Quenched topological susceptibility.

Jaime Fabián Nieto Castellanos

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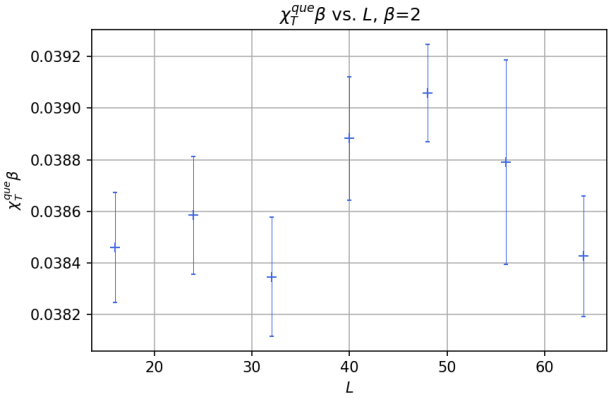
We show results of χ_T^q obtained by using the HMC algorithm and C. Lang's program for pure gauge theory. We used a square lattice of dimensions $L \times L$. We also compare the values with χ_T^q computed in ref. [1] and with the analytic result by Seiler [2], which states that in infinite volume

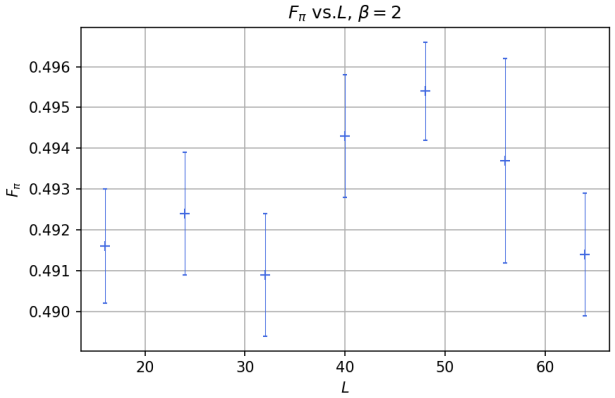
$$\chi_T^q = \frac{g^2}{4\pi^2} = \frac{1}{4\beta\pi^2}. \tag{1}$$

F_π for different β was calculated with the Witten-Veneziano formula

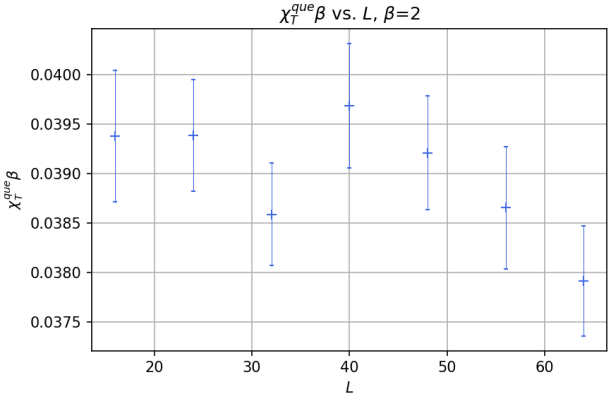
$$m_{\eta'}^2 = \frac{2N_f}{F_\pi^2}\chi_T^q, \quad m_{\eta'}^2 = \frac{N_f g^2}{\pi}, \quad N_f = 2. \tag{2}$$



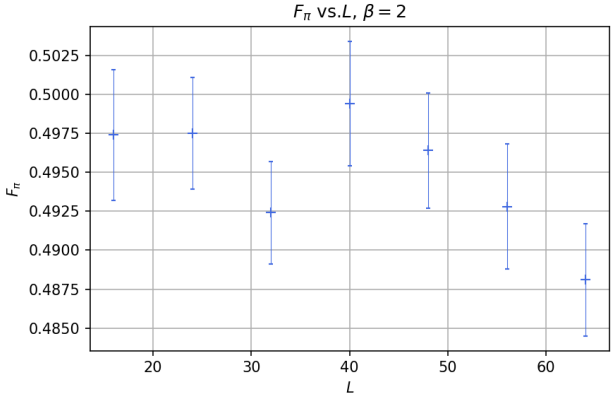
(a) $\chi_T^q\beta$ vs. L, obtained with C. Lang's program. $\langle\chi_T\beta\rangle = 0.03865(9)$.



