

Executed Command

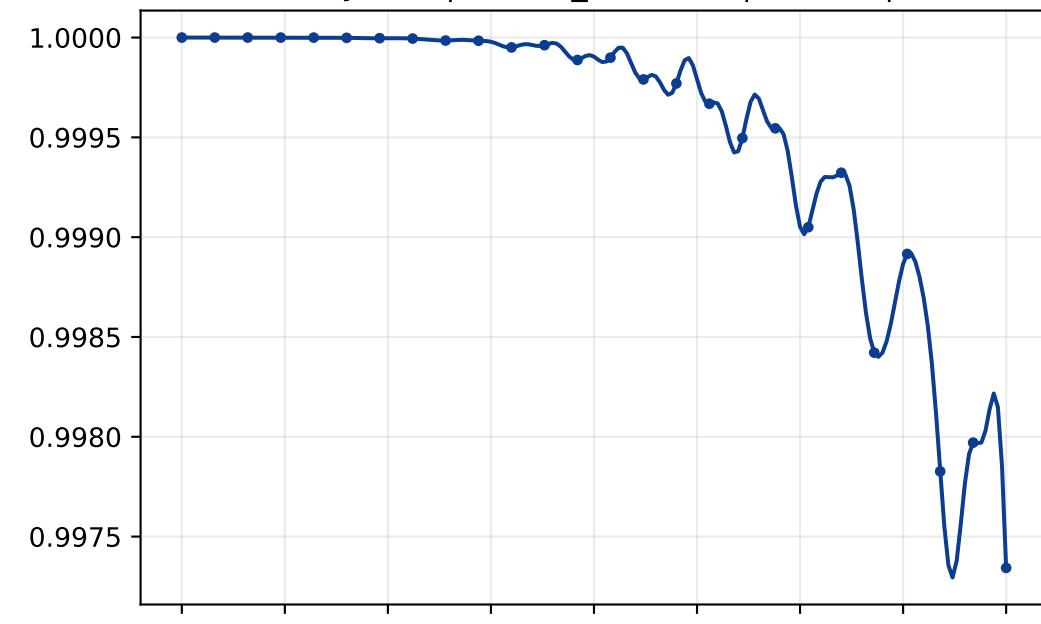
Reference: pipelines/PIPELINE_RUN_GUIDE.md

Script: pipelines/hardcoded_hubbard_pipeline.py

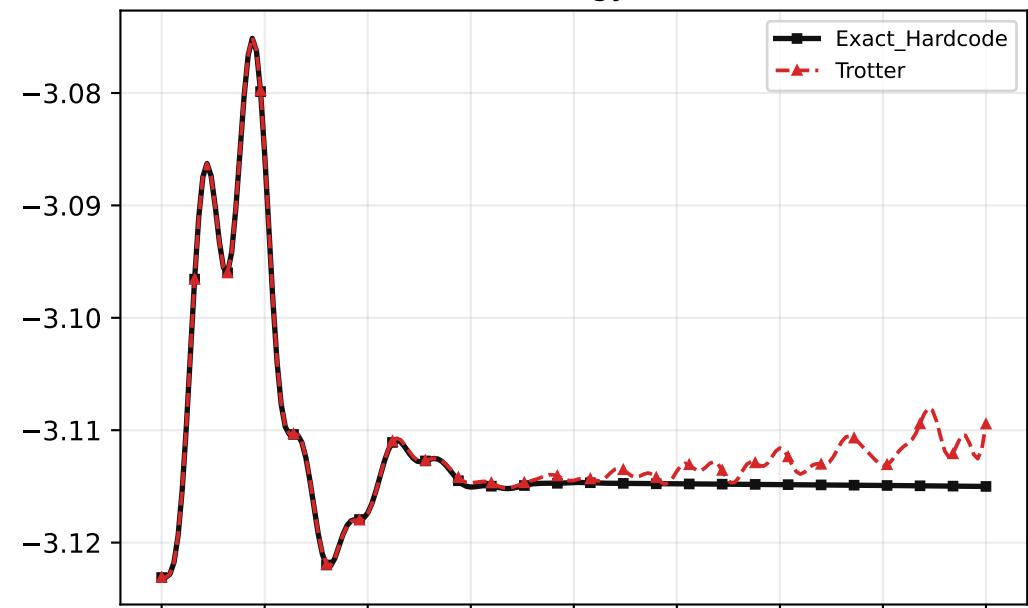
```
/Library/Frameworks/Python.framework/Versions/3.12/bin/python3 Fermi-Hamil-JW-VQE-TROTTER-
PIPELINE/pipelines/hardcoded_hubbard_pipeline.py --L 3 --initial-state-source exact --t 1.0 --u 4.0 --dv 0.0
--boundary periodic --ordering blocked --t-final 20.0 --num-times 201 --trotter-steps 128 --enable-drive
--drive-pattern staggered --drive-A 0.2 --drive-omega 2.0 --drive-tbar 3.0 --drive-phi 0.0 --drive-time-
sampling midpoint --skip-qpe --vqe-restarts 1 --vqe-maxiter 120 --output-json artifacts/compare_A02_L3.json
--output-pdf artifacts/compare_A02_L3.pdf
```

