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Subleading Shape Functions in Inclusive B Decays GIL PAZ, Cornell University — Inclusive decays of B mesons into final states containing light particles, such as $\bar{B} \to X_u l \bar{\nu}$ and $\bar{B} \to X_s \gamma$ play a prominent role in the extraction of —Vub—. Recently, significant progress has been made by systematically incorporating higher-order perturbative corrections. This leaves power corrections to the heavy-quark limit as the principal source of theoretical uncertainties. In this work, we use Soft Collinear Effective theory (SCET) to perform a systematic study of such power-suppressed effects. At tree level, the results can be expressed in terms of a set of subleading shape functions defined via the Fourier transforms of forward matrix elementsm of bi-local light-cone operators in heavy-quark effective theory. We also identify a new contribution arising from four-quark operators, which was not considered previously. We show that, when shape functions appearing in process-independent combinations are combined into single functions, then a total of three subleading shape functions are required to describe arbitrary current-induced decay distributions of B mesons into light final-state particles. While subleading shape-function effects had been studied in the past, our results do not agree with some of these studies. We present analytical expressions for a variety of distributions in $\bar{B} \to X_u l \bar{\nu}$ which can be used directly for the analysis of experimental data. We also give a formula for the triple differential rate, which allows for arbitrary cuts on kinematic variables. A numerical analysis of the decay distributions suggests that power corrections are small, with the possible exception of the endpoint region of the charged-lepton energy spectrum.

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