(b) F_π vs. L, obtained with the WV formula by using C. Lang program's result. $\langle F_\pi\rangle = 0.4928(5)$



(c) $\chi_T^q\beta$ vs. L, obtained with the HMC algorithm. $\langle\chi_T\beta\rangle = 0.0390(4)$

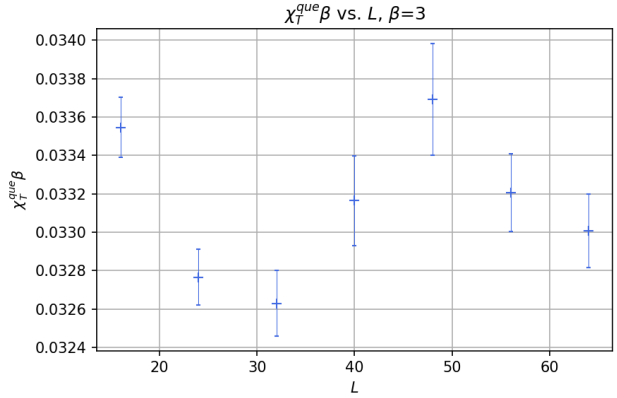


(d) F_π vs. L, obtained with the WV formula by using the HMC algorithm's result $\langle F_\pi\rangle = 0.495(1)$.

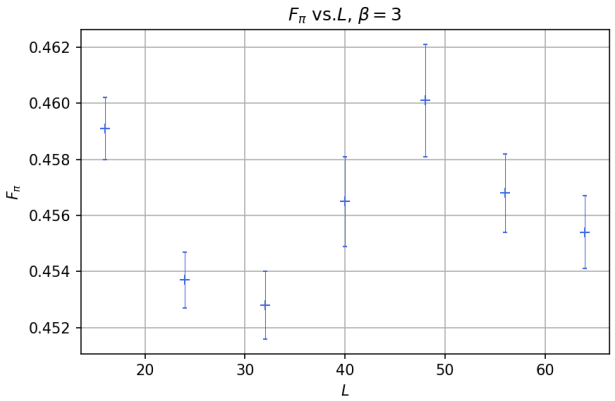
Figure 1: Quenched topological susceptibility and F_π computed with the WV formula for $\beta = 2$. With C. Lang's program, 10^5 measurements were performed. With the HMC algorithm, 10^4 measurements separated by 10 sweeps were performed.

	χ_T
C. Lang's program	0.0192(1)
HMC algorithm	0.0189(2)
Ref. [1] results	0.0196(6)
Analytic value for infinite volume (eq. (1))	0.01266

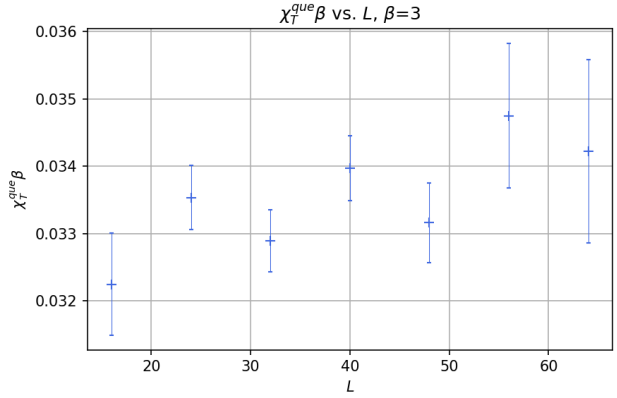
Table 1: $\beta = 2$. Different values of χ_T quenched.



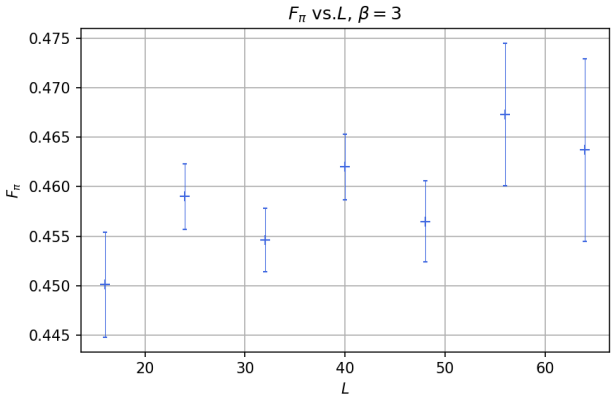
(a) $\chi_T^q\beta$ vs. L, obtained with C. Lang's program. $\langle\chi_T\beta\rangle = 0.0331(1)$.



