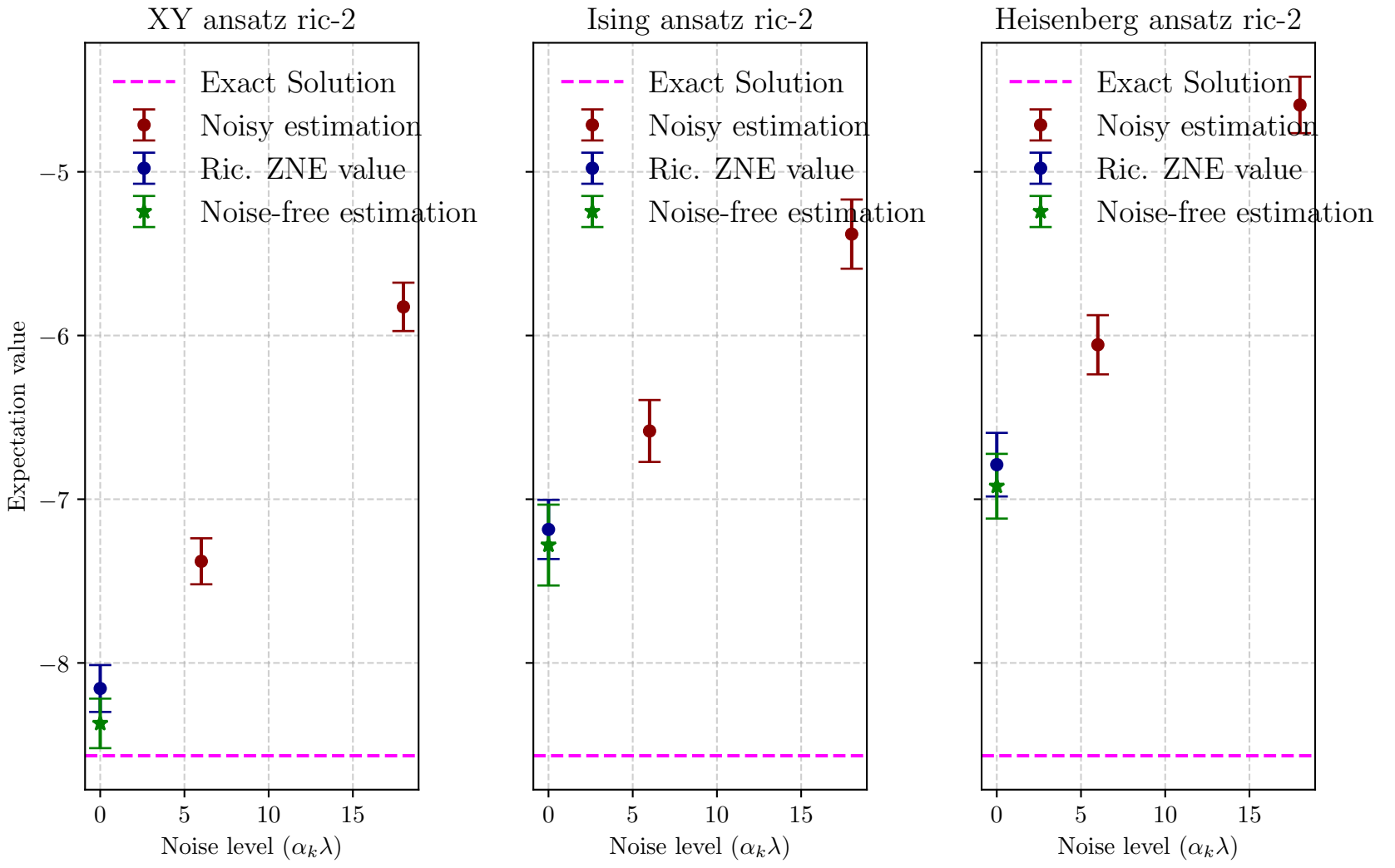
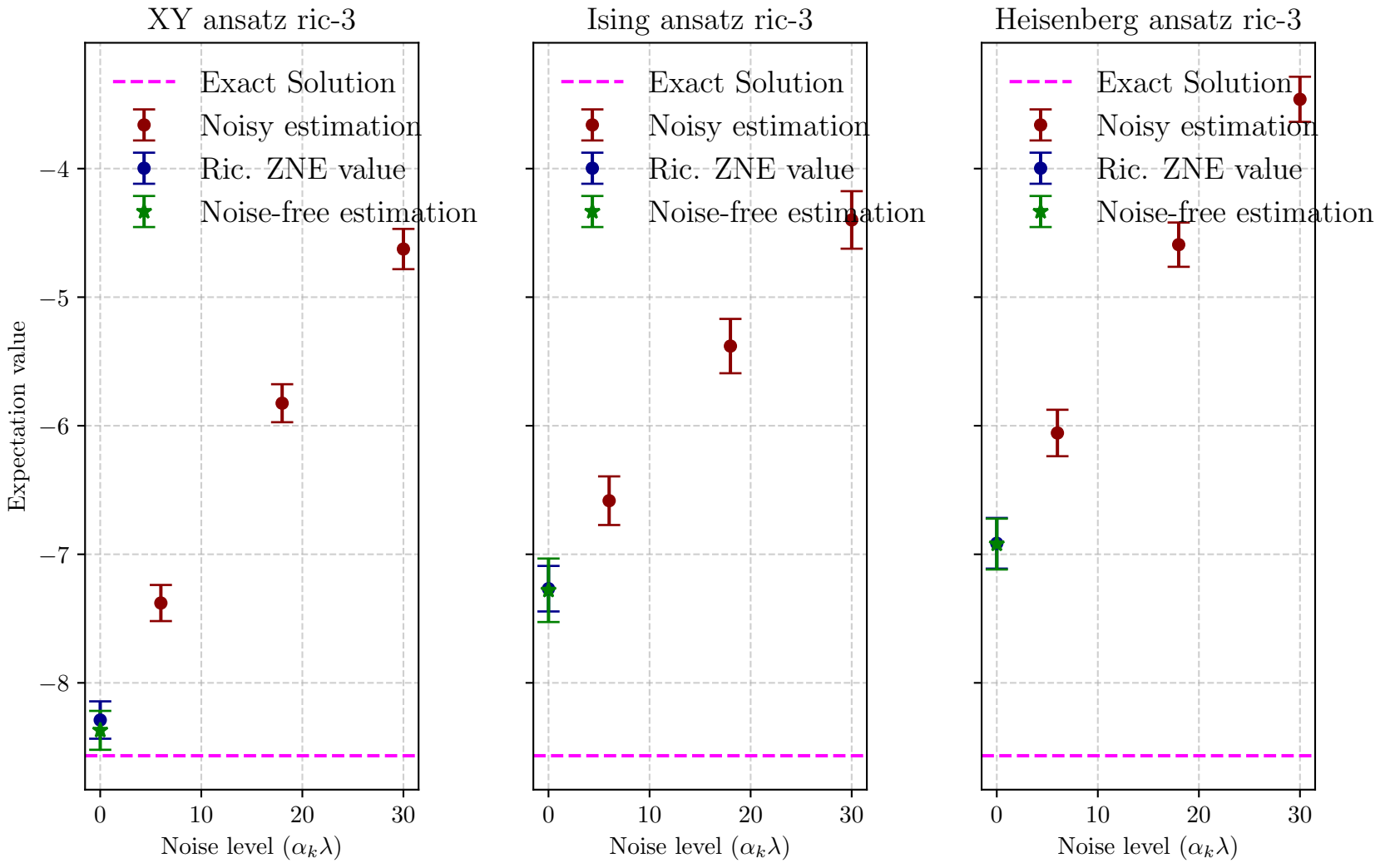
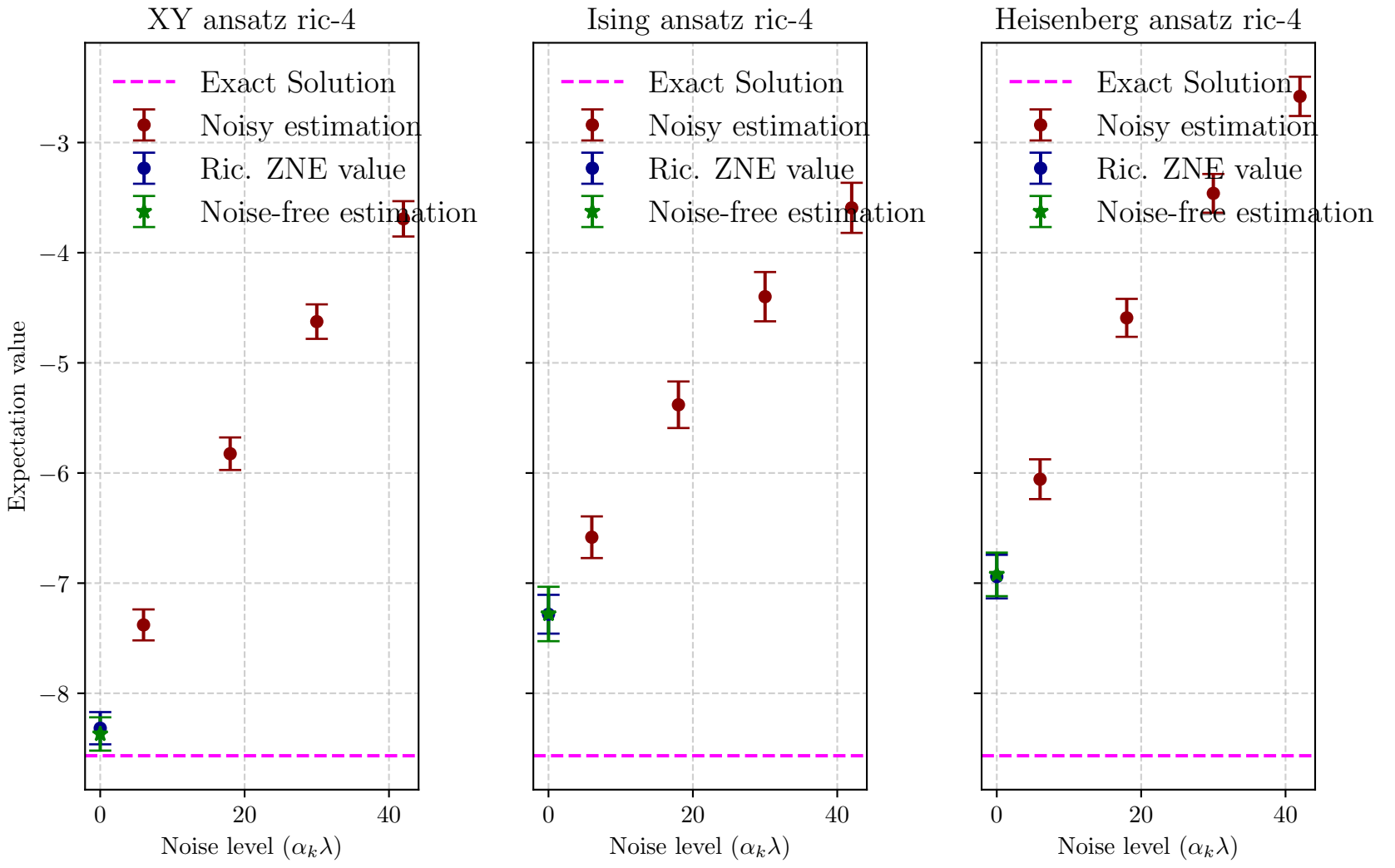
Description	Simulation	Mean ± Std
xy-ric2	vqe	-7.37909 ± 0.14052
xy-ric2	redundant (noise=6)	-7.37909 ± 0.14052
xy-ric2	redundant (noise=18)	-5.82492 ± 0.14775
xy-ric2	zne	-8.15618 ± 0.14317
xy-ric2	noiseoff	-8.36934 ± 0.15125
ising-ric2	vqe	-6.58315 ± 0.18915
ising-ric2	redundant (noise=6)	-6.58315 ± 0.18915
ising-ric2	redundant (noise=18)	-5.38044 ± 0.21133
ising-ric2	zne	-7.18451 ± 0.18074
ising-ric2	noiseoff	-7.28002 ± 0.24691
heisenberg-ric2	vqe	-6.05646 ± 0.18070
heisenberg-ric2	redundant (noise=6)	-6.05646 ± 0.18070
heisenberg-ric2	redundant (noise=18)	-4.59153 ± 0.17228
heisenberg-ric2	zne	-6.78892 ± 0.19421
heisenberg-ric2	noiseoff	-6.92055 ± 0.19767
