

Semileptonic decays of heavy+light and heavy+heavy mesons

Dyson-Schwinger equations (DSEs) is employed successfully to provide a unified explanation for the properties of hadrons with 0 – 3 heavy quarks, viz. from the lightest (almost) Nambu-Goldstone bosons to triply heavy baryons, e.g.. Each semileptonic transition is conventionally characterized by the value of the dominant form factor and we present predictions for transition form factors and decay widths for heavy+light mesons, including $B_{(s)} \rightarrow \pi(K), D_s \rightarrow K; D \rightarrow \pi, K$ and $B_c \rightarrow \eta_c, J/\Psi$. The form factors are a leading source of uncertainty in all such calculations: our results agree quantitatively with available data and provide benchmarks for the hitherto unmeasured $D_s \rightarrow K^0, \bar{B}_s \rightarrow K^+$ form factors. The analysis delivers a value of $|V_{cs}| = 0.974(10)$ and also predictions for all branching fraction ratios in the pseudoscalar meson sector that can be used to test lepton flavour universality. Quantitative comparisons are provided between extant theory and the recent measurement of $\mathcal{B}_{B_s^0 \rightarrow K^- \mu^+ \nu_\mu}$. Here, further, refined measurements would be useful in moving toward a more accurate value of $|V_{ub}|$.

Working with branching fractions calculated from $B_c \rightarrow \eta_c, J/\Psi$, the following values of the ratios for τ over μ final states are obtained:

$$R_{\eta_c} = 0.313(22) \text{ and } R_{J/\psi} = 0.242(47).$$

Combined with other recent results, our analysis confirms a 2σ discrepancy between the Standard Model prediction for $R_{J/\psi}$ and the single available experimental result.

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