(b) F_π vs. L, obtained with the WV formula by using C. Lang program's result. $\langle F_\pi\rangle = 0.4563(9)$



(c) $\chi_T^q\beta$ vs. L, obtained with the HMC algorithm. $\langle\chi_T\beta\rangle = 0.0335(3)$

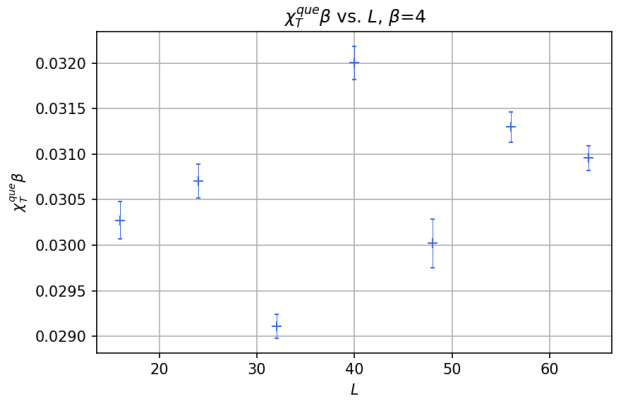


(d) F_π vs. L, obtained with the WV formula by using the HMC algorithm's result $\langle F_\pi\rangle = 0.459(2)$.

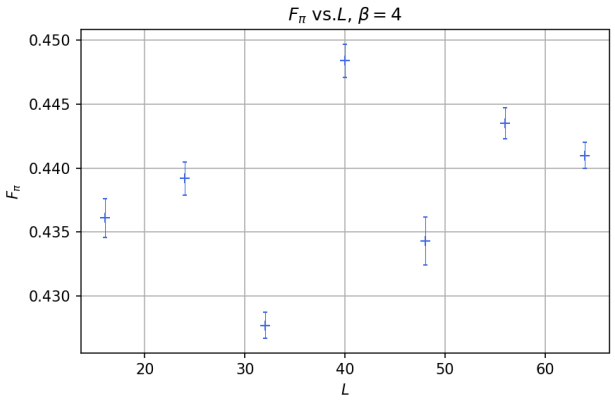
Figure 2: Quenched topological susceptibility and F_π computed with the WV formula for $\beta = 3$. With C. Lang's program, 10^5 measurements were performed. With the HMC algorithm, 10^4 measurements separated by 10 sweeps were performed.

	χ_T
C. Lang's program	0.01100(6)
HMC algorithm	0.0114(5)
Ref. [1] results	0.0110(3)
Analytic value for infinite volume (eq. (1))	0.0084

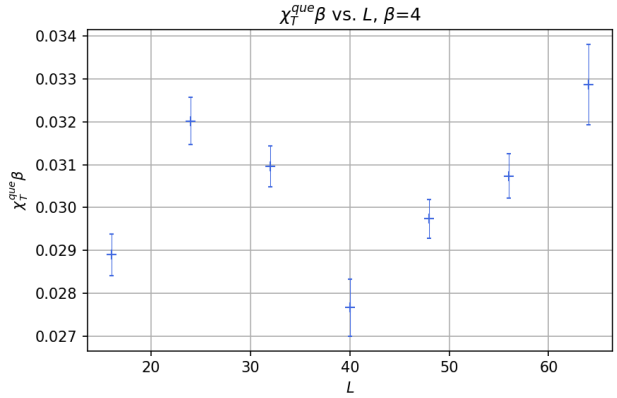
Table 2: $\beta = 3$. Different values of χ_T quenched.



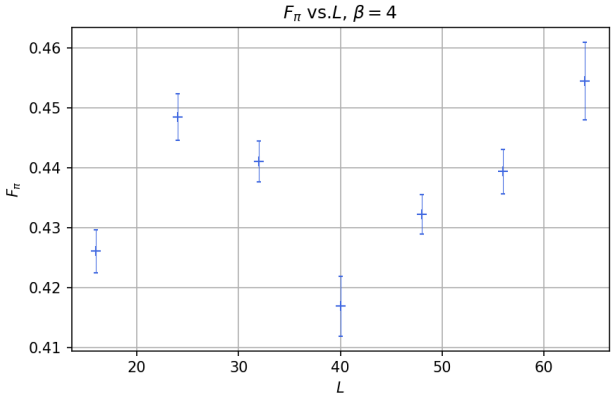
(a) $\chi_T^q\beta$ vs. L, obtained with C. Lang's program. $\langle\chi_T\beta\rangle = 0.0306(3)$.



