1 Benchamrk week 5

Context: 30×15 SC with open boundary conditons.

We have a phase gradient of 117°. Starting from $\pi/2$. $T = 10^{-3}K$ and we iterrate until a relative change in both the real and imaginary part of Δ reach 0.001%.

The way matlab deals with the eigenvectors and eigenvalues seams strange. So if we take χ_n along with E_n like the theory does, the algorithm dosnt converge for:

1. Real guess of Δ and all parameters are free

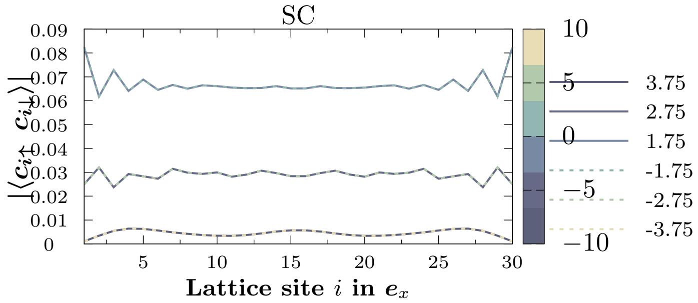

Figure 1

From this we can read the following parameters: $\mu = \pm 1.75 -> 0.0651$, $\mu = \pm 2.75 -> 0.02836$, $\mu = \pm 3.75 -> 0.00568$.

2. Fixed norm of Δ on the side according to 1.

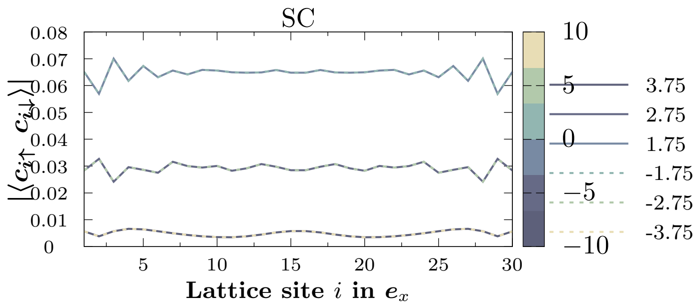

Figure 2

And we try with a longer SC to try to minimise the fluctuations.

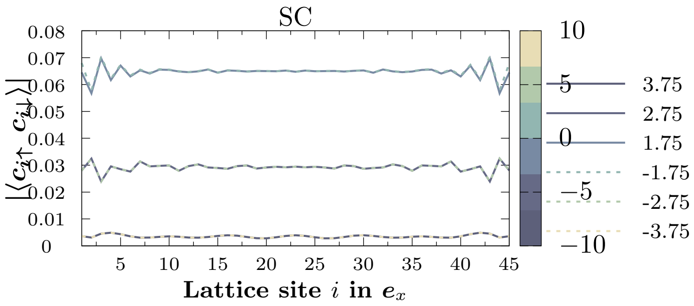

Figure 3

Until now everything works as expected :) so we can stick with the model of SC30 which is faster to compute.

3.Fixed $|\Delta_0|$ and a phase of $\pi/3$ on the sides.

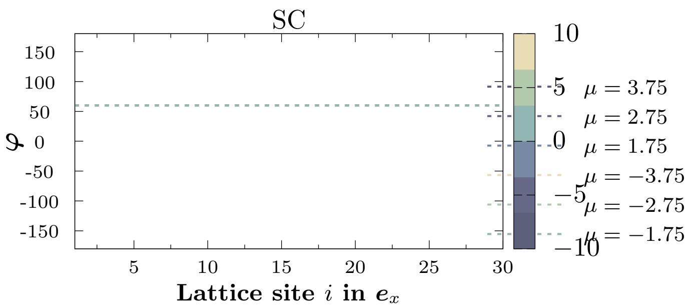

Figure 4: using a start of $\pi/3$ on the sides

The algorithme doesn't seam to converge and the relative change sattles at 0.00285%.

4.Fixed phase of $\pi/3$ on the sides left and a gradient of $117°$.

