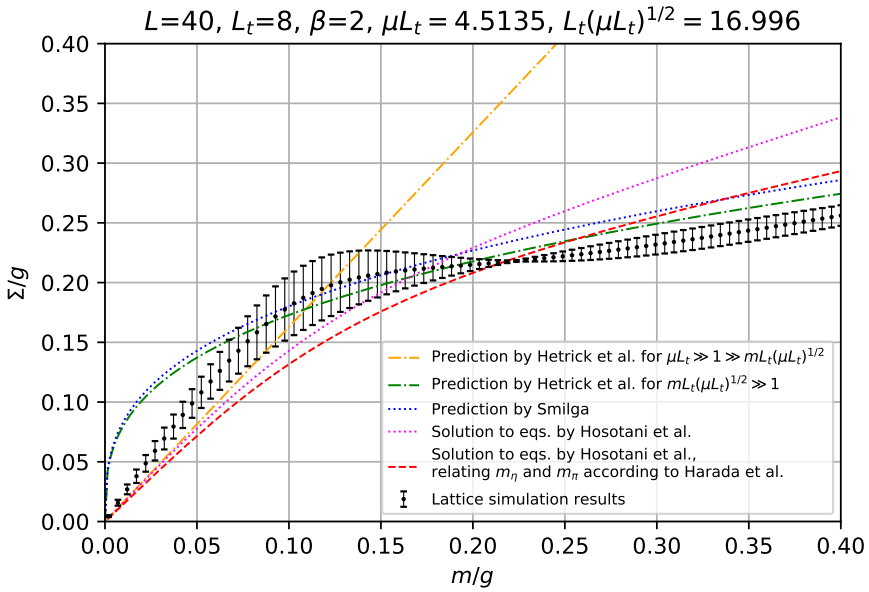
$\langle\overline{\psi}\psi\rangle$ at finite temperature with the overlap operator.

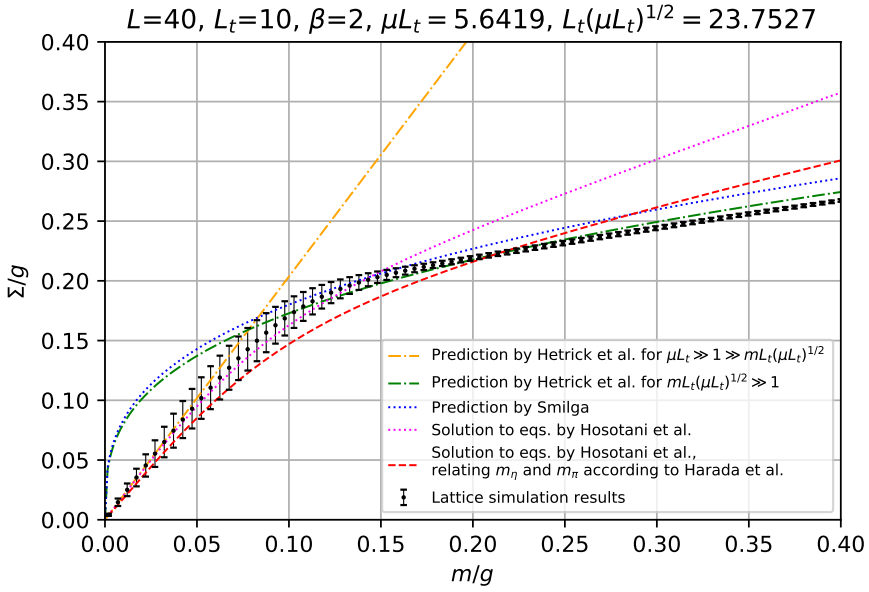
March 24, 2022

1 $\beta = 2$

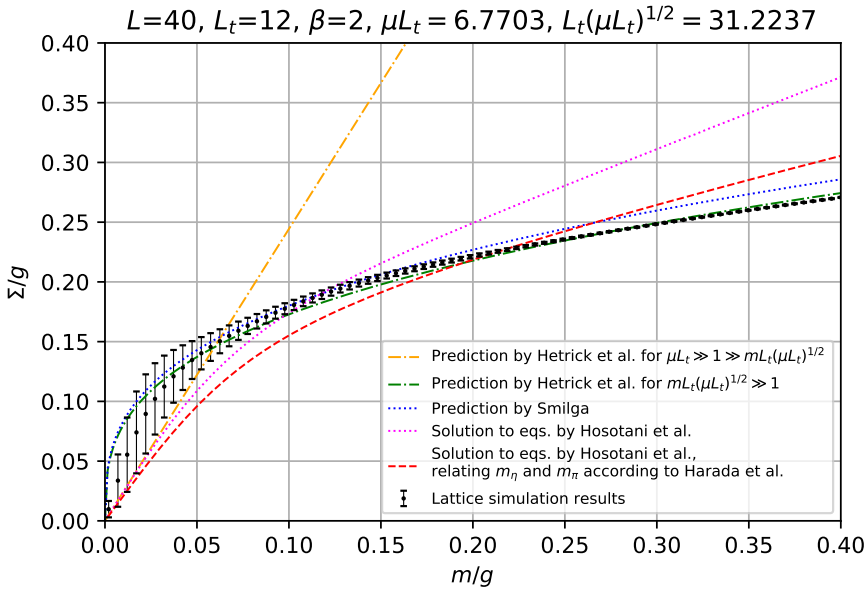
1.1 Lattice vs. equations by Hosotani



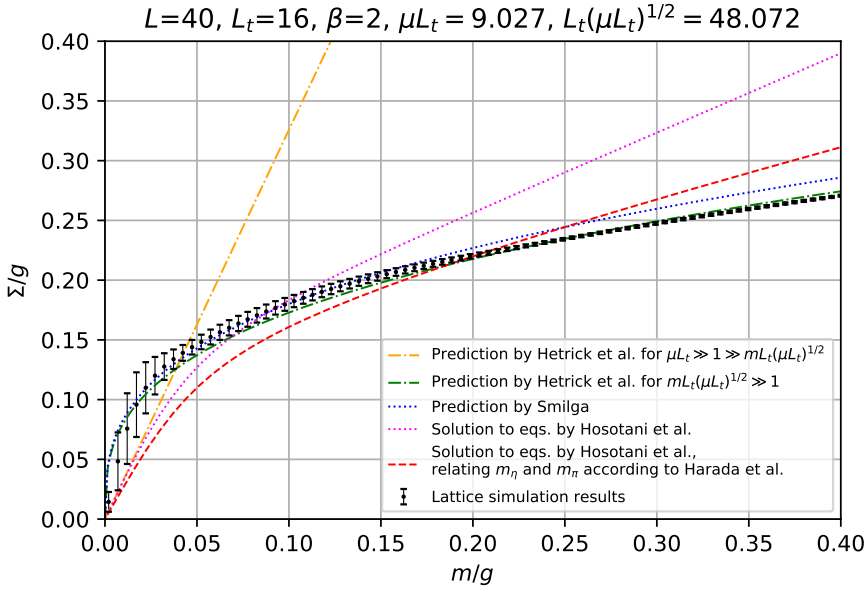
(a) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.



(b) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.

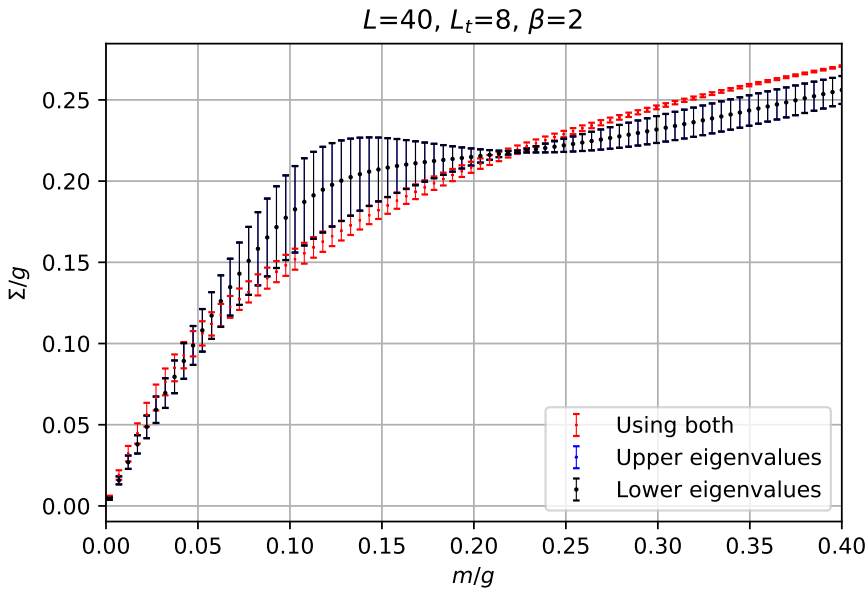


(c) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x12.

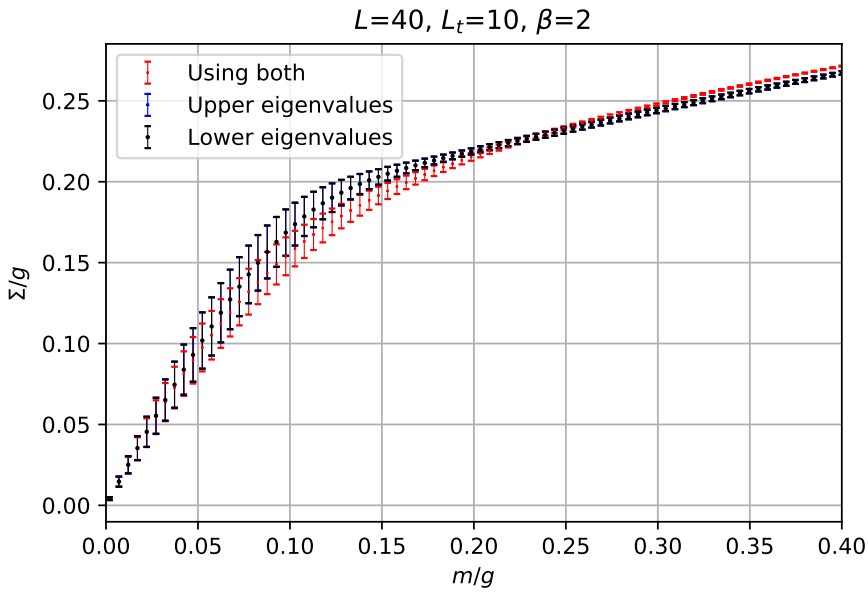


(d) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x16.

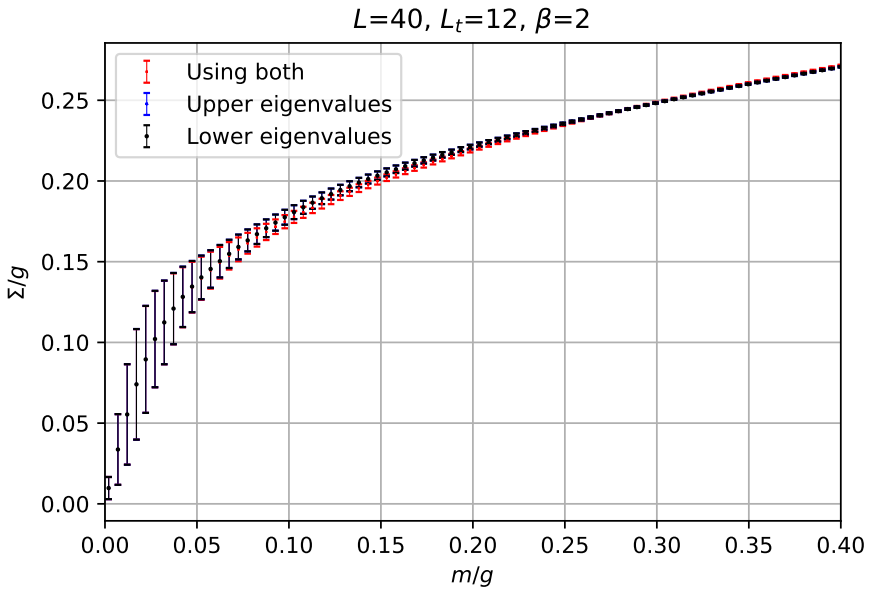
1.2 Comparison of Σ with the lower and upper half plane eigenvalues.



