Chiral symmetry and taste symmetry on the eigenvalue spectrum of staggered Dirac operators

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Chirality of HYP-smeared staggered quarks and its matrix elements on Dirac eigenspace are studied. We introduce a new chirality operator and a new shift operator, and show that chiral Ward identities relate them. Leakage is defined as matrix elements between two eigenstates of the staggered Dirac operator, which represents the transition matrix from one eigenstate to the other. Numerical evidence of Ward identities on leakage patterns for the chirality and shift operators is presented. We also show that approximate conservation of taste symmetry appears as a characteristic of leakage patterns of the chirality, which allows us to distinguish would-be zero modes from non-zero modes. The amount of the unphysical leakages indicates the size of the taste symmetry breaking.

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