

Hubbard-Holstein Meta Results (Readable Tables Edition)

This version reformats tables so text fits within cells.

All raw HH data remains in the appended appendix pages from the prior meta PDF.

Parsed counts: proof=8, L1-L3=12, termwise_diag=4, zero_holstein=8, smoke=1

Focused Term-wise Reruns (Config)

	case	L	ordering	boundary	J	U	g	omega0	n_ph_max	(N_up,N_dn)	reps	restarts	maxiter	num_params
L=2	term-wise (foc heav...	2	blocked	open	1.0	4.0	0.0	0.0	1	(1,1)	2	20	2000	22
L=3	term-wise (foc heav...	3	blocked	open	1.0	4.0	0.0	0.0	1	(2,1)	2	12	1200	36
L=3	term-wise (foc heav...	3	blocked	open	1.0	4.0	0.0	0.0	1	(2,1)	3	10	1200	54

Focused Term-wise Reruns (Outcome)

	case	E_exact_filtered	E_vqe	deltaE	deltaE<1e-3	success	nfev	nit	best_restart	runtime_s
L=2	term-wise (focus heav...	-0.82842712474619	-0.82842712376211	9.840770e-10	True	True	360	15	18	16.52
L=3	term-wise (focus heav...	-1.23606797749979	-1.41421355312479	1.781456e-01	False	True	832	22	3	369.66
L=3	term-wise (focus heav...	-1.23606797749979	-1.41421329284117	1.781453e-01	False	True	2403	43	9	585.74

HH Proof Sweep (8 cases) - Readable Table

case	L	ordering	boundary	omega0	g_ep	dv	E_vqe	E_exact_filtered	abs_err	tol	pass	run
case01	1	blocked	open	0.500	0.200	0.000	0.250000000000	0.250000000000	3.331e-16	1.000e-03	PASS	primary
case02	1	interleaved	open	0.500	0.200	0.000	0.250000000000	0.250000000000	3.331e-16	1.000e-03	PASS	primary
case03	1	blocked	open	0.800	0.000	0.000	0.400000000000	0.400000000000	0.000e+00	1.000e-03	PASS	primary
case04	1	blocked	open	0.000	0.300	0.000	0.000000000000	0.000000000000	0.000e+00	1.000e-03	PASS	primary
case05	2	blocked	open	0.400	0.150	0.000	0.781966014470	0.83951276438	1.621e+00	1.000e-03	FAIL	retry
case06	2	interleaved	open	0.400	0.150	0.000	0.781966014470	0.83951276438	1.621e+00	1.000e-03	FAIL	retry
case07	2	blocked	periodic	0.400	0.150	0.000	0.781966014470	0.83951276438	1.621e+00	1.000e-03	FAIL	retry
case08	2	blocked	open	0.400	0.150	0.200	0.781966011250	0.83951276438	1.621e+00	1.000e-03	FAIL	retry

HH L1-L3 Sweep (rows 1-6)

id	L	ordering	boundary	omega0	g_ep	dv	run	E_vqe	E_exact_filter	abs_err	tol	pass	restarts	maxiter
L1_case01	1	blocked	open	0.5	0.2	0.0	primary	0.2499999999999999	0.23330669073875469	0.001	0.001	True	5	200
L1_case02	1	interleaved	open	0.5	0.2	0.0	primary	0.2499999999999999	0.23330669073875469	0.001	0.001	True	5	200
L1_case03	1	blocked	open	0.8	0.0	0.0	primary	0.4	0.4	0.0	0.001	True	5	200
L1_case04	1	blocked	open	0.0	0.3	0.0	primary	0.0	0.0	0.0	0.001	True	5	200
L2_case01	2	blocked	open	0.4	0.15	0.0	retry 0.7819660144708395	1276438214787788607	1276438214787788607	0.001	0.001	False	10	400
L2_case02	2	interleaved	open	0.4	0.15	0.0	retry 0.7819660144708395	1276438214787788626	1276438214787788626	0.001	0.001	False	10	400