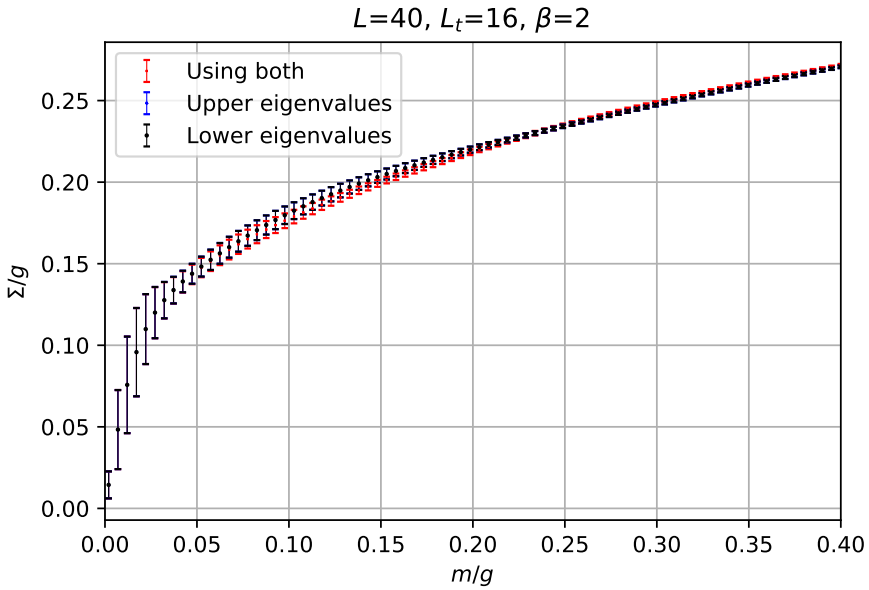
(e) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.



(f) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.



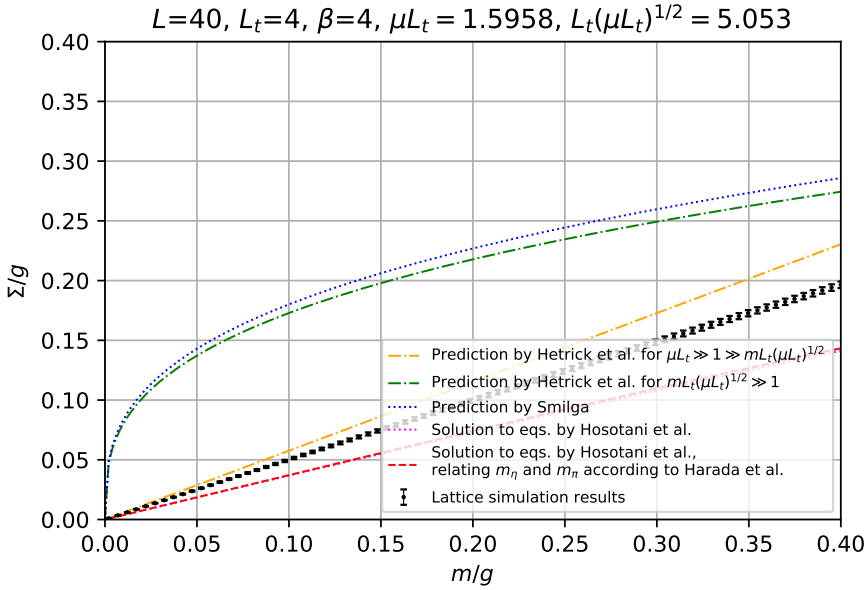
(g) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x12.



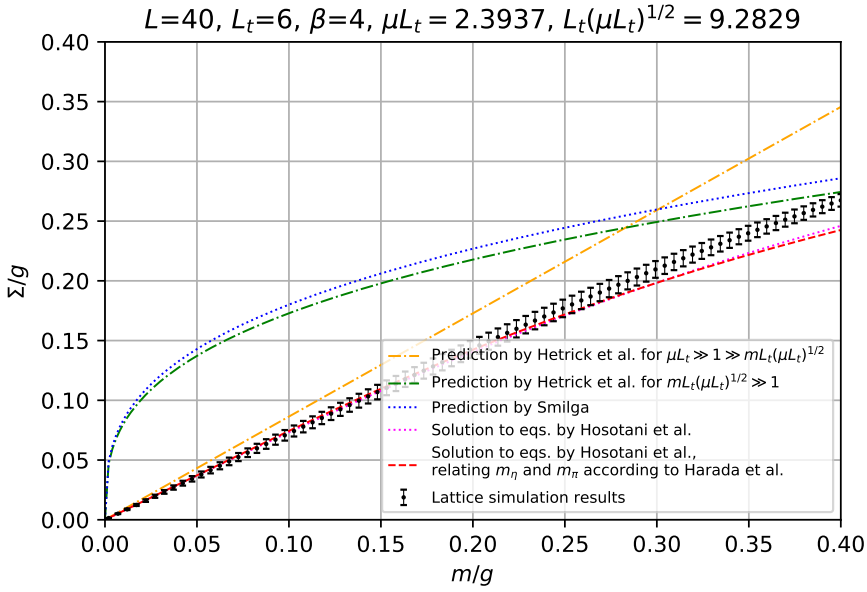
(h) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x16

2 $\beta = 4$

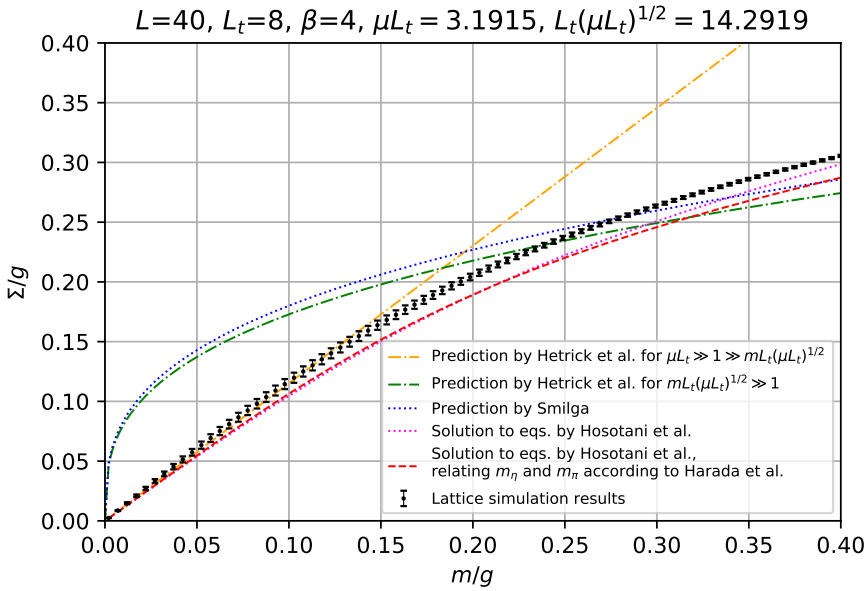
2.1 Lattice vs. equations by Hosotani



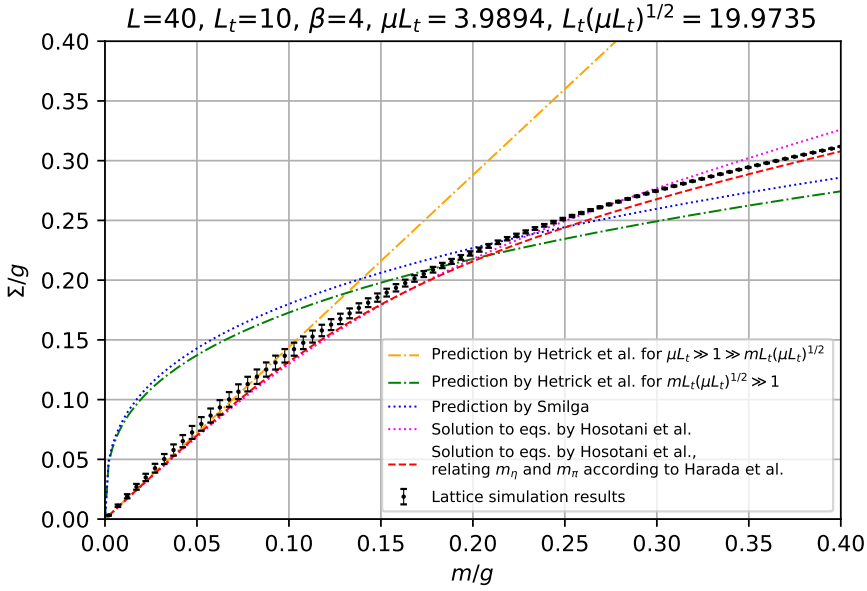
(i) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x4.



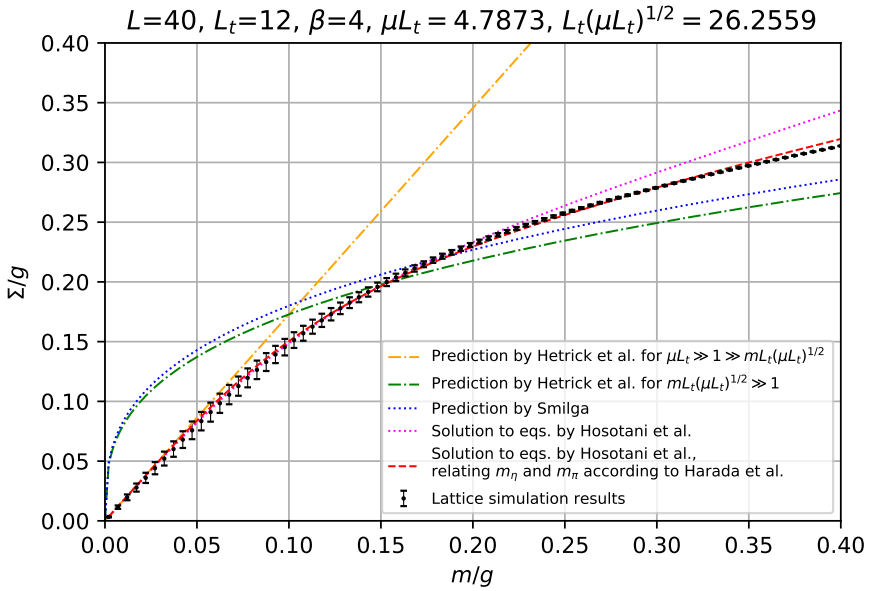
(j) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x6.



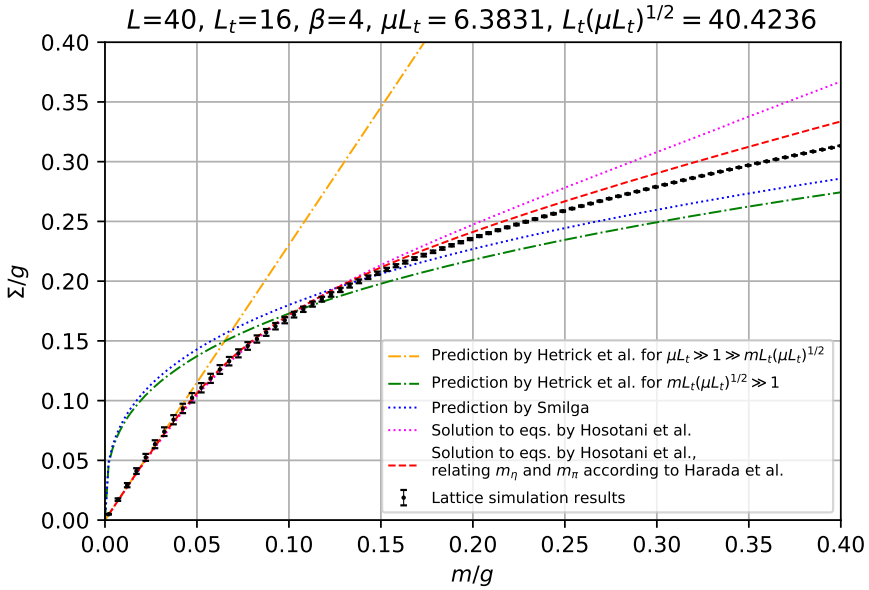
(k) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.



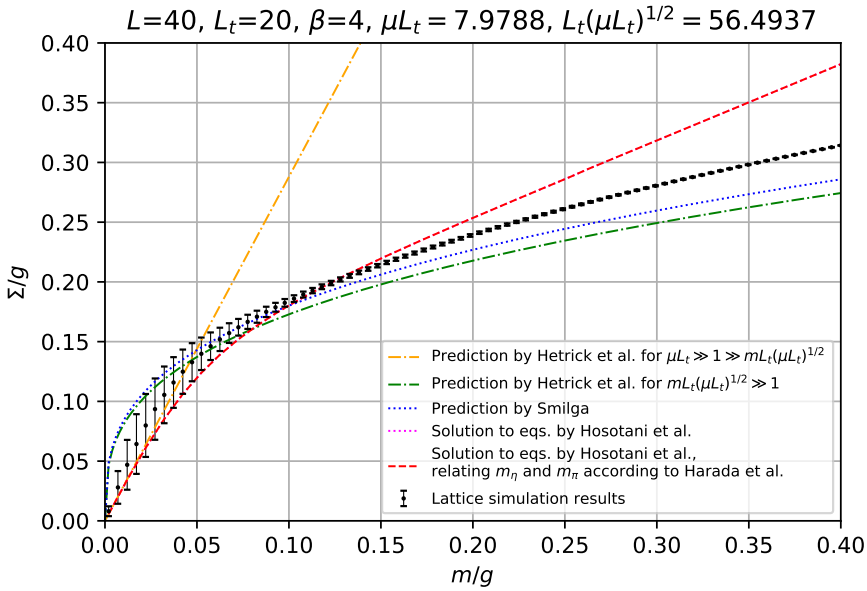
(l) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.



