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The Dispersion Matrix approach to semileptonic heavy-to-heavy and heavy-to-light B decays

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Semileptonic heavy-to-heavy and heavy-to-light B decays are very intriguing transitions since a long-standing tension affects the inclusive and the exclusive determinations of the CKM matrix elements $|V_{cb}|$ and $|V_{ub}|$. In the former case, another discrepancy exists between the SM expectations and the measurements of the ratios $R(D^{(*)})$, which are a test of Lepton Flavour Universality (LFU). In both cases, a central role is played by the hadronic Form Factors (FFs) describing these decays. Our goal is to re-examine the $b \to c$ and $b \to u$ quark transitions through the Dispersive Matrix (DM) approach, which is based on the non-perturbative determination of the dispersive bounds. It describes in a model-independent way the FFs in the full kinematical range, starting from existing Lattice QCD data at large momentum transfer. From the DM bands we obtain the new SM expectations $R(D) = 0.296(8)$ and $R(D^*) = 0.275(8)$, each of which is compatible with the corresponding average of measurements at the 1.3σ level. The value of $R(D^*)$ corresponds to the use of the recent FNAL LQCD results for the FFs as input for the DM approach. Then, by comparing the DM bands of the FFs with the experiments we obtain $|V_{ub}| = (3.85 \pm 0.27) \cdot 10^{-3}$ from $B \to \pi$ and $B_s \to K$ decays and $|V_{cb}| = (41.2 \pm 0.8) \cdot 10^{-3}$ from $B \to D^{(*)}$ and $B_s \to D_s^{(*)}$ decays. These values are compatible with the inclusive ones and with the indirect determinations from the Unitarity Triangle within the 1σ level.

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