xy-ric3-uniform-scaling	vqe	-7.37909 ± 0.14052
xy-ric3-uniform-scaling	redundant (noise=6)	-7.37909 ± 0.14052
xy-ric3-uniform-scaling	redundant (noise=18)	-5.82492 ± 0.14775
xy-ric3-uniform-scaling	redundant (noise=30)	-4.62559 ± 0.15660
xy-ric3-uniform-scaling	zne	-8.28925 ± 0.14534
xy-ric3-uniform-scaling	noiseoff	-8.36934 ± 0.15125
ising-ric3-uniform-scaling	vqe	-6.58315 ± 0.18915
ising-ric3-uniform-scaling	redundant (noise=6)	-6.58315 ± 0.18915
ising-ric3-uniform-scaling	redundant (noise=18)	-5.38044 ± 0.21133
ising-ric3-uniform-scaling	redundant (noise=30)	-4.39924 ± 0.22365
ising-ric3-uniform-scaling	zne	-7.26757 ± 0.17710
ising-ric3-uniform-scaling	noiseoff	-7.28002 ± 0.24691
heisenberg-ric3-uniform-scaling	vqe	-6.05646 ± 0.18070
heisenberg-ric3-uniform-scaling	redundant (noise=6)	-6.05646 ± 0.18070