(m) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x12.

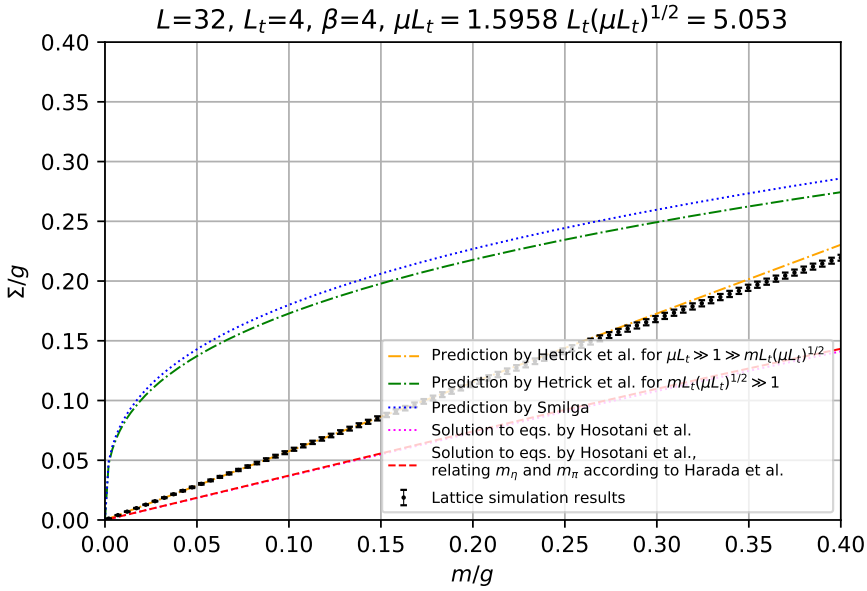


(n) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x16.

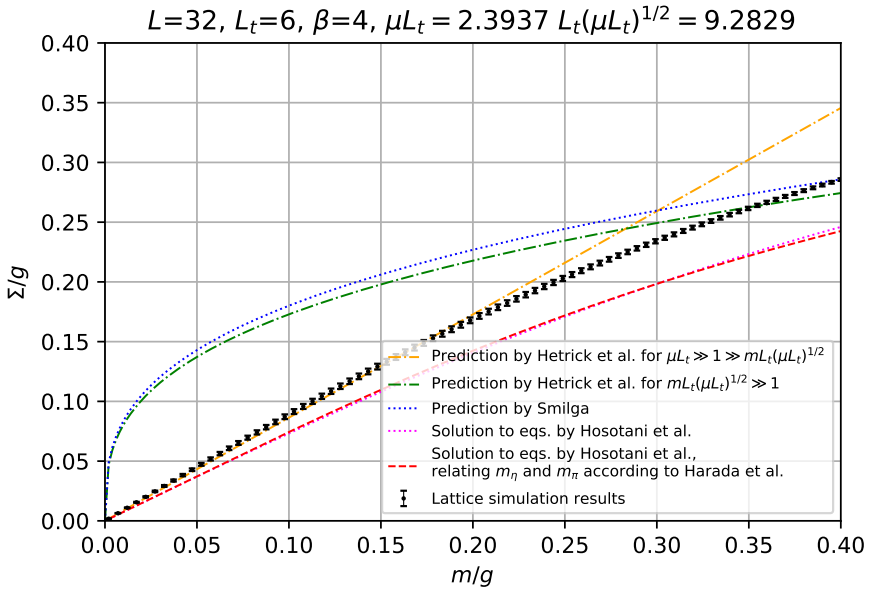


(o) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x20.

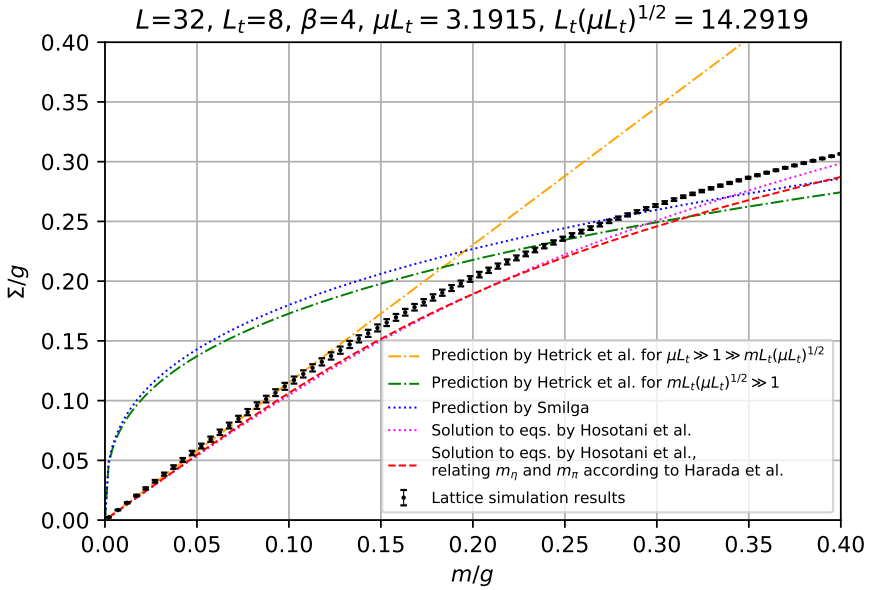
Figure 1: $L = 40$.



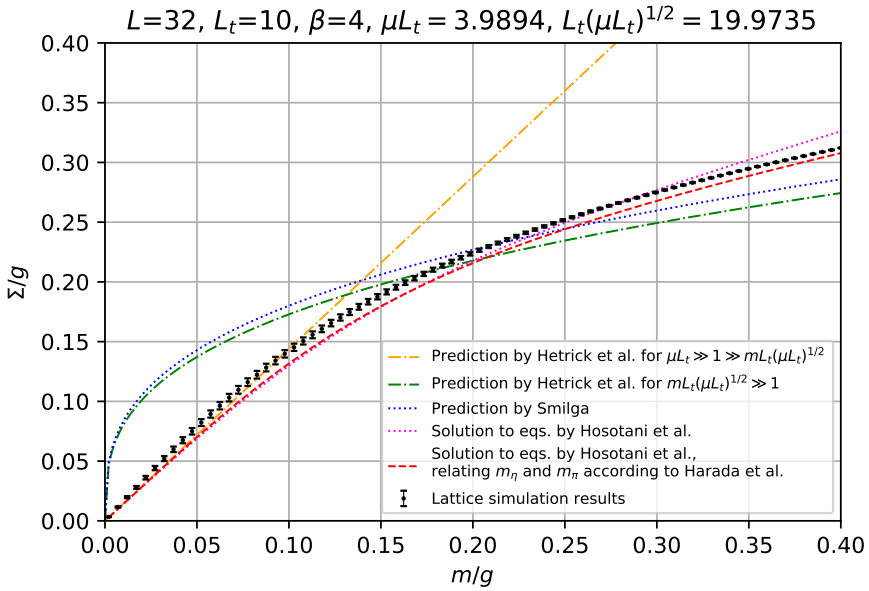
(a) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x4.



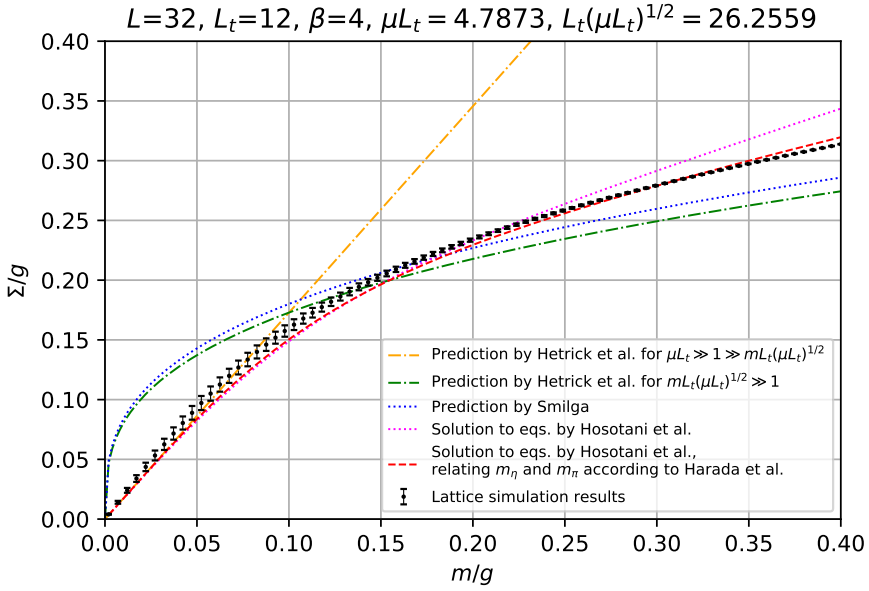
(b) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x6.



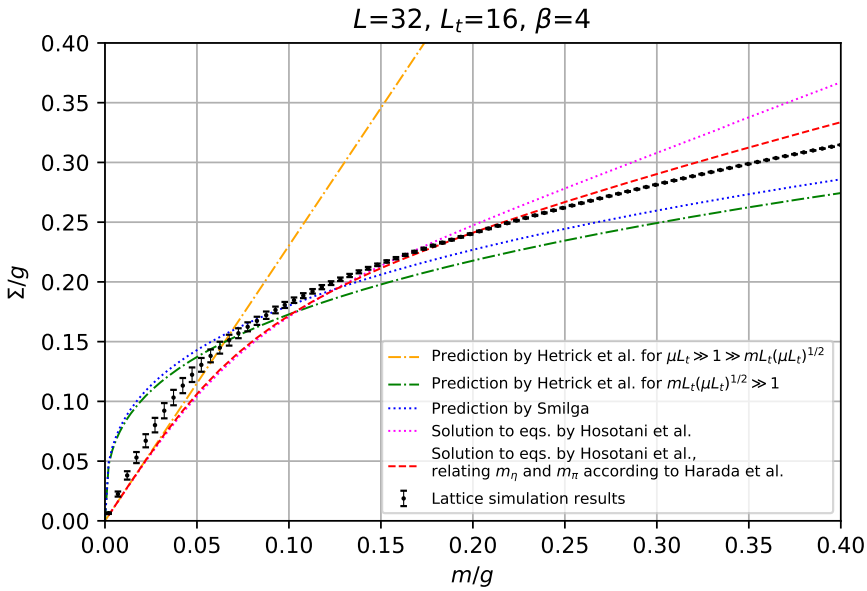
(c) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x8.



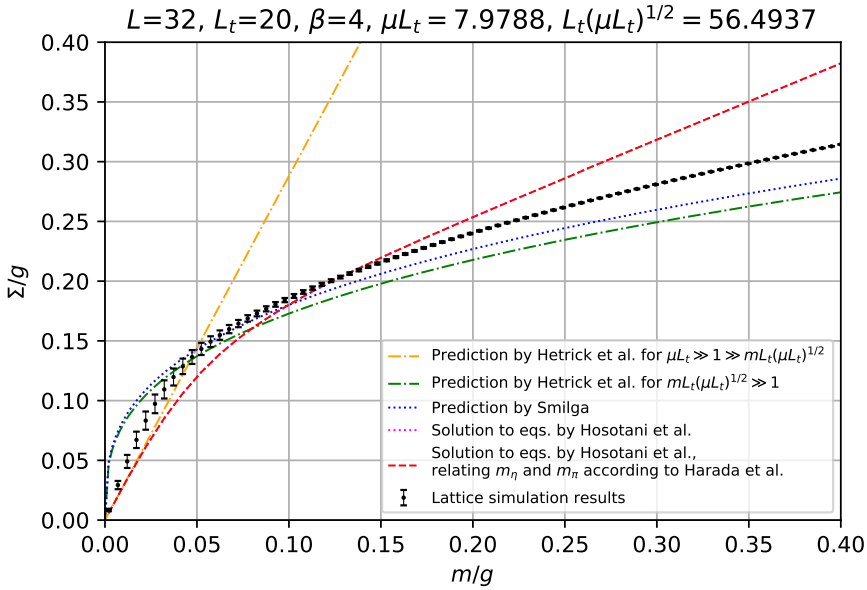
(d) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x10.



(e) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x12.



