Analysis of unquenched twisted-mass data with Wilson and DBW2 action

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Abstract: Aiming at simulations of QCD with light dynamical flavors, we apply the twisted-mass fermions formulation for Wilson quarks (tmQCD) and test different actions for the gauge sector. We present here the analysis of sets of $N_f = 2$ dynamical-quark configurations for the Wilson-plaquette and DBW2 action in the gauge sector. The lattice spacing ranges between 0.2 and 0.15 fm. In the case of the DBW2 action the lightest quark-mass is $m_{ud} = 0.2m_s$. We investigate the problem of the determination of the twist angle ω and its tuning to full twist $\omega = \pi/2$, where the theory is $O(a)$ improved. We extract physical quantities as the pion mass and decay constant m_π and f_π, and monitor the "untwisted" PCAC quark mass m_χ^{PCAC}. New methods for the determination of the renormalization constants of the vector and axialvector current Z_V and Z_A, exploiting peculiarities of the twisted theory, are presented. The dependence of m_π and f_π upon the quark mass is checked against the predictions of chiral perturbation theory.