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D/B to $a_0(980)/Pion/\rho/b_1$ transitions from light-cone QCD sum rules and BLFQ

We use light-cone QCD sum rules with chiral currents to study the transition form factors in the semileptonic decay of charmed and bottom scalar mesons, $D/B \rightarrow a_0(980)/Pion/\rho/b_1 + l\nu_l$ ($l = e, \mu$). For this, we consider various distribution amplitudes of the mesons $a_0(980)$, pion, ρ , and b_1 corresponding to different form factors. Our analysis yields several simple relations connecting form factors of these mesons, independent of contributions from their twist-3 light-cone distribution amplitudes. Our results show that the weak decay widths derived using various distribution amplitudes align well with the measurements reported by BESIII. This work also represents our first application of distribution amplitudes from the basis light-front quantization framework to a semileptonic decay process. To support the reliability of this method, we have carefully analyzed decay widths using this approach and aimed to validate the plausibility of the results it produces.

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