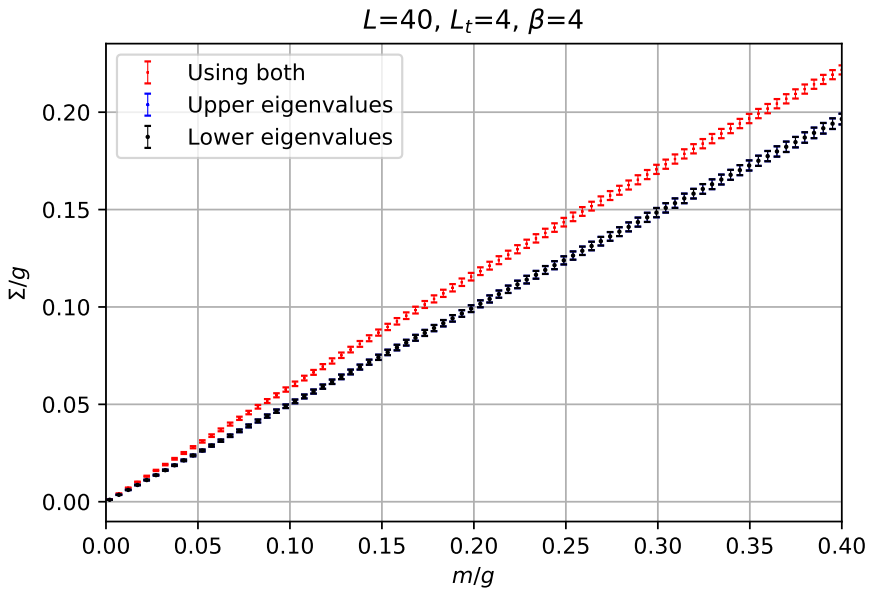
(f) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x16.



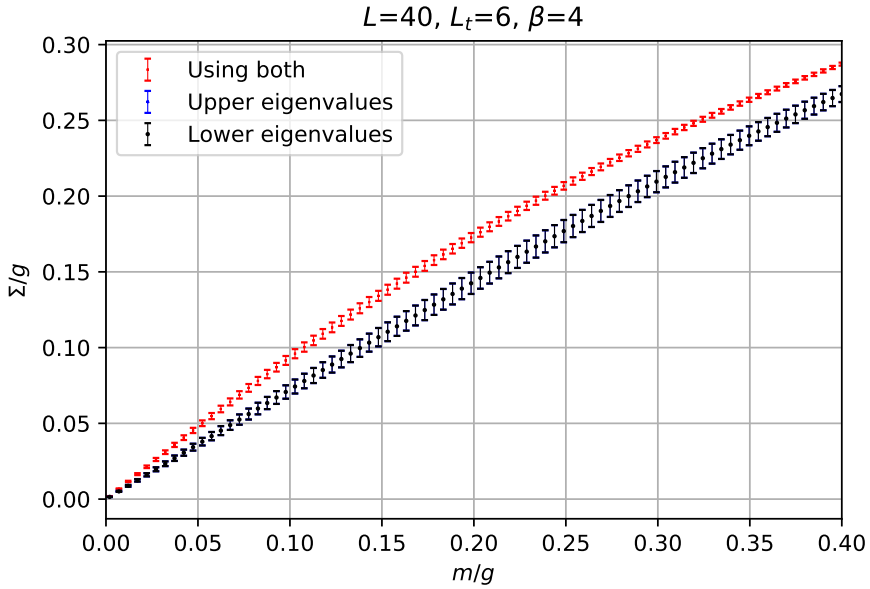
(g) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x20.

Figure 2: $L = 32$.

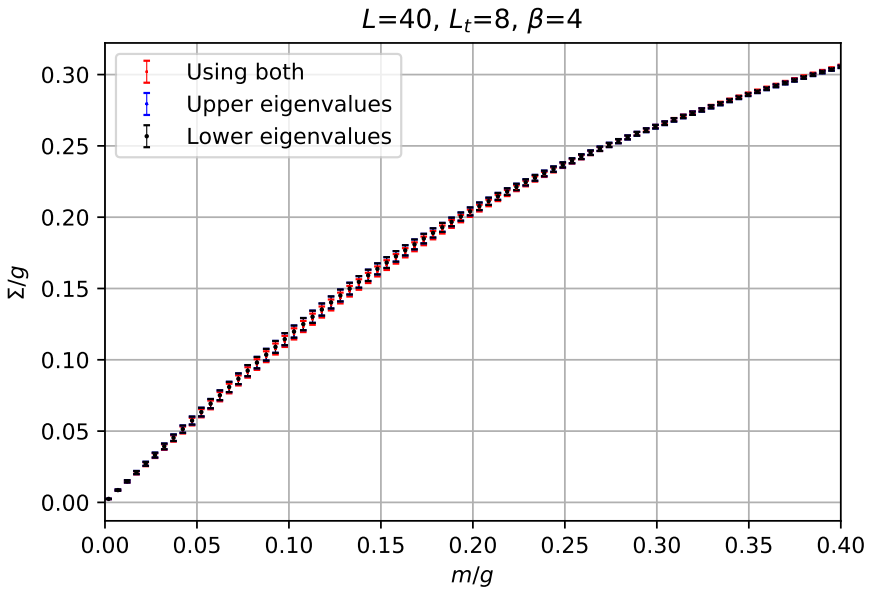
2.2 Comparison of Σ with the lower and upper half plane eigenvalues.



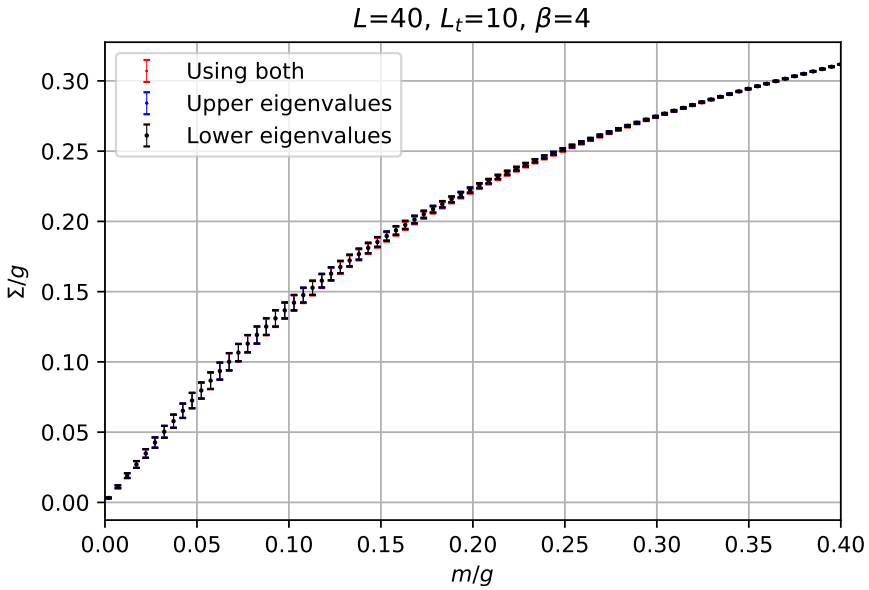
(a) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.



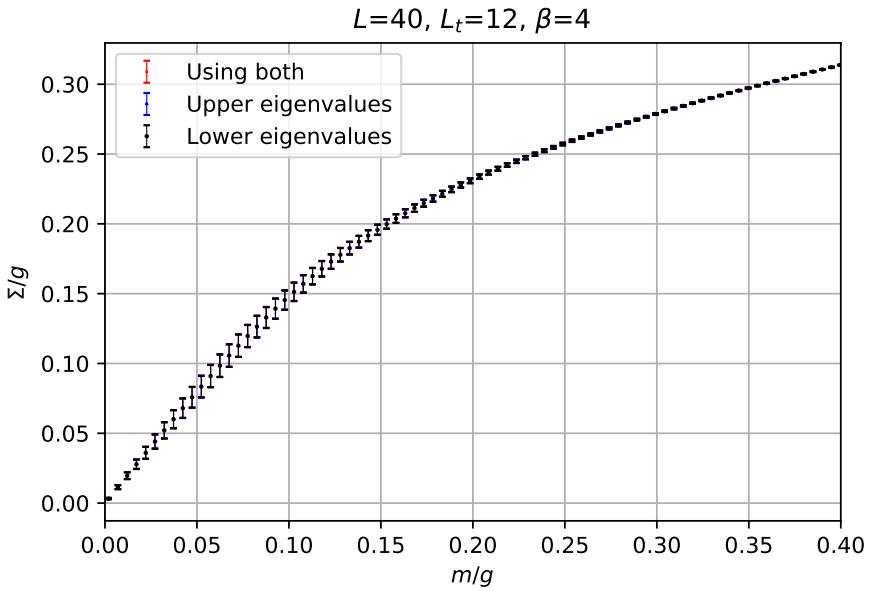
(b) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.



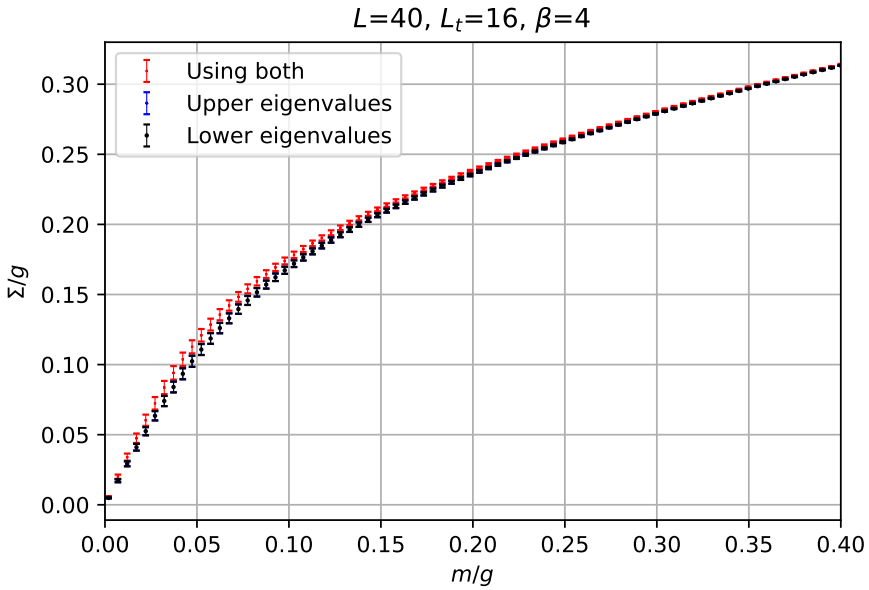
(c) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.



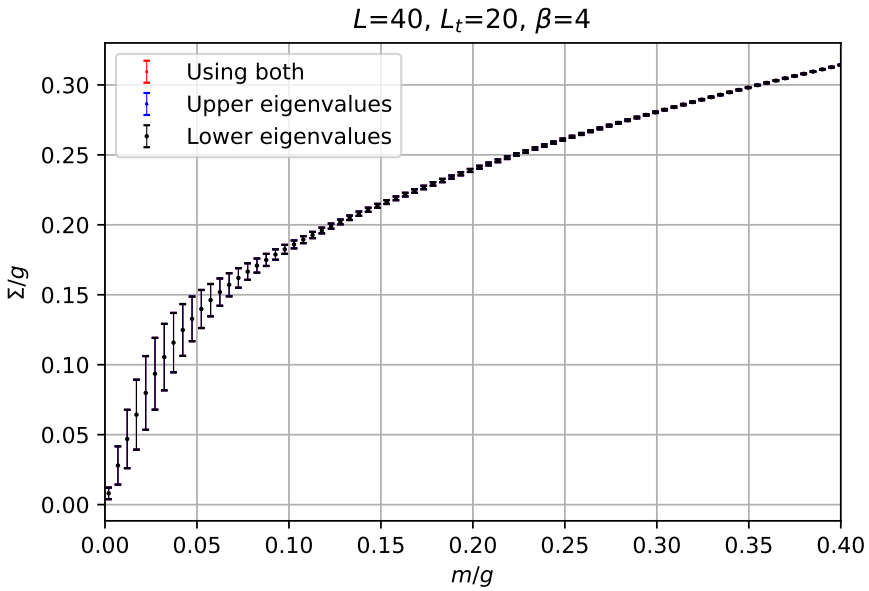
(d) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.



(e) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x12.

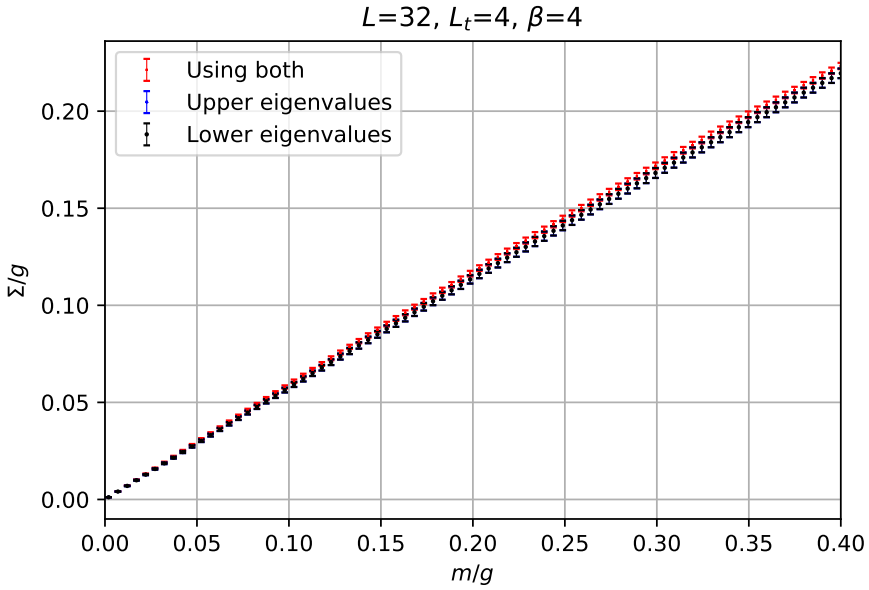


(f) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x16.