Hardcoded Hubbard Pipeline: L=3

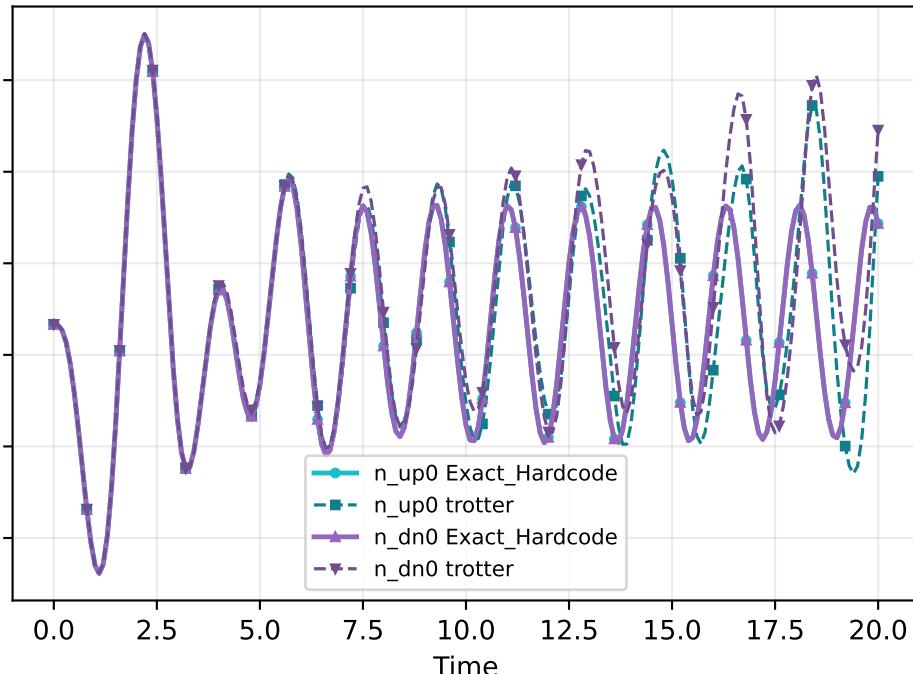
Fidelity(t) = $| \langle \text{Exact_Hardcode} | \text{Trotter} \rangle |^2$