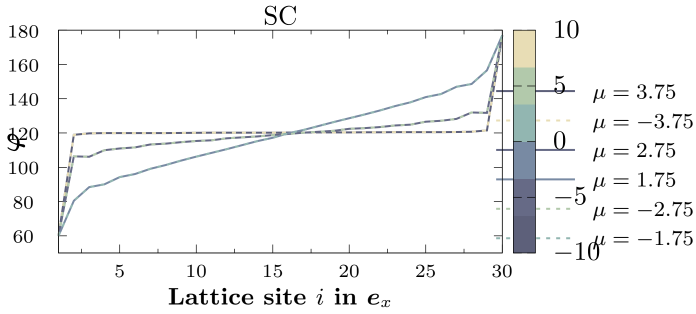

Figure 5: using a start of $\pi/3$ on the sides

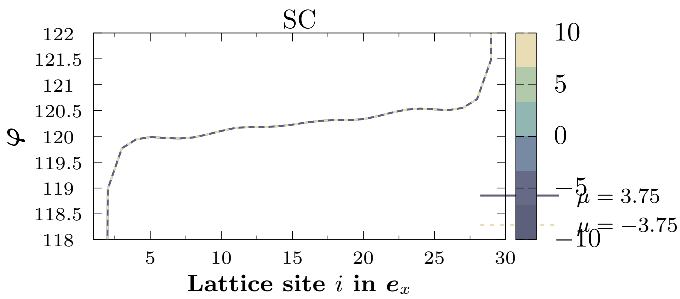

Figure 6: using a start of $\pi/3$ on the sides.

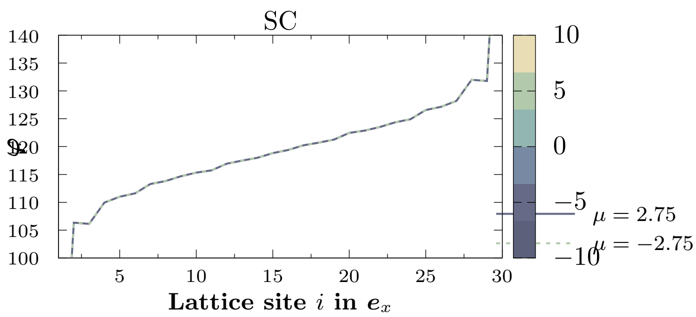

Figure 7: using a start of $\pi/3$ on the sides.

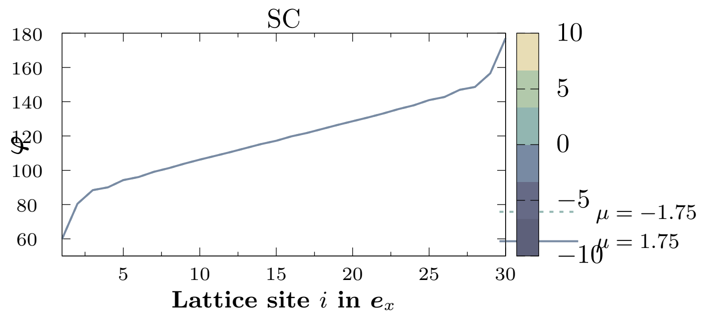

Figure 8: using a start of $\pi/3$ on the sides.

And the current map:

