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Operator Basis Construction in Effective Field Theories and Its Applications

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We present a general algorithm—the Young Tensor Method—for systematically constructing complete and independent operator bases in effective field theories. This method is applied to a variety of theories, including the Standard Model Effective Field Theory (SMEFT) and low-energy effective field theories. In the process, we introduce the concept of the J-basis, a generalized partial wave basis that facilitates the study of partial wave unitarity bounds and enables the classification of all possible tree-level ultraviolet (UV) completions of effective operators. Furthermore, by constructing the 4-fermion operator basis in Georgi–Glashow-type models, we investigate dynamical chiral symmetry breaking using the functional renormalization group (FRG) approach.

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