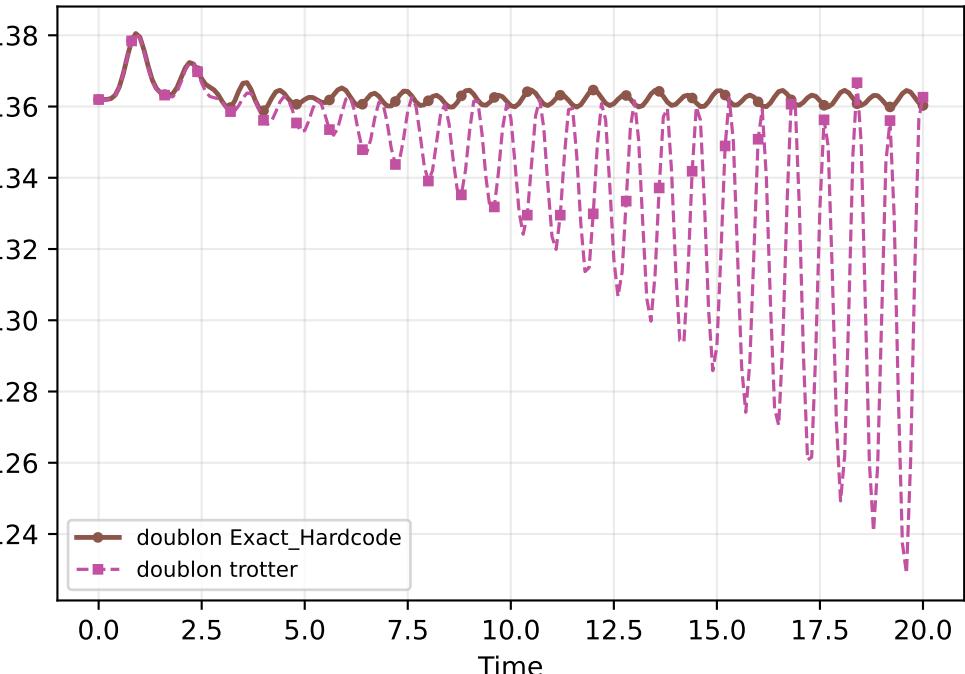
Energy



Site-0 Occupations

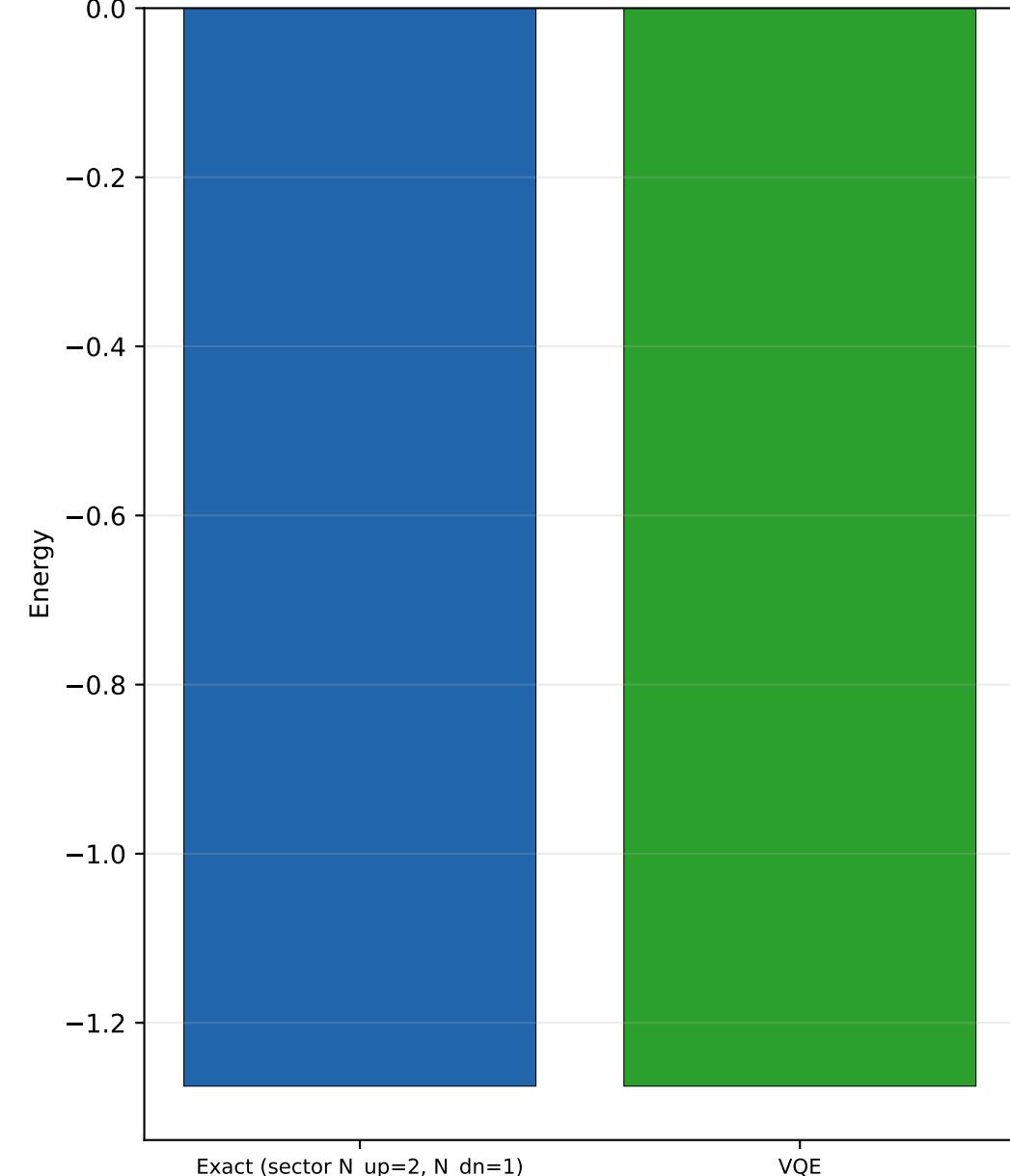


Total Doublon

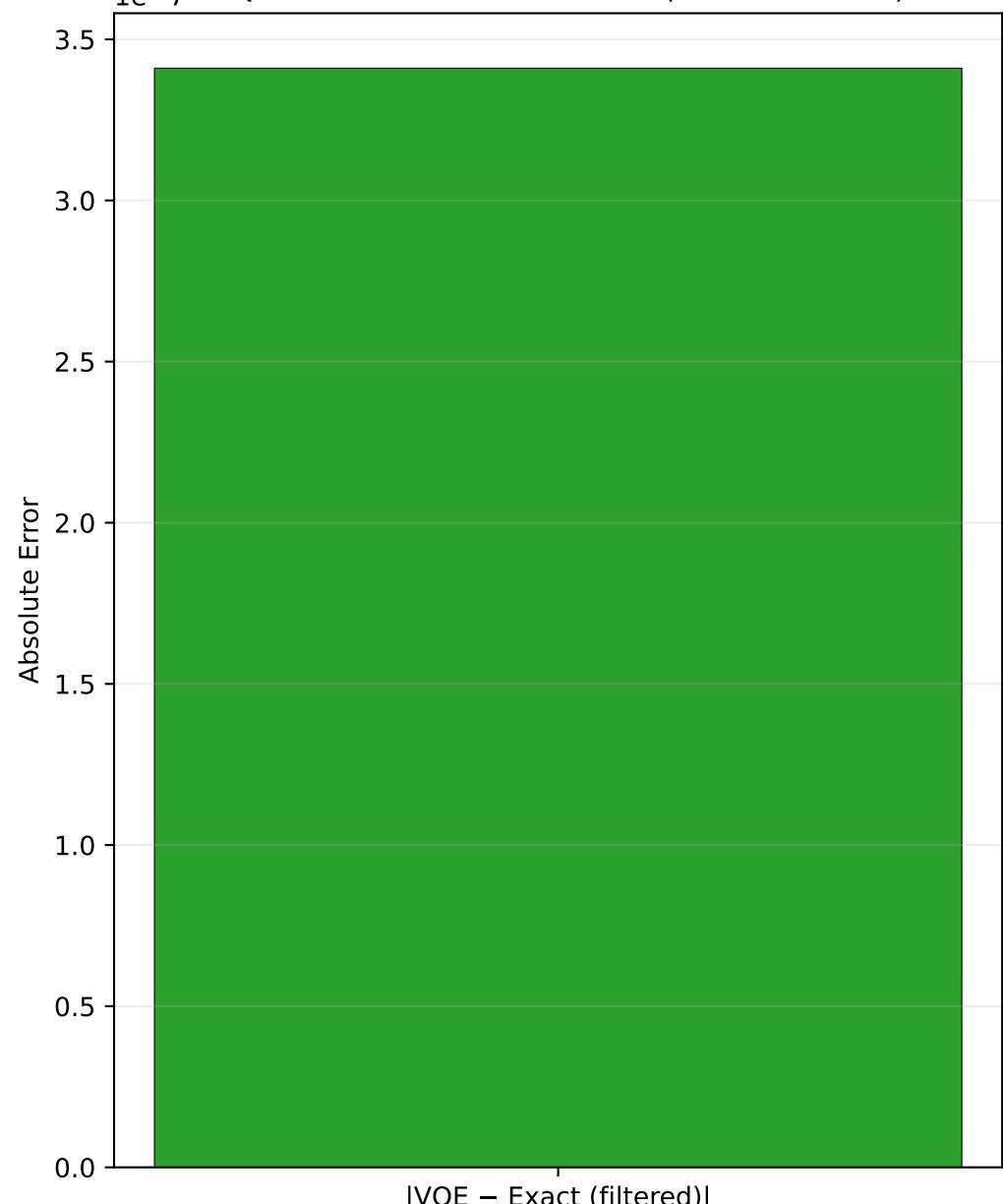


VQE optimises within the half-filled sector; exact (filtered) is the true sector ground state.
Full-Hilbert exact energy is in the JSON text summary only.

VQE Energy vs Exact (filtered sector)



$1e-7$ VQE Absolute Error vs Exact (filtered sector)



Hardcoded Hubbard pipeline summary

```
settings: {"L": 3, "t": 1.0, "u": 4.0, "dv": 0.0, "boundary": "periodic", "ordering": "blocked", "t_final": 20.0, "num_times": 1000}
exact_trajectory_label: Exact_Hardcode
exact_trajectory_method: python_matrix_eigendecomposition
ground_state_exact_energy (full Hilbert): -3.123105625618
ground_state_exact_energy_filtered: -1.2749172176353751
filtered_sector: {'n_up': 2, 'n_dn': 1}
vqe_energy: -1.274916876603393
qpe_energy_estimate: None
initial_state_source: exact
hamiltonian_terms: 22
reference_sanity: {'checked': False, 'reason': 'no matching bundled reference for these settings'}
```