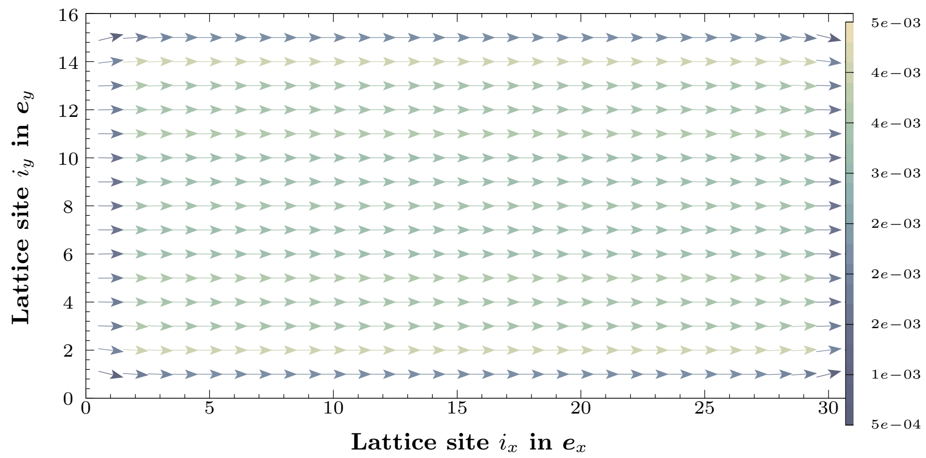

Figure 9: using a start of $\pi/3$ on the sides. V1 $\mu = 2.75$.

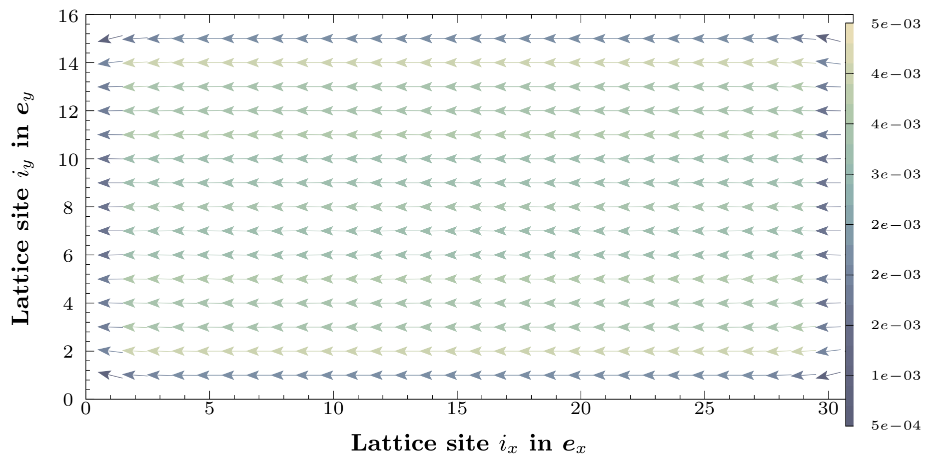

Figure 10: using a start of $\pi/3$ on the sides. V2 $\mu = 2.75$.

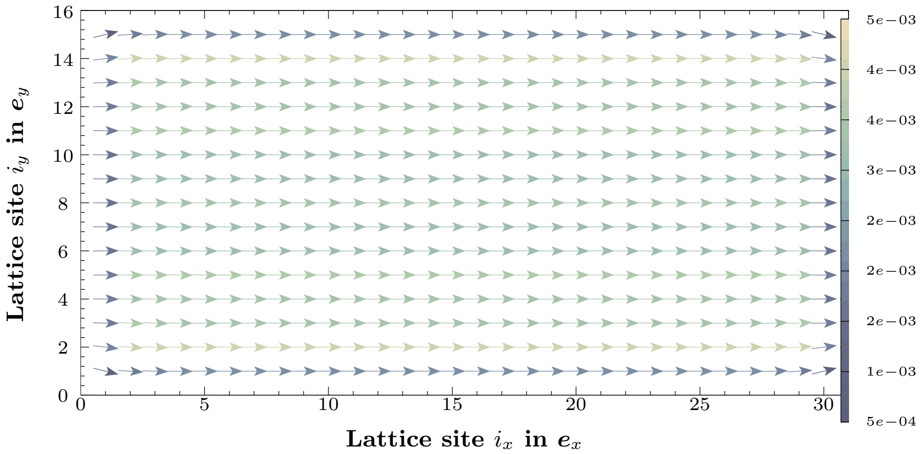

Figure 11: using a start of $\pi/3$ on the sides. V1 $\mu = -2.75$.