HH L1-L3 Sweep (rows 7-12)

id	L	ordering	boundary	omega0	g_ep	dv	run	E_vqe	E_exact_filtered	abs_err	tol	pass	restarts	maxiter
L2_case03	2	blocked	periodic	0.4	0.15	0.0	retry 0.78	196601447028	395127643882	14787788607	0.001	False	10	400
L2_case04	2	blocked	open	0.4	0.15	0.2	retry 0.78	196601125096	395127643882	14787756473	0.001	False	10	400
L3_case01	3	blocked	open	0.4	0.15	0.0	retry 1.03	363653368112	249096922047	85462257291	22490969204	False	10	400
L3_case02	3	interleaved	open	0.4	0.15	0.0	retry 1.03	363648531922	249096922047	85461773868	22490969204	False	10	400
L3_case03	3	blocked	periodic	0.4	0.15	0.0	retry -0.52	132639335831	191385570879	78121644299	31913855778	False	10	400
L3_case04	3	blocked	open	0.4	0.15	0.2	retry 1.03	363623212252	249096922047	85459241000	22490969204	False	10	400

L2/L3 Layerwise vs Term-wise Diagnostic

L	n_qubits	ham_terms	ansatz	num_params	E_exact_filtered	E_vqe	abs_err	success	nfev	nit	runtime_s
2	6	17	layerwise	4	-0.839512764388781966014471332147877886070			True	50	9	1.358489036560058
2	6	17	termwise	16	-0.839512764388808449630800123106313358699			True	1080	63	9.96136713027954
3	9	27	layerwise	4	-1.224909692047633636533681725854622572918			True	91	17	20.4678242206573
3	9	27	termwise	26	-1.224909692047647337686813885153282390915			True	2326	86	568.738838911056

Zero-Holstein Matrix (rows 1-4)

case_id	L	ordering	boundary	dv	E_exact_filtered	E_layerwise	err _layerwise	pass_lw	E_termwise	err _termwise	pass_tw	improvement
L2_blk_open_dv0	2	blocked	open	0.0	-1.23606797749978	8196601125084	1803398875013	False	-0.99999962159227	3606835590704	False	1.381965632843092
L2_int_open_dv0	2	interleaved	open	0.0	-1.23606797749978	8196601125084	1803398875013	False	-0.99999966409122	3606831340850	False	1.381965675341625
L2_blk_periodic_dv0	2	blocked	periodic	0.0	-1.23606797749978	8196601125084	1803398875013	False	-0.99999962159227	3606835590704	False	1.381965632843092
L2_blk_open_dv01	2	blocked	open	0.2	-1.63606797749978	81803398873378	15180339887660	False	-1.39999962550062	3606835199912	False	1.381965636766884

Zero-Holstein Matrix (rows 5-8)

case_id	L	ordering	boundary	dv	E_exact_filtered	E_layerwise	err _layerwise	pass_lw	E_termwise	err _termwise	pass_tw	improvement
L3_blk_open_dv0	3	blocked	open	0.0	-1.820089374374074	3363623085429	5372560522918	False	-1.66666649307055	5342288130022	False	2.100302723928953
L3_int_open_dv0	3	interleaved	open	0.0	-1.820089374374074	3363623085224	5372560522703	False	-1.66666656191635	5342281245845	False	2.100302792768582
L3_blk_periodic_dv0	3	blocked	periodic	0.0	-1.909515966155351	2132627819127	8818968796469	False	-1.999999997766319	048403160944	False	0.697705656355256
L3_blk_open_dv01	3	blocked	open	0.2	-2.420089374374074	16636377119862	5372560317616	False	-2.2666665666981	5342280768117	False	2.100302795494992

Zero-Holstein Smoke (L=2 term-wise)

L2_blocked_open_

case_id	L	ordering	boundary	N_up	N_dn	J	U	g	omega0	reps	num_params	exact_filters	E_vqe	abs_err	pass
L2_blocked_open_	2	blocked	open	1	1	1.0	4.0	0.0	0.0	2	22-0.828427124078284269563796561914541	4	-0.828427124078284269563796561914541	1.5e-14	True

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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.5,
    "g_ep": 0.2,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
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    "num_terms": 7,
    "coefficients_exyz": [
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        "coeff": {
          "re": 1.0,
          "im": 0.0
        }
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      {
        "label_exyz": "eez",
        "coeff": {
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          "im": 0.0
        }
      },
      {
        "label_exyz": "eze",
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        }
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        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```

