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Two-body nonleptonic decays of D, Ds, B and Bs mesons in the factorization approach: Theoretical predictions for heavy-ion physics applications

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Heavy flavor mesons serve as crucial probes of the Quark-Gluon Plasma (QGP) in heavy-ion collisions at RHIC and LHC facilities. Precise theoretical predictions of their decay properties in vacuum are essential baseline measurements for understanding medium modifications in hot QCD matter. Using the factorisation approach, this work presents a comprehensive study of two-body nonleptonic decays of D, Ds, B, and Bs mesons. We calculated branching fractions for 100 decay channels, employing relativistic quark model form factors and mass values of parent particles with Hydrogen-like and Gaussian-like wavefunctions as input. Our results demonstrate good agreement with PDG data and existing theoretical predictions for most channels, validating the factorization framework's effectiveness. The Gaussian wavefunction approach shows particular promise, with branching fraction predictions aligning well with experimental values like PDG. Discrepancies in some channels reflect known limitations of the factorization approximation and highlight the importance of final-state interactions. Our results provide important theoretical benchmarks for collision data and guiding future advancements in computational modelling within the field of QCD matter.

Author: PARMAR, Manakkumar (Sardar Vallabhbhai National Institute of Technology, Surat)

Co-authors: LODHA, Chetan; Dr RAI, Ajay Kumar (Sardar vallabhbhai National Institute of Technology--Surat)

Presenter: PARMAR, Manakkumar (Sardar Vallabhbhai National Institute of Technology, Surat)

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