) dilepton invariant mass q^2 moments of the spectrum, which depend on a reduced set of HQE parameters. Specifically, at dimension eight, i.e. $1/m_b^5$, "intrinsic charm" (IC) contributions proportional to $1/(m_b^3 m_c^2)$ enter, which are numerically expected to be sizeable and therefore interesting for improving the theoretical predictions for $B \to X_c \ell \bar{\nu}$.

In this talk, I will discuss how we determine the RPI HQE parameters at $1/m_b^5$ and briefly review how RPI is employed in inclusive V_{cb} determinations. Furthermore, I will show how the "intrinsic charm" and "genuine" $1/m_b^5$ contribute to the q^2-moments of $B \to X_c \ell \bar{\nu}$. Consequently, I will show that the total $1/m_b^5$ contributions may not be as sizeable as initially expected.

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