heisenberg-ric3-uniform-scaling	redundant (noise=18)	-4.59153 ± 0.17228
heisenberg-ric3-uniform-scaling	redundant (noise=30)	-3.46107 ± 0.17562
heisenberg-ric3-uniform-scaling	zne	-6.91435 ± 0.19705
heisenberg-ric3-uniform-scaling	noiseoff	-6.92055 ± 0.19767
xy-ric4-uniform-scaling	vqe	-7.37909 ± 0.14052
xy-ric4-uniform-scaling	redundant (noise=6)	-7.37909 ± 0.14052
xy-ric4-uniform-scaling	redundant (noise=18)	-5.82492 ± 0.14775
xy-ric4-uniform-scaling	redundant (noise=30)	-4.62559 ± 0.15660
xy-ric4-uniform-scaling	redundant (noise=42)	-3.69251 ± 0.16044
xy-ric4-uniform-scaling	zne	-8.31693 ± 0.14624
xy-ric4-uniform-scaling	noiseoff	-8.36934 ± 0.15125
ising-ric4-uniform-scaling	vqe	-6.58315 ± 0.18915
ising-ric4-uniform-scaling	redundant (noise=6)	-6.58315 ± 0.18915
ising-ric4-uniform-scaling	redundant (noise=18)	-5.38044 ± 0.21133
ising-ric4-uniform-scaling	redundant (noise=30)	-4.39924 ± 0.22365
ising-ric4-uniform-scaling	redundant (noise=42)	-3.59276 ± 0.22745
ising-ric4-uniform-scaling	zne	-7.28218 ± 0.17606
ising-ric4-uniform-scaling	noiseoff	-7.28002 ± 0.24691
heisenberg-ric4-uniform-scaling	vqe	-6.05646 ± 0.18070
heisenberg-ric4-uniform-scaling	redundant (noise=6)	-6.05646 ± 0.18070
heisenberg-ric4-uniform-scaling	redundant (noise=18)	-4.59153 ± 0.17228
heisenberg-ric4-uniform-scaling	redundant (noise=30)	-3.46107 ± 0.17562
heisenberg-ric4-uniform-scaling	redundant (noise=42)	-2.58067 ± 0.17819
heisenberg-ric4-uniform-scaling	zne	-6.94072 ± 0.19769
heisenberg-ric4-uniform-scaling	noiseoff	-6.92055 ± 0.19767