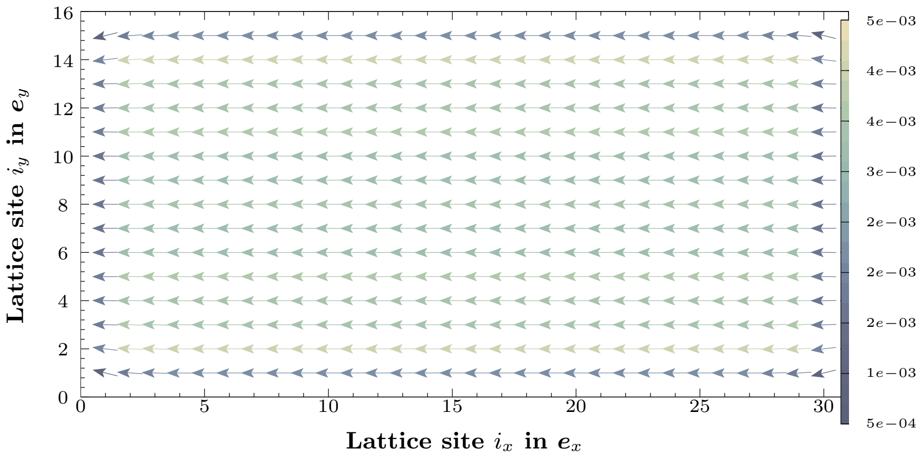

Figure 12: using a start of $\pi/3$ on the sides. V2 $\mu = -2.75$.

And the continuity maps:

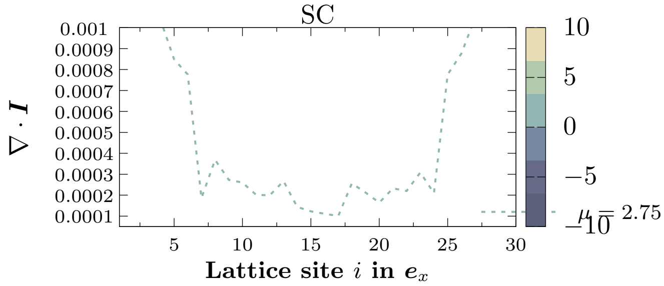

Figure 13: using a start of $\pi/3$ on the sides. V1 $\mu = 2.75$.

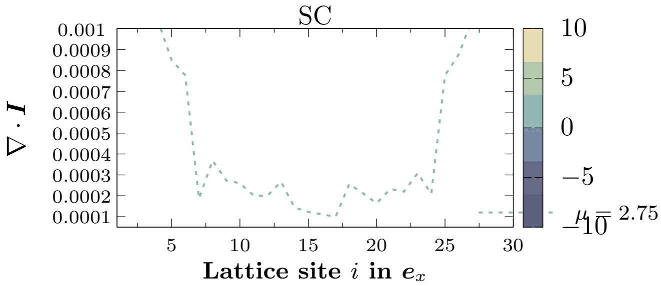

Figure 14: using a start of $\pi/3$ on the sides. V2 $\mu = 2.75$.

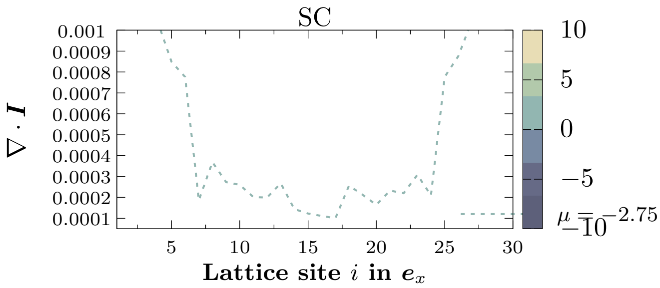

Figure 15: using a start of $\pi/3$ on the sides. V1 $\mu = -2.75$.