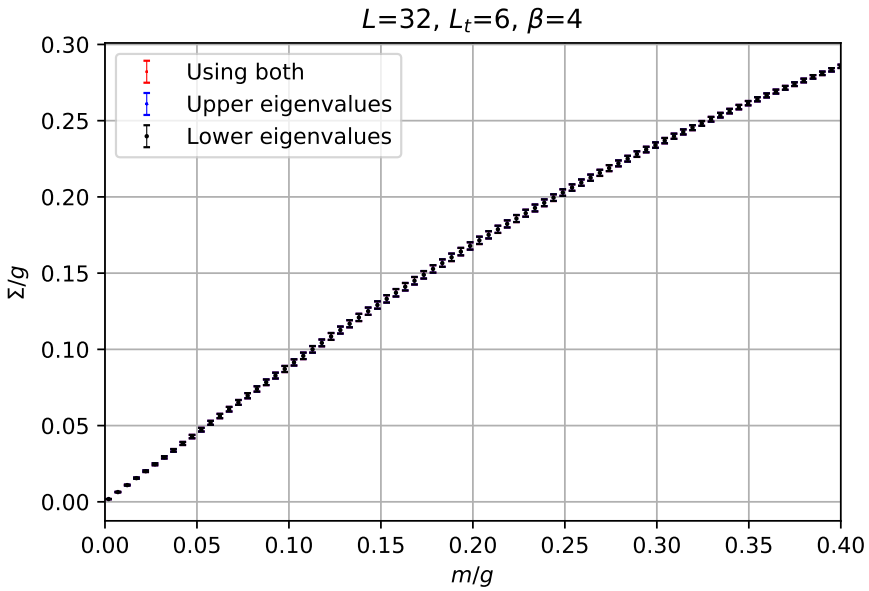


(g) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x20.

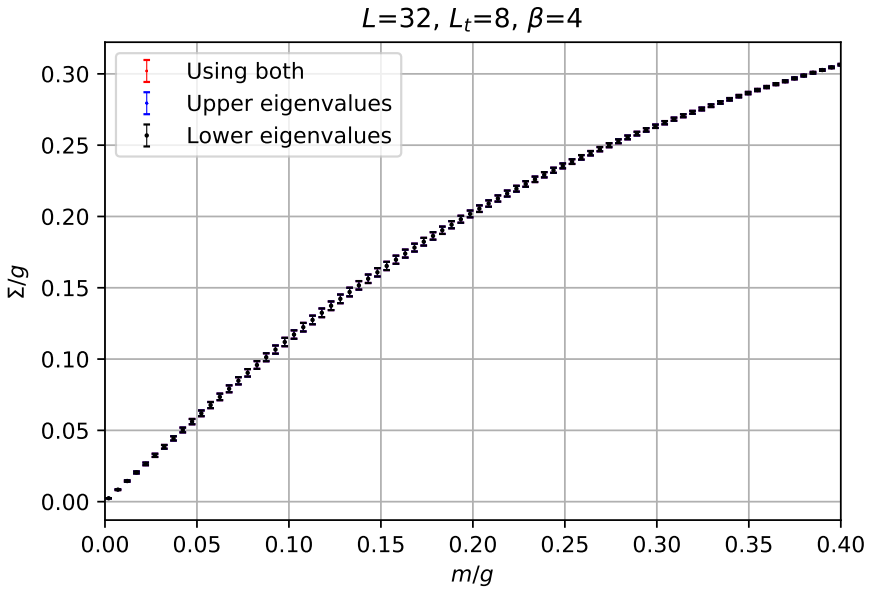
Figure 3: $L = 40$



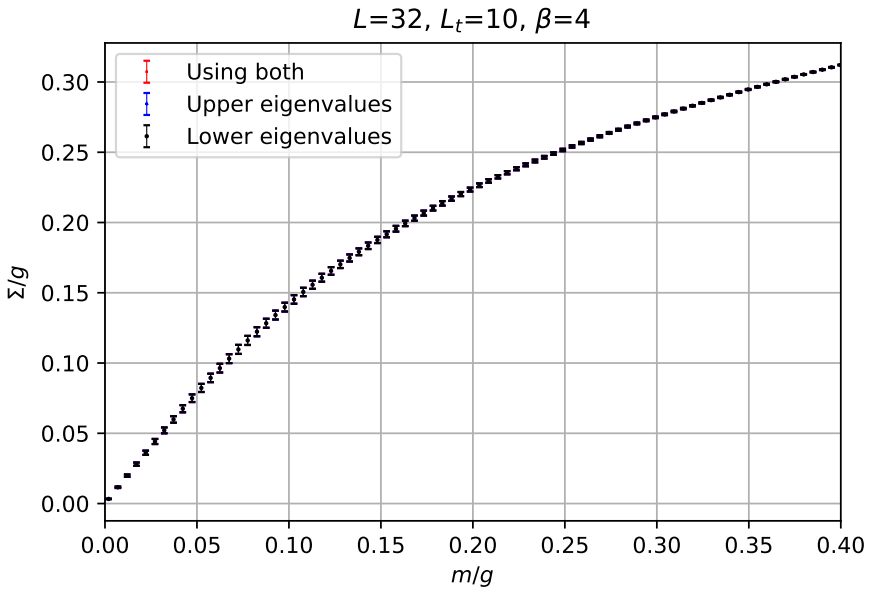
(a) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x4.



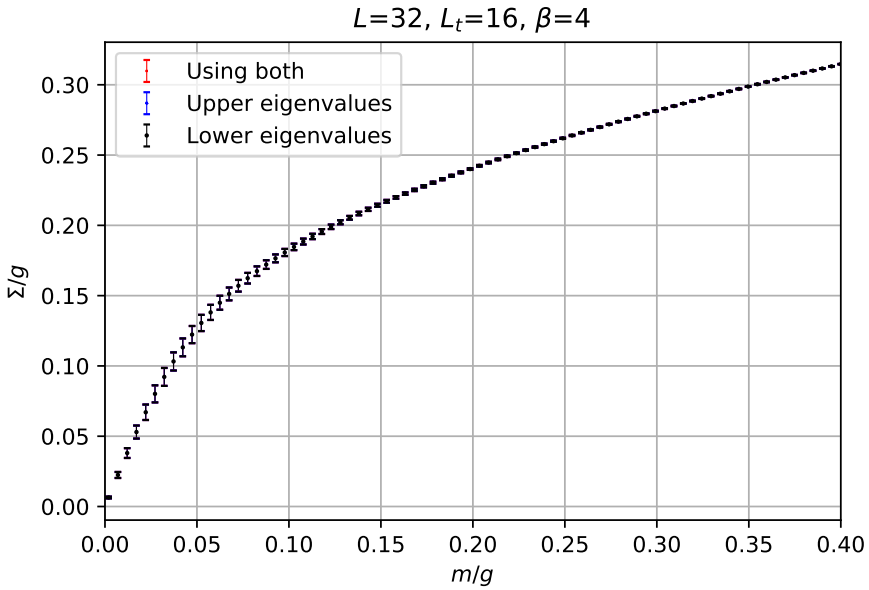
(b) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x6.



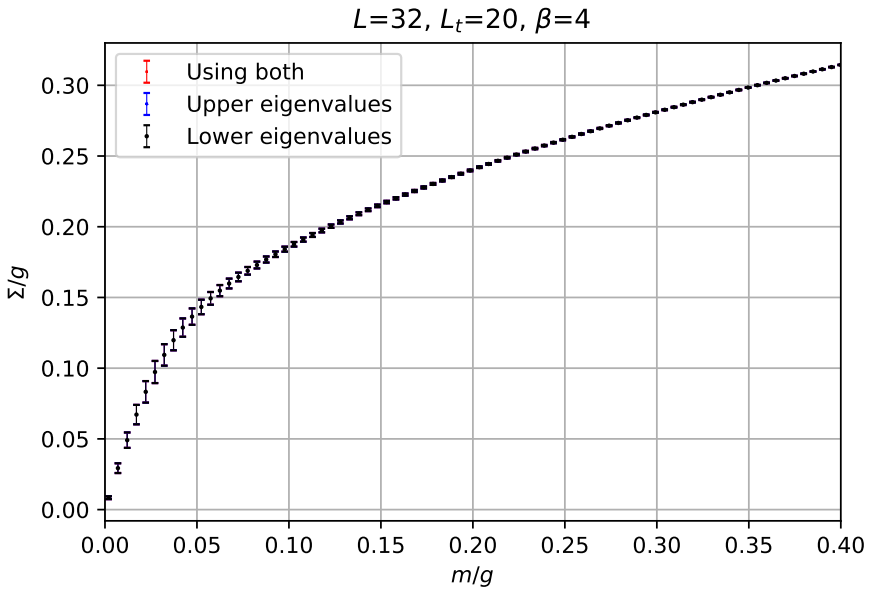
(c) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x8.



(d) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x10.



(e) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x16.

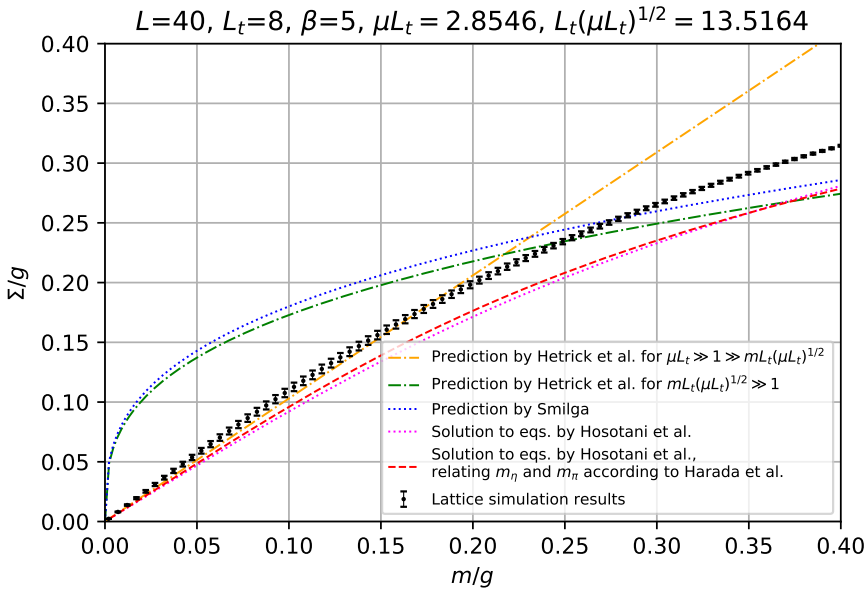


(f) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 32x20.

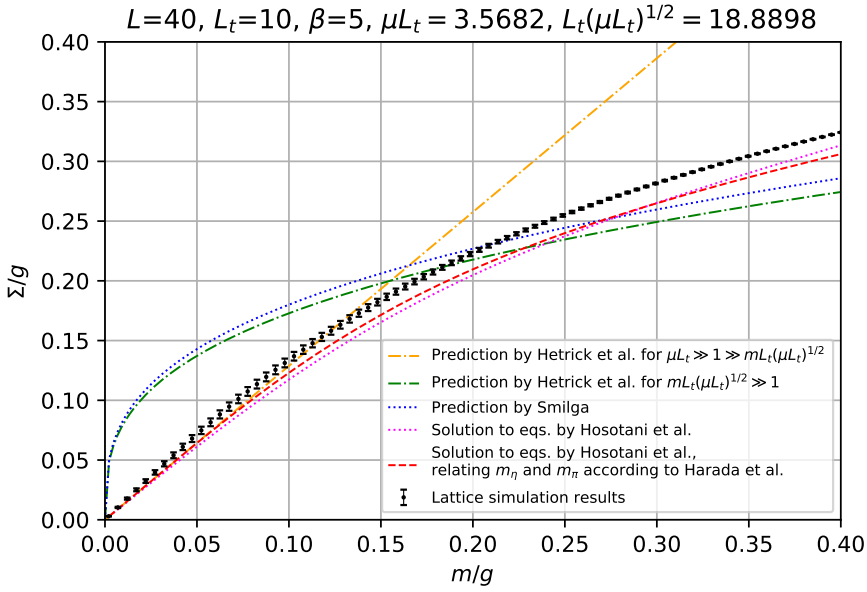
Figure 4: $L = 32$

3 $\beta = 5$

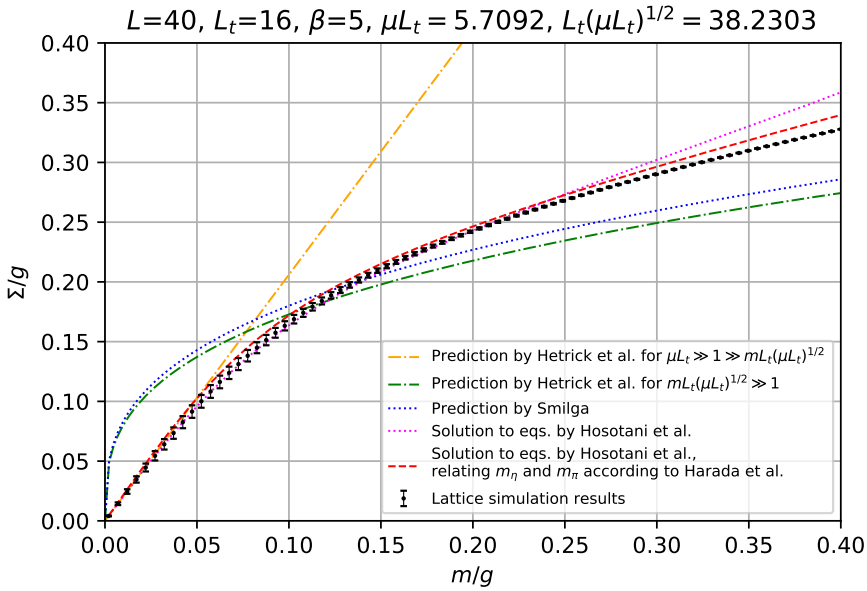
3.1 Lattice vs. equations by Hosotani



(a) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.