(b) F_π vs. L, obtained with the WV formula by using C. Lang program's result. $\langle F_\pi\rangle = 0.438(2)$



(c) $\chi_T^q\beta$ vs. L, obtained with the HMC algorithm. $\langle\chi_T\beta\rangle = 0.0304(6)$



(d) F_π vs. L, obtained with the WV formula by using the HMC algorithm's result $\langle F_\pi\rangle = 0.437(4)$.

Figure 3: Quenched topological susceptibility and F_π computed with the WV formula for $\beta = 4$. With C. Lang's program, 10^5 measurements were performed. With the HMC algorithm, 10^4 measurements separated by 10 sweeps were performed.

	χ_T
C. Lang's program	0.00774(3)
HMC algorithm	0.0076(2)
Ref. [1] results	0.0075(2)
Analytic value for infinite volume (eq. (1))	0.0063

Table 3: $\beta = 4$. Different values of χ_T quenched.

With the extrapolation that was performed in the limit $m \to \infty$ by using the old results for χ_T, we had obtained

$$\chi_T^q = 0.0073(3) \quad \text{for } \beta = 4, \tag{3}$$

which is compatible with the values of Table 3. In figure 4 we show χ_T^q for different β.

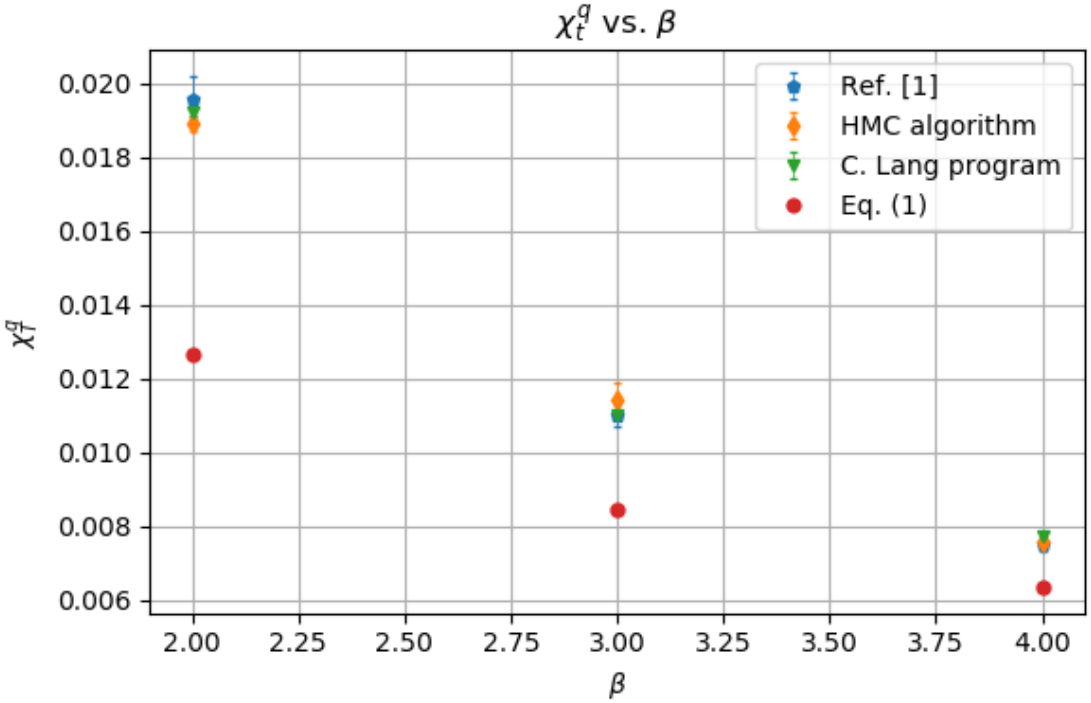


Figure 4: χ_T^q vs. β. We used the data from Tables 1, 2 and 3.

References

[1] I. Bautista, W. Bietenholz, A. Dromard, U. Gerber, L. Gonglach, C. P. Hofmann, H. Mejía, and M.Wagner, *Phys. Rev. D* **92** (2015)

[2] E. Seiler, *Phys. Lett. B* **525** (2002).