O($a^2$) cutoff effects in Wilson fermion simulations

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We show that the size of the O($a^2$) flavour violating cutoff artifacts that have been found to affect the neutral pion mass in simulations with maximally twisted Wilson fermions is controlled by a continuum QCD quantity that is roughly proportional to the squared matrix element of the pseudoscalar density operator between the vacuum and the one-pion state. This number is fairly large and it is determined by the dynamical mechanism of spontaneous chiral symmetry breaking. If no other unexpectedly large matrix element of this kind occurs in continuum QCD, one can argue that the neutral pion mass is the only physical quantity blurred by such large cutoff effects. A simple analysis shows that for standard Wilson fermions O($a^2$) corrections can either affect the determination of the pion mass or be shifted from the latter to other observables, depending on the way the critical mass is evaluated.