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On HQET and NRQCD Operators of Mass Dimension 8 and Above

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Effective field theories such as Heavy Quark Effective Theory (HQET) and Non Relativistic Quantum Chromo-(Electro-) dynamics NRQCD (NRQED) are indispensable tools for controlling the effects of the strong interaction. The increasing experimental precision requires the knowledge of higher dimensional operators. These operators are important to the evaluation of decay rates of the B-meson. We present a general method that allows for an easy construction of HQET (NRQED and NRQCD) operators that contain two heavy quark (non-relativistic) fields and any number of covariant derivatives. As an application of our method, we give for the first time all such terms in the $1/M^4$ NRQCD Lagrangian, where M is the mass of the spin-half field. We analyze the general dimension-nine spin-independent HQET matrix element, which was not considered so far in the literature, and calculate moments of the leading power shape function up to and including dimension nine HQET operators.

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