XY ansatz ric-2
Ising ansatz ric-2
Heisenberg ansatz ric-2
Exact Solution
Noisy estimation
Ric. ZNE value
Noise-free estimation
Expectation value
−5
−6
−7
−8
0
5
10
15
Noise level ($\alpha_k\lambda$)


XY ansatz ric-3
Ising ansatz ric-3
Heisenberg ansatz ric-3
Exact Solution
Noisy estimation
Ric. ZNE value
Noise-free estimation
Expectation value
−4
−5
−6
−7
−8
0
10
20
30
Noise level ($\alpha_k\lambda$)


XY ansatz ric-4
Ising ansatz ric-4
Heisenberg ansatz ric-4
Exact Solution
Noisy estimation
Ric. ZNE value
Noise-free estimation
Expectation value
−3
−4
−5
−6
−7
−8
0
20
40
Noise level ($\alpha_k\lambda$)

XY VQE CONFIGURATION

Parameter	Value
run	vqe
nqubits	7
state	dmatrix
output.file_name_prefix	xy_noisefree_time_evo
output.draw.status	True
output.draw.fig_dpi	100
output.draw.type	png
observable.def	ising
observable.coefficients.cn	[0.5, 0.5, 0.5, 0.5, 0.5, 0.5]
observable.coefficients.bn	[1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
observable.coefficients.r	1
ansatz.layer	30
ansatz.gateset	1
ansatz.ugate.type	xy-iss
ansatz.ugate.coefficients.cn	[0.5, 0.5, 0.5, 0.5, 0.5, 0.5]
ansatz.ugate.coefficients.bn	[0, 0, 0, 0, 0, 0, 0]
ansatz.ugate.coefficients.r	0
ansatz.ugate.time.min	0.0
ansatz.ugate.time.max	10.0
vqe.iteration	10
vqe.optimization.status	True
vqe.optimization.algorithm	SLSQP
vqe.optimization.constraint	True
init_param.value	random
noise_profile.status	True
noise_profile.type	depolarizing
noise_profile.noise_prob	[0.001, 0.001, 0, 0]
noise_profile.noise_on_init_param.status	False
noise_profile.noise_on_init_param.value	0
redundant.identity_factors	[[0, 0, 0, 0], [1, 1, 0, 0]]
zne.method	richardson
zne.degree	1
zne.sampling	default
zne.data_points	

ISING VQE CONFIGURATION

Parameter	Value
run	vqe
nqubits	7
state	dmatrix
output.file_name_prefix	ising_noisefree_time_evo
output.draw.status	True
output.draw.fig_dpi	100
output.draw.type	png
observable.def	ising
observable.coefficients.cn	[0.5, 0.5, 0.5, 0.5, 0.5, 0.5]
observable.coefficients.bn	[1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
observable.coefficients.r	1
ansatz.layer	30
ansatz.gateset	1
ansatz.ugate.type	ising
ansatz.ugate.coefficients.cn	[0.5, 0.5, 0.5, 0.5, 0.5, 0.5]
ansatz.ugate.coefficients.bn	[0, 0, 0, 0, 0, 0, 0]
ansatz.ugate.coefficients.r	0
ansatz.ugate.time.min	0.0
ansatz.ugate.time.max	10.0
vqe.iteration	10
vqe.optimization.status	True
vqe.optimization.algorithm	SLSQP
vqe.optimization.constraint	True
init_param.value	random
noise_profile.status	True
noise_profile.type	depolarizing
noise_profile.noise_prob	[0.001, 0.001, 0, 0]
noise_profile.noise_on_init_param.status	False
noise_profile.noise_on_init_param.value	0
redundant.identity_factors	[[0, 0, 0, 0], [1, 1, 0, 0]]
zne.method	richardson
zne.degree	1
zne.sampling	default
zne.data_points	

HEISENBERG VQE CONFIGURATION

Parameter	Value
run	vqe
nqubits	7
state	dmatrix
output.file_name_prefix	heisenberg_noisefree_time_evo
output.draw.status	True
output.draw.fig_dpi	100
output.draw.type	png
observable.def	ising
observable.coefficients.cn	[0.5, 0.5, 0.5, 0.5, 0.5, 0.5]
observable.coefficients.bn	[1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
observable.coefficients.r	1
ansatz.layer	30
ansatz.gateset	1
ansatz.ugate.type	heisenberg
ansatz.ugate.coefficients.cn	[0.5, 0.5, 0.5, 0.5, 0.5, 0.5]
ansatz.ugate.coefficients.bn	[0, 0, 0, 0, 0, 0, 0]
ansatz.ugate.coefficients.r	0
ansatz.ugate.time.min	0.0
ansatz.ugate.time.max	10.0
vqe.iteration	10
vqe.optimization.status	True
vqe.optimization.algorithm	SLSQP
vqe.optimization.constraint	True
init_param.value	random
noise_profile.status	True
noise_profile.type	depolarizing
noise_profile.noise_prob	[0.001, 0.001, 0, 0]
noise_profile.noise_on_init_param.status	False
noise_profile.noise_on_init_param.value	0
redundant.identity_factors	[[0, 0, 0, 0], [1, 1, 0, 0]]
zne.method	richardson
zne.degree	1
zne.sampling	default
zne.data_points	