χ plots and calculations

October 24, 2022

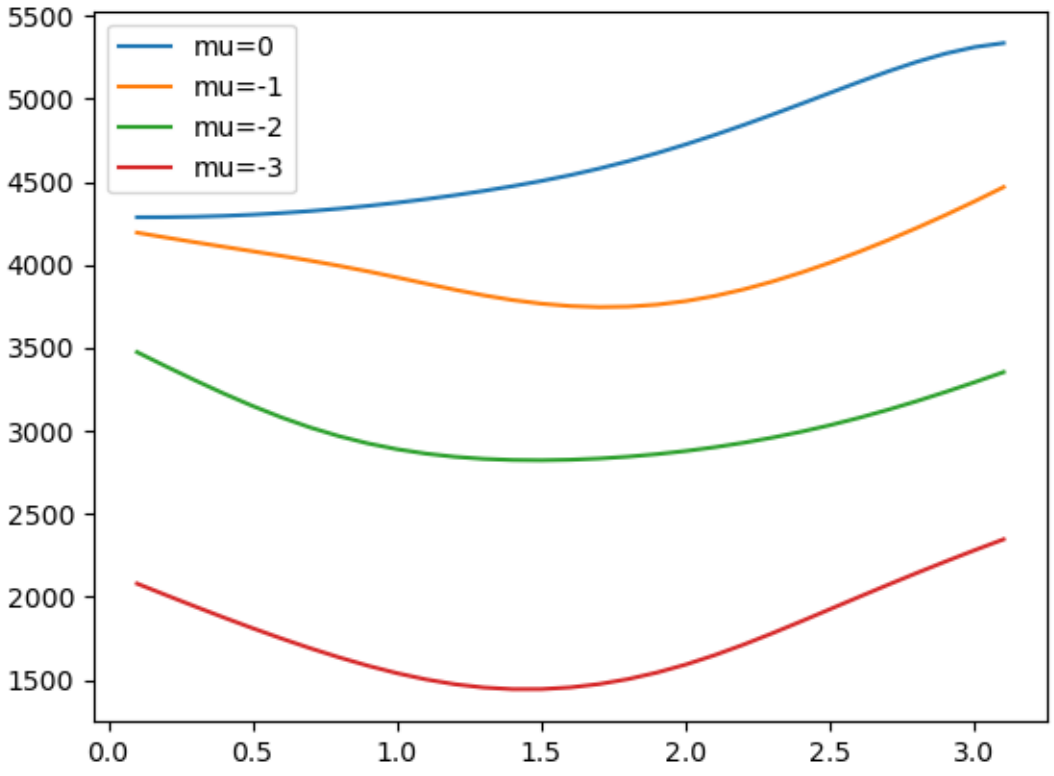
$$\chi_0(q) = \sum_k \frac{f(\epsilon_{k+q}) - f(\epsilon_k)}{\epsilon_{k+q} - \epsilon_k}, \epsilon_k = -2t(\cos k_x + \cos k_y + \cos k_z) - \mu$$

$$f(\epsilon) = 1/(e^{\beta\epsilon} + 1)$$

We (plan on) resolving the singularity by treating them as derivatives as $q \to 0$

$$\lim_{q\to 0} \frac{f(\epsilon_{k+q}) - f(\epsilon_k)}{\epsilon_{k+q} - \epsilon_k} = \frac{dqf'(\epsilon_k)}{dq\epsilon'_k} = \frac{f'(\epsilon_k)}{\epsilon'_k}$$

We take the k values to be up to until π in each direction as this is the space q is taken over in the plot of Scalapino's 1986 paper. $\beta = 4$, $t = 1$, with varying values of μ. I haven't actually plotted the $q = 0$ point because I did this last minute and the other points aren't lining up yet.


mu=0
mu=-1
mu=-2
mu=-3
5500
5000
4500
4000
3500
3000
2500
2000
1500
0.0
0.5
1.0
1.5
2.0
2.5
3.0

penis penis