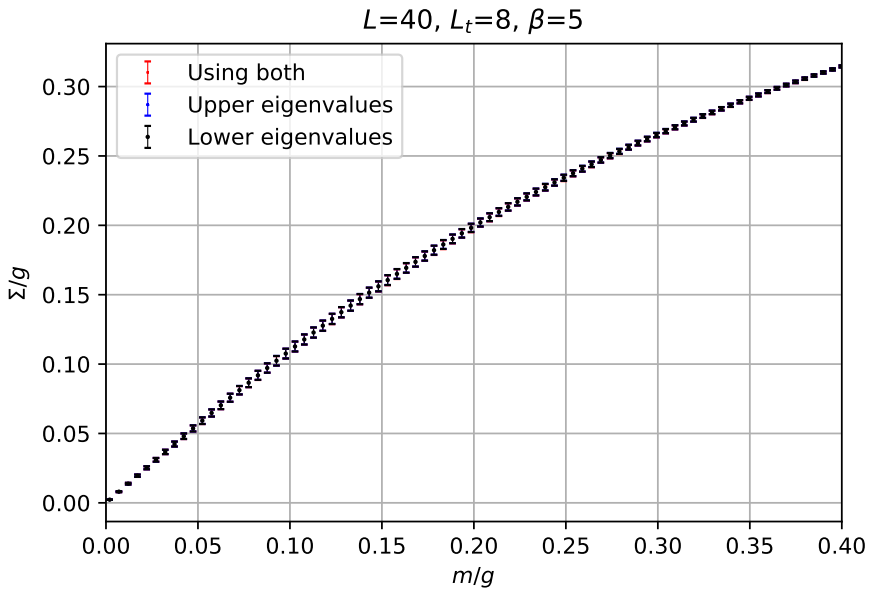


(b) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.

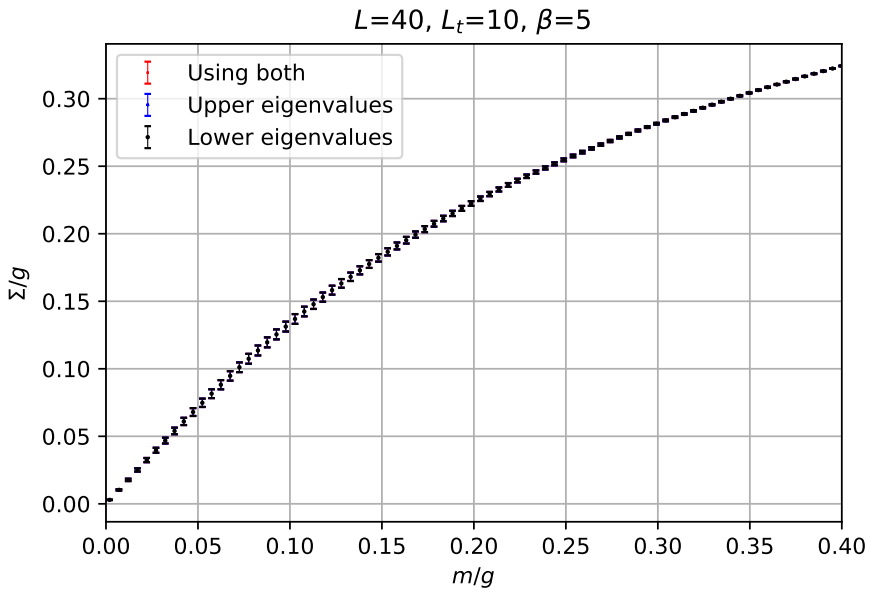


(c) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x16.

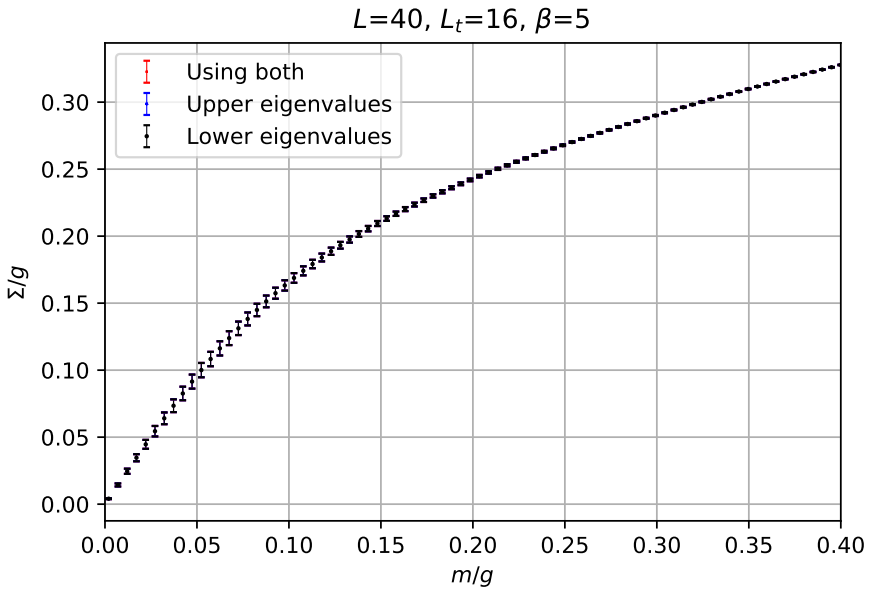
3.2 Comparison of Σ with the lower and upper half plane eigenvalues.



(d) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x8.



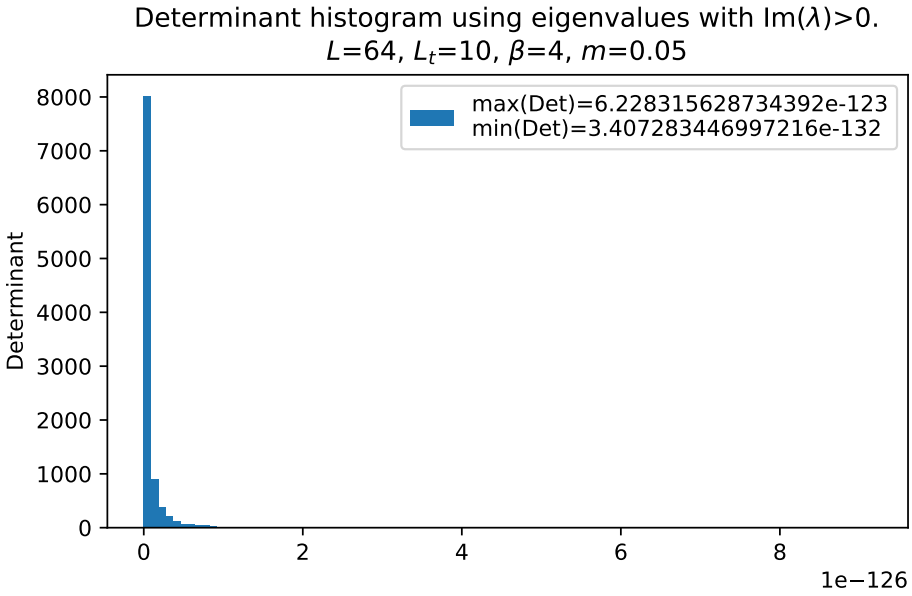
(e) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x10.



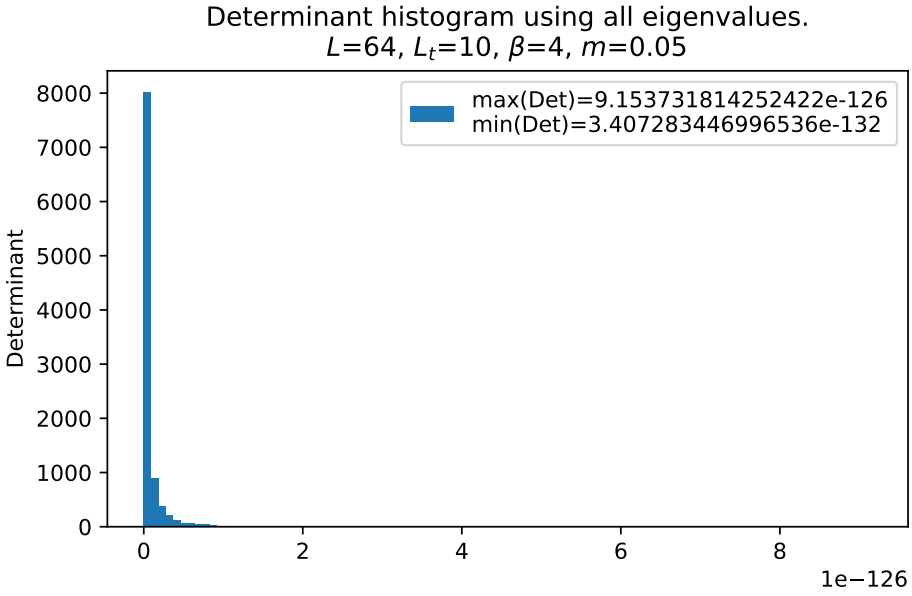
(f) $\langle\overline{\psi}\psi\rangle$ for a lattice of size 40x16.

Figure 5: $\beta = 5$

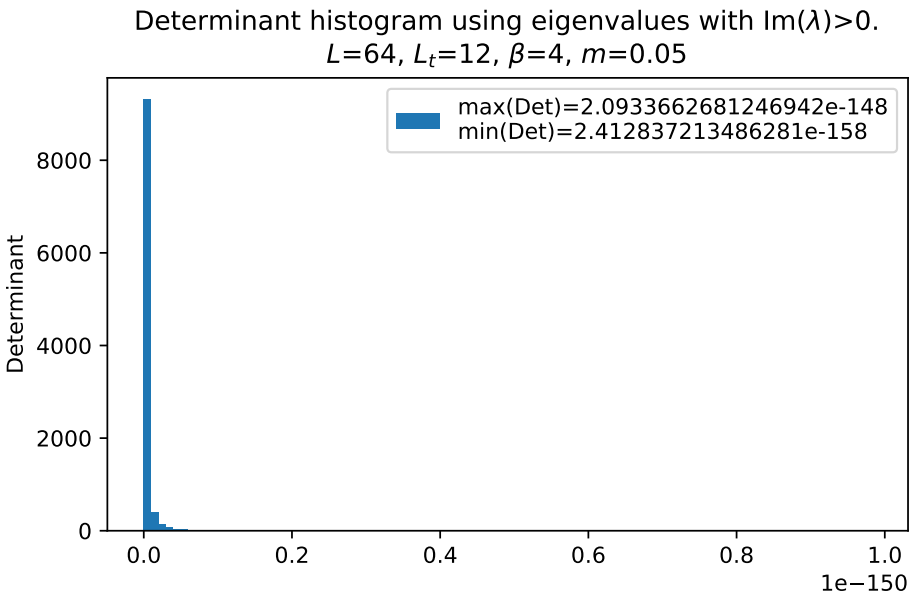
4 Histograms



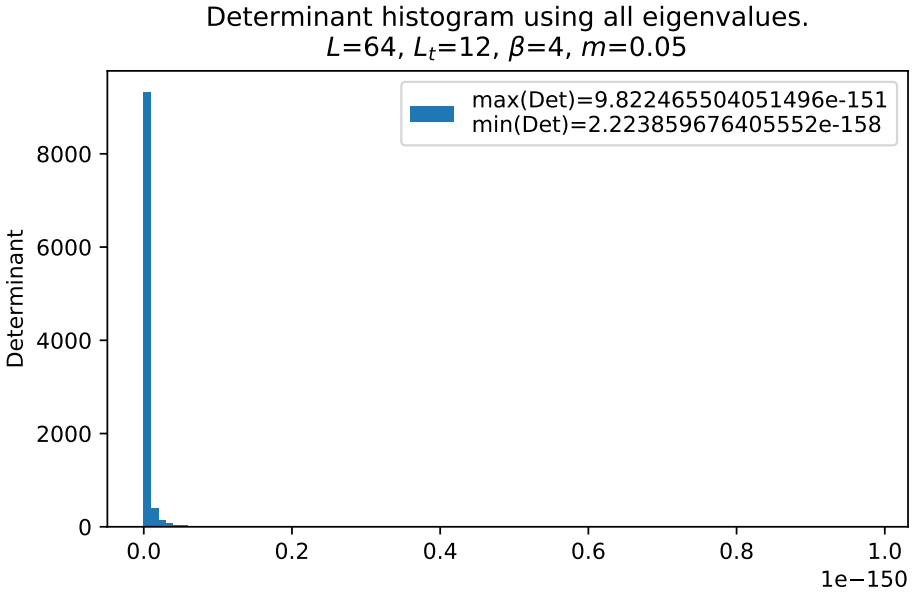
(a)



