Spectral flow of staggered Wilson Dirac operator in $SU(2)$ instanton backgrounds

Andriy Petrashyk

Nanyang Technological University, Singapore

Objective

Investigate robustness of staggered Wilson fermion index in rough $SU(2)$ instanton backgounds.

Context

Staggered fermions correctly reproduce index when looking at the spectral flow of

$$H_{st}\,(m) = iD_{st} - m\Gamma_5$$

[Adams, 2010]

here varying the parameter m is equivalent to varying the Wilson parameter r in the Wilson case.
A true analogue of the hermitian Wilson $H(m) = \gamma_5(D_W - m)$ will be

$$H_{sW}\,(m) = \Gamma_{55}(D_{st} + (1 - \Gamma_{55}\Gamma_5) - m)$$

[Adams, 2011]

Instanton Backgrounds

We'll look at spectral flows of $H_W(m)$, $H_st(m)$ and $H_sW(m)$ in $SU(2)$ instanton backgrounds

$$U_\mu(n) = exp\left[i\vec{a}_\mu(n)\cdot\vec{\sigma}\vartheta_\mu(n,\rho^2)\right]$$

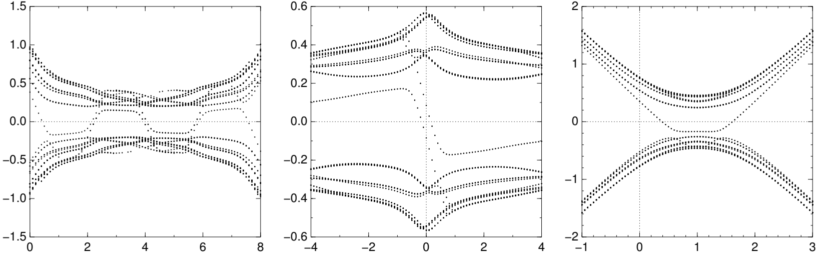
[Edwards et al., 1998]

And will roughen the smooth instanton fields by acting on the smooth link variables with random $SU(2)$ elements in the vicinity of I:

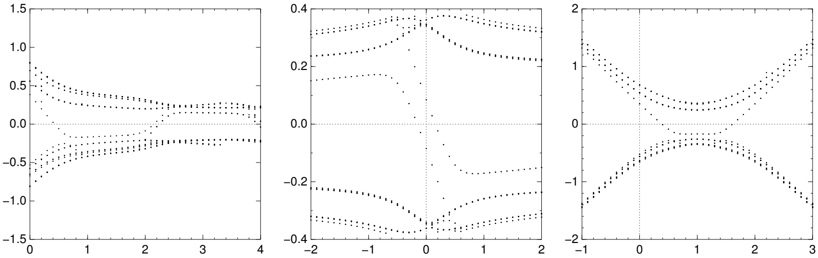
$$U_\mu(n)_{(\epsilon)} = I\cdot r_\mu^{(0)}(x) + i\sum_{j=1}^{3}\sigma_j r_\mu^{(j)}(x)$$

Spectral flow in smooth background

Instantons are of size 2.0 are at the centre of the lattice. Lattice size 8^4, Dirichlet B.C.s



zoomed in



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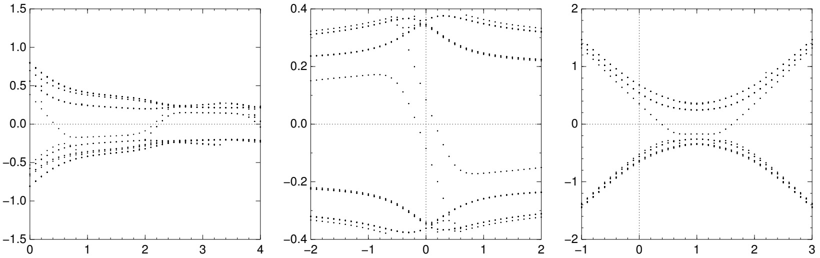
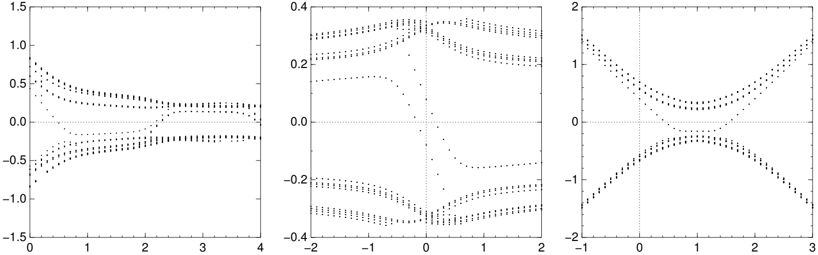


roughen the background



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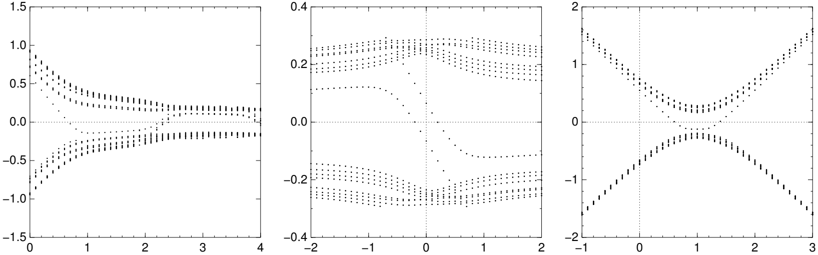

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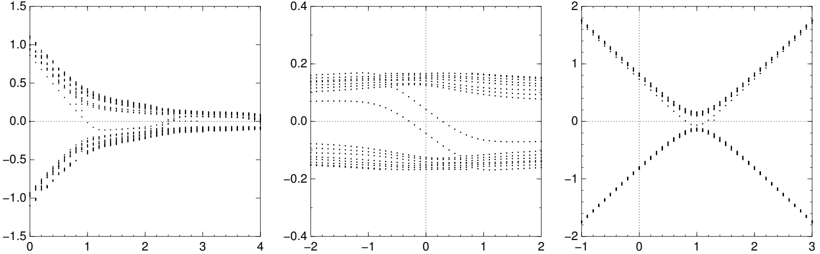

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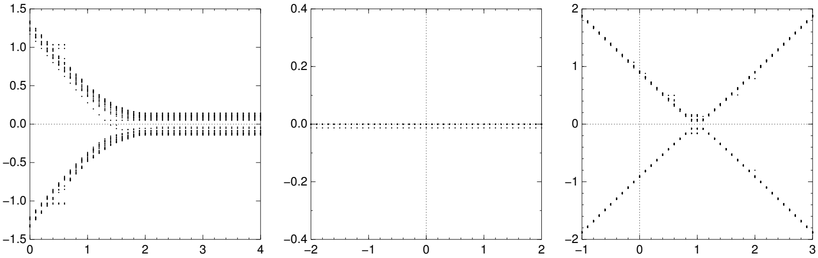

Conclusion

Wilson fermion index still seems more robust, although not significantly.
Comuputational efficiency of staggered Wilson outweighs this lack of robustness?