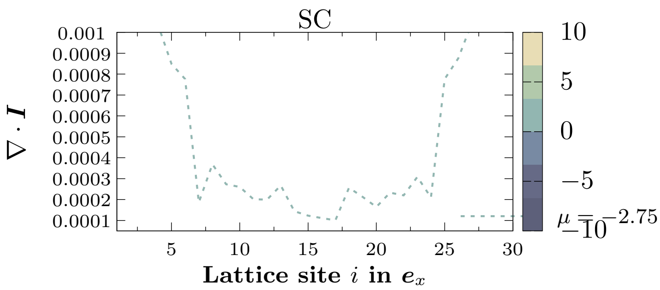

Figure 16: using a start of $\pi/3$ on the sides. V2 $\mu = -2.75$.

The different versions are very symmetric. However the eigenvector were derived using χ_n and E_{-n} so we are going to stick with V2 for the current.

5. Phase start independance of the gradient.
One last important physical property to show is the independance of the phase start of the gradient. The gradient is relevant for the current so the physic should stay invariant under phase start change.

We use $\mu = -2.75$ with $\varphi_1 = -\pi/3$ and $\varphi_2 = 3\pi/4$.

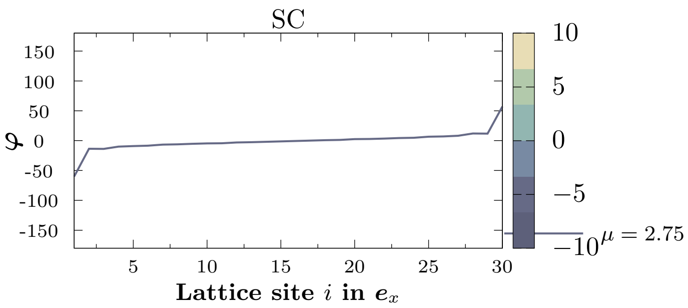

Figure 17: Using a start of $-\pi/3$ on the side.

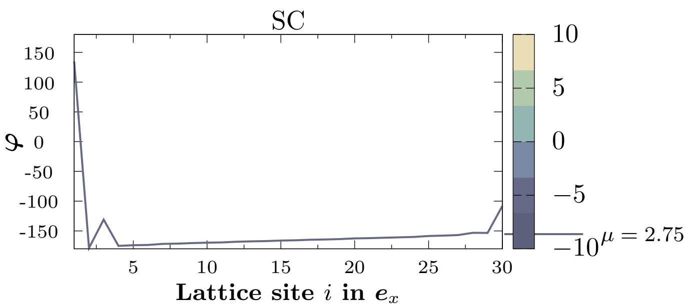

Figure 18: Using a start of $3\pi/4$ on the side.

The gradient has the same shape so the current will eb very much the same. The low variations makes the continuity map very similar. We admit that this works fine. The pick on the lattice point numer 3 results of some asumed numerical error. A better accuracy should solve this. The algorithm had 200 iterrations here.

Here is a map of the phase to track down this specific point:

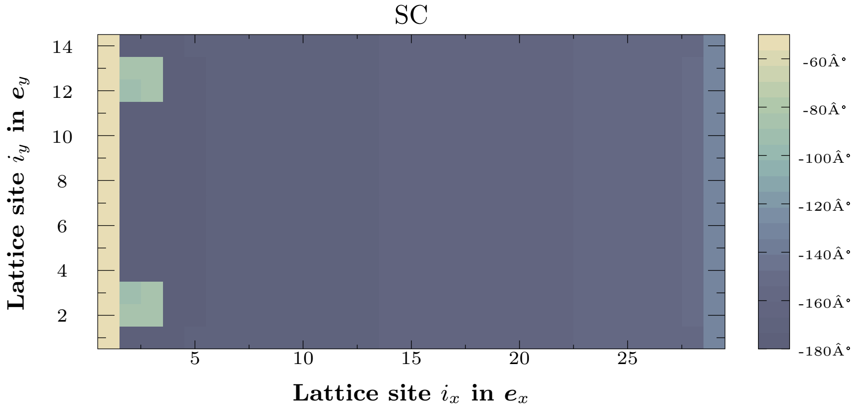

Figure 19: Using a start of $3\pi/4$ on the side.

Let's go.