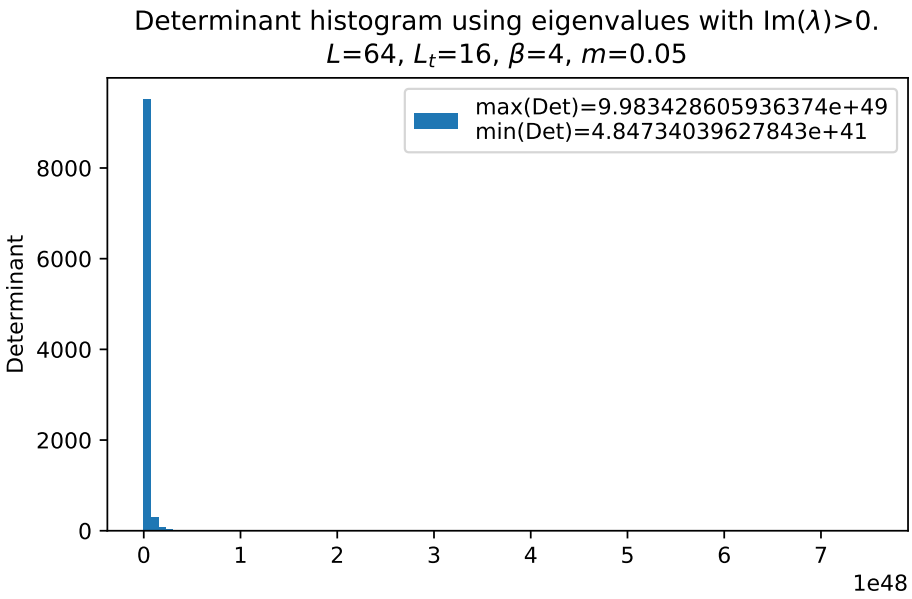
(b)


Determinant histogram using eigenvalues with Im(λ)>0.
L=64, L_t=12, β=4, m=0.05
max(Det)=2.0933662681246942e-148
min(Det)=2.412837213486281e-158
Determinant
8000
6000
4000
2000
0
0.0
0.2
0.4
0.6
0.8
1.0
1e−150

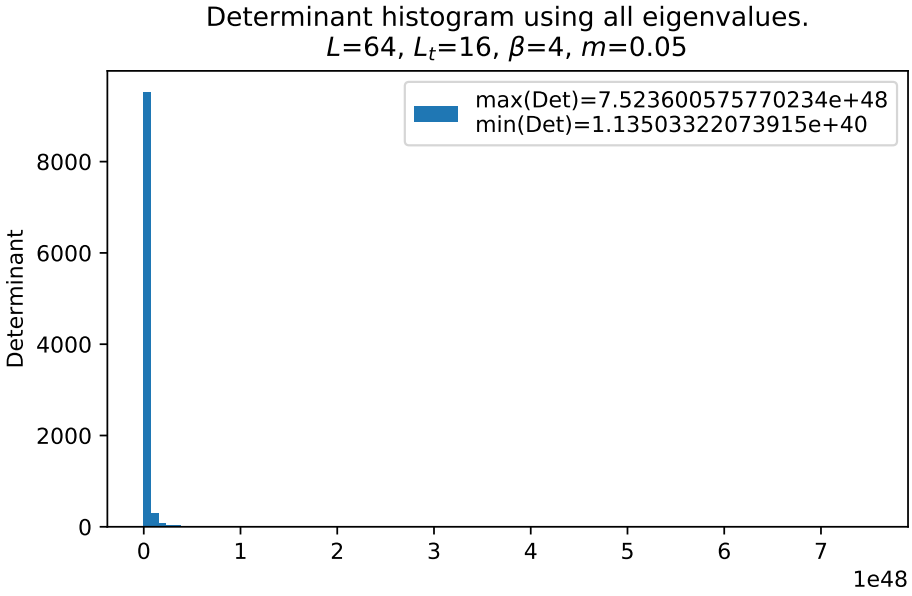
(c)


Determinant histogram using all eigenvalues.
L=64, L_t=12, β=4, m=0.05
max(Det)=9.822465504051496e-151
min(Det)=2.223859676405552e-158
Determinant
8000
6000
4000
2000
0
0.0
0.2
0.4
0.6
0.8
1.0
1e−150

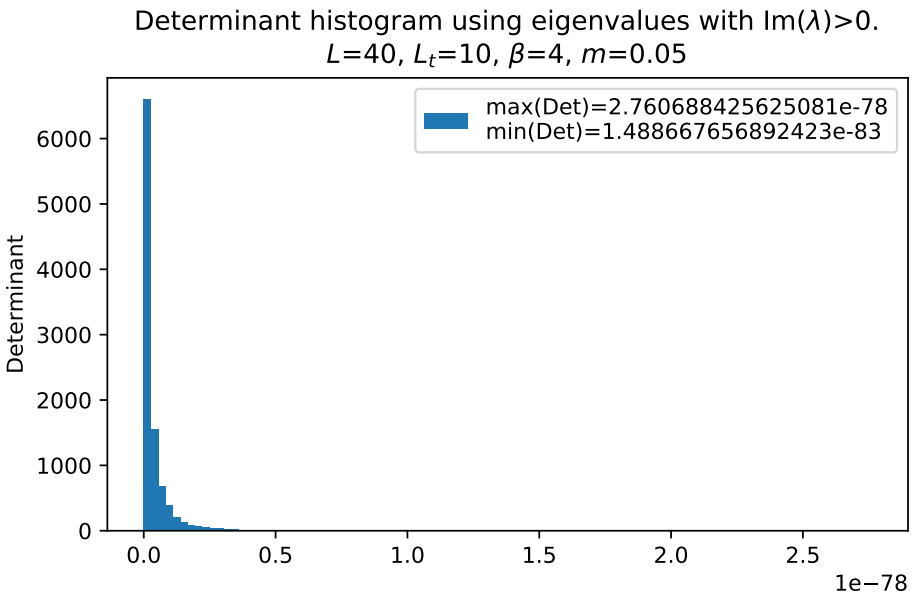
(d)


Determinant histogram using eigenvalues with Im(λ)>0.
L=64, L_t=16, β=4, m=0.05
max(Det)=9.983428605936374e+49
min(Det)=4.84734039627843e+41
Determinant
8000
6000
4000
2000
0
0
1
2
3
4
5
6
7
1e48

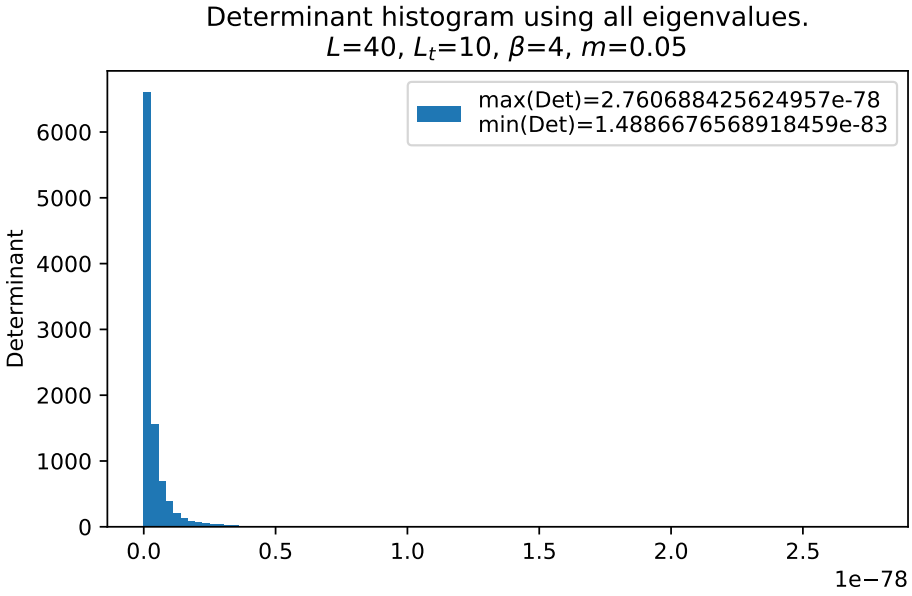
(e)


Determinant histogram using all eigenvalues.
L=64, L_t=16, β=4, m=0.05
max(Det)=7.523600575770234e+48
min(Det)=1.13503322073915e+40
Determinant
8000
6000
4000
2000
0
0
1
2
3
4
5
6
7
1e48

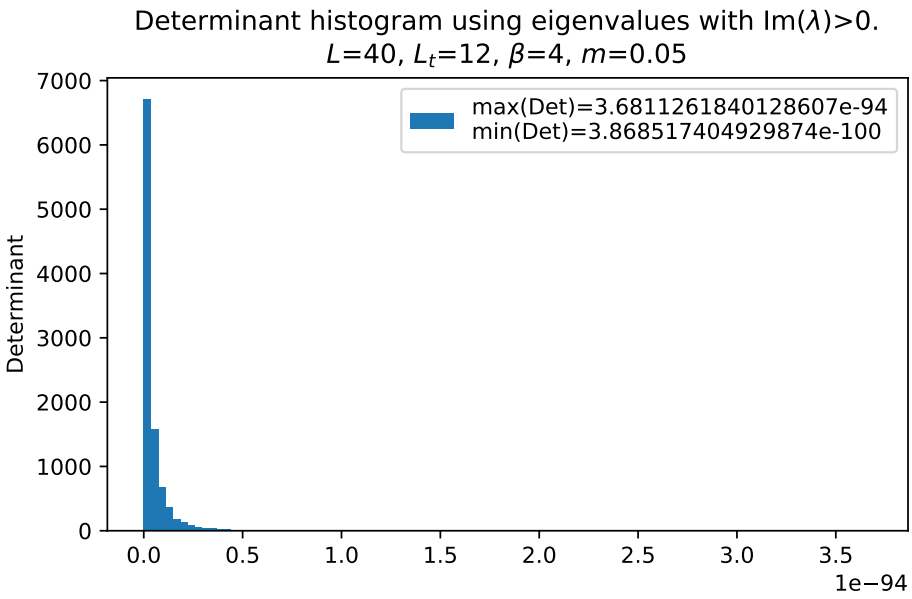
(f)


Determinant histogram using eigenvalues with Im(λ)>0.
L=40, L_t=10, β=4, m=0.05
max(Det)=2.760688425625081e-78
min(Det)=1.488667656892423e-83
Determinant
6000
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
1e−78

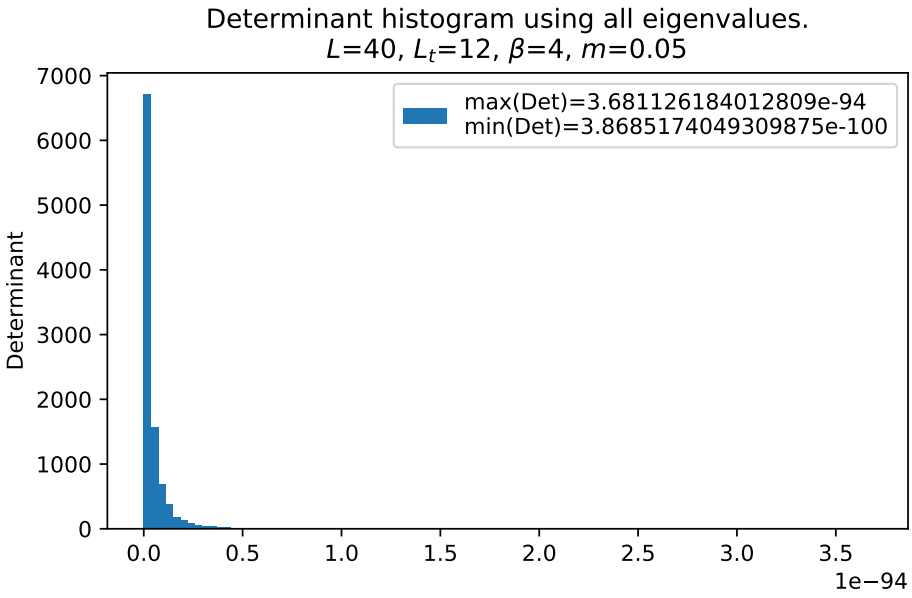
(g)


Determinant histogram using all eigenvalues.
L=40, L_t=10, β=4, m=0.05
max(Det)=2.760688425624957e-78
min(Det)=1.4886676568918459e-83
Determinant
6000
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
1e−78

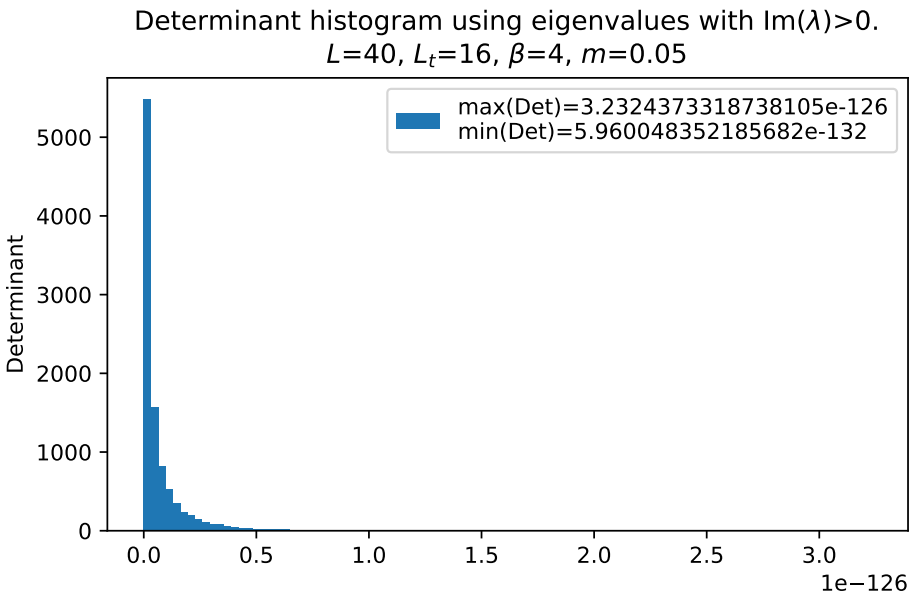
(h)


Determinant histogram using eigenvalues with Im(λ)>0.
L=40, L_t=12, β=4, m=0.05
max(Det)=3.6811261840128607e-94
min(Det)=3.868517404929874e-100
Determinant
7000
6000
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1e−94

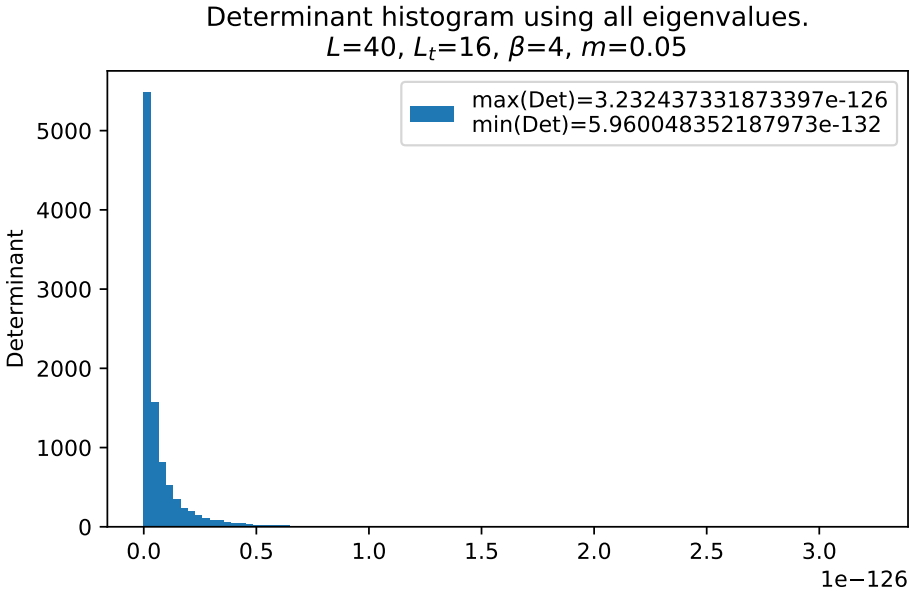
(i)


Determinant histogram using all eigenvalues.
L=40, L_t=12, β=4, m=0.05
max(Det)=3.681126184012809e-94
min(Det)=3.8685174049309875e-100
Determinant
7000
6000
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1e−94

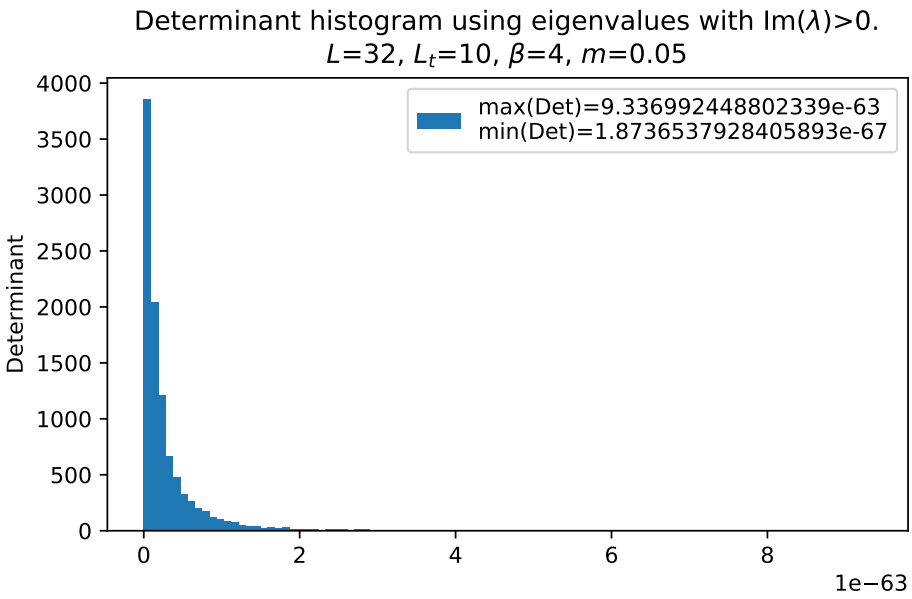
(j)


Determinant histogram using eigenvalues with Im(λ)>0.
L=40, L_t=16, β=4, m=0.05
max(Det)=3.2324373318738105e-126
min(Det)=5.960048352185682e-132
Determinant
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1e−126

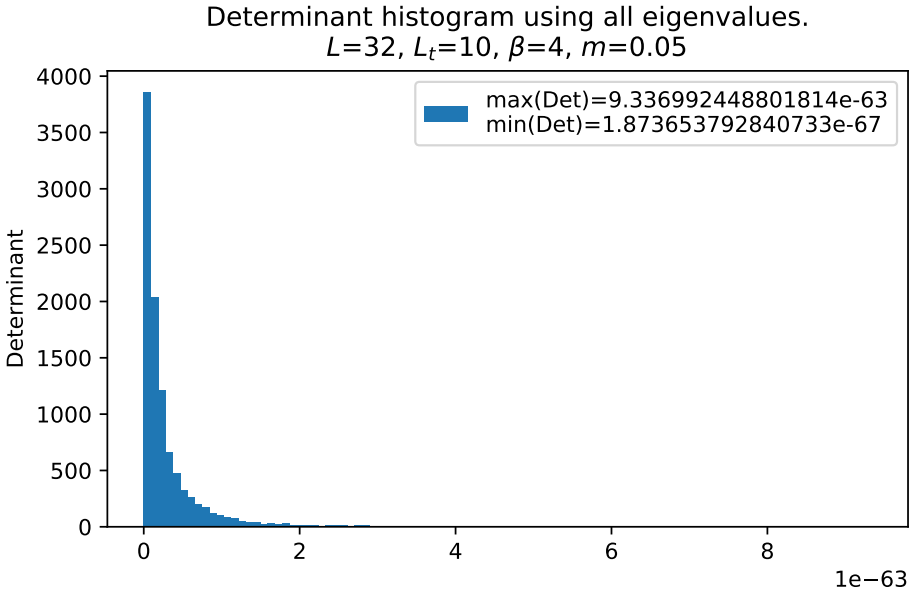
(k)


Determinant histogram using all eigenvalues.
L=40, L_t=16, β=4, m=0.05
max(Det)=3.232437331873397e-126
min(Det)=5.960048352187973e-132
Determinant
5000
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
1e−126

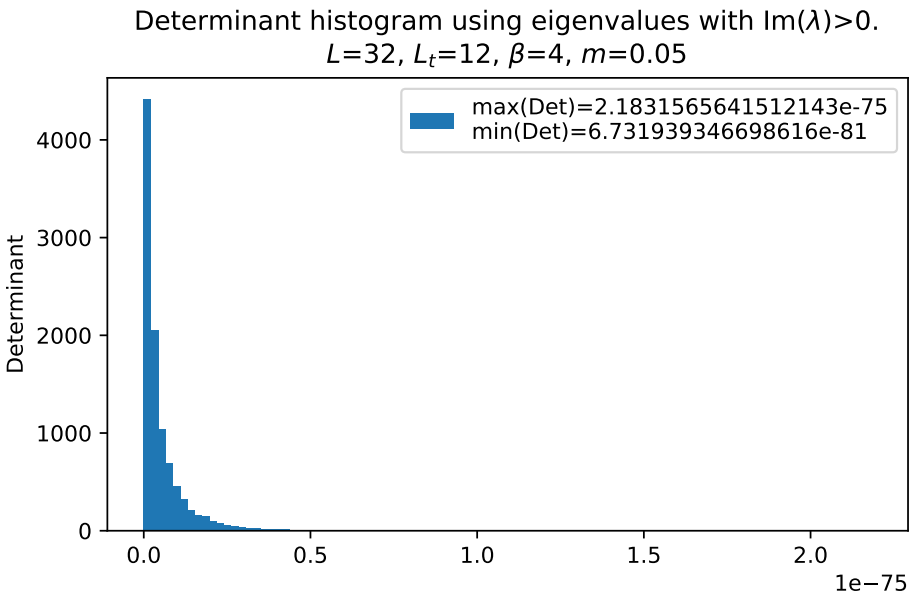
(l)


Determinant histogram using eigenvalues with Im(λ)>0.
L=32, Lt=10, β=4, m=0.05
max(Det)=9.336992448802339e-63
min(Det)=1.8736537928405893e-67
Determinant
4000
3500
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
1e−63

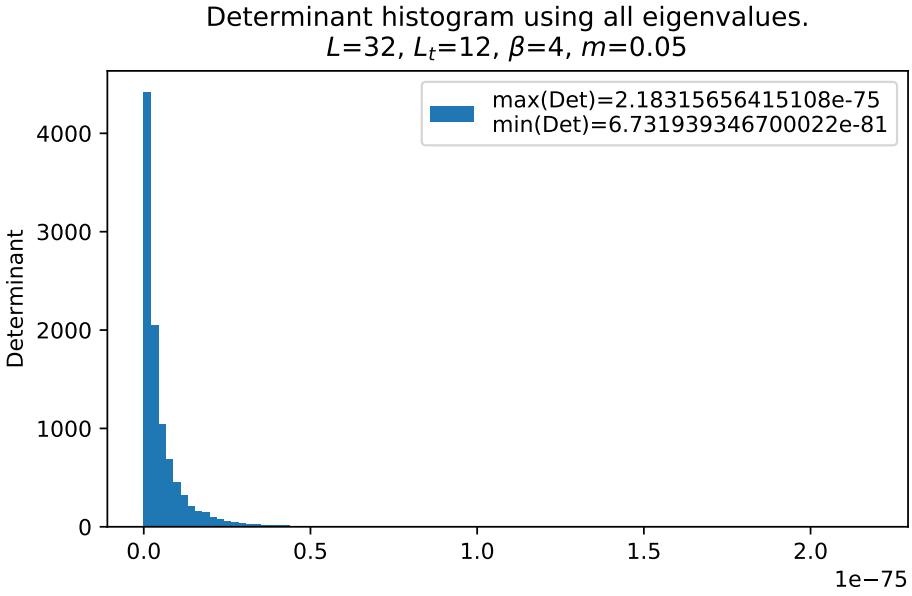
(m)


Determinant histogram using all eigenvalues.
L=32, Lt=10, β=4, m=0.05
max(Det)=9.336992448801814e-63
min(Det)=1.873653792840733e-67
Determinant
4000
3500
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
1e−63

(n)


Determinant histogram using eigenvalues with Im(λ)>0.
L=32, L_t=12, β=4, m=0.05
max(Det)=2.1831565641512143e-75
min(Det)=6.731939346698616e-81
Determinant
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
1e−75

(o)


Determinant histogram using all eigenvalues.
L=32, L_t=12, β=4, m=0.05
max(Det)=2.18315656415108e-75
min(Det)=6.731939346700022e-81
Determinant
4000
3000
2000
1000
0
0.0
0.5
1.0
1.5
2.0
1e−75

(p)