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      "label_xyz": "xez",
      "coeff": {
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        "im": 0.0
      }
    },
    {
      "label_xyz": "xze",
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        "im": 0.0
      }
    },
    {
      "label_xyz": "zee",
      "coeff": {
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        "im": 0.0
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    }
  ]
},
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  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.24999999999999967,
  "exact_filtered_energy": 0.25,
  "best_restart": 2,
  "nfev": 4,
  "nit": 1,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 0
  },
  "num_parameters": 3,
  "reps": 1,
  "optimal_point": [
    0.018043080779231543,
    0.40206457366636006,
    -0.14766195556539888
  ],
  "hf_bitstring_qn_to_q0": "01"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
```

```

    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "001": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.25,
      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.25,
      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

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{
  "generated_utc": "2026-02-27T19:11:17.643823+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.5,
    "g_ep": 0.2,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
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    "num_terms": 7,
    "coefficients_exyz": [
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        "coeff": {
          "re": 1.0,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```

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      "coeff": {
        "re": -0.1,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xze",
      "coeff": {
        "re": -0.1,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zee",
      "coeff": {
        "re": -0.25,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": 0.17984378812835755,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.24999999999999967,
  "exact_filtered_energy": 0.25,
  "best_restart": 2,
  "nfev": 4,
  "nit": 1,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 0
  },
  "num_parameters": 3,
  "reps": 1,
  "optimal_point": [
    0.018043080779231543,
    0.40206457366636006,
    -0.14766195556539888
  ],
  "hf_bitstring_qn_to_q0": "01"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
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    "num_evaluation_qubits": 6,
    "shots": 1024
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    "source": "hf",
    "amplitudes_qn_to_q0": {
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        "re": 1.0,
        "im": 0.0
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    }
  },
  "trajectory": [
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      "fidelity": 1.0,
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      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
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      "doublon_trotter": 0.0
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      "fidelity": 1.0,
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      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```



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{
  "generated_utc": "2026-02-27T19:11:18.659718+00:00",
  "pipeline": "hardcoded",
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    "u": 2.0,
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    "omega0": 0.8,
    "g_ep": 0.0,
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    "boundary": "open",
    "ordering": "blocked",
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    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
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    "num_terms": 5,
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          "im": 0.0
        }
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      {
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      {
        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {

```

```
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        "im": 0.0
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    }
  ],
  "ground_state": {
    "exact_energy": 0.3999999999999999,
    "method": "matrix_diagonalization"
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  "vqe": {
    "success": true,
    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
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    "exact_filtered_energy": 0.4,
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    "nfev": 3,
    "nit": 1,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 1,
      "n_dn": 0
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    "num_parameters": 2,
    "reps": 1,
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      0.08962366125254097
    ],
    "hf_bitstring_qn_to_q0": "01"
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  "qpe": {
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    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
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    "shots": 1024
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  "initial_state": {
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      "001": {
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        "im": 0.0
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    }
  },
  "trajectory": [
    {
```

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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 0.0,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 0.0,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
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    "energy_trotter": 0.4,
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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 0.0,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 0.0,
    "doublon_trotter": 0.0
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],
"sanity": {
  "jw_reference": {
    "checked": false,
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}
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    "omega0": 0.0,
    "g_ep": 0.3,
    "n_ph_max": 1,
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    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
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        }
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          "im": 0.0
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      },
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          "im": 0.0
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    ]
  }
}
```

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      },
    },
    {
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        "im": 0.0
      }
    }
  ]
},
"ground_state": {
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},
"vqe": {
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  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.0,
  "exact_filtered_energy": 0.0,
  "best_restart": 0,
  "nfev": 3,
  "nit": 1,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 0
  },
  "num_parameters": 2,
  "reps": 1,
  "optimal_point": [
    0.00036904600724477226,
    0.08962366125254097
  ],
  "hf_bitstring_qn_to_q0": "01"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "001": {
```

```

    "re": 1.0,
    "im": 0.0
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 0.0,
    "energy_trotter": 0.0,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 0.0,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 0.0,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 0.0,
    "energy_trotter": 0.0,
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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 0.0,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 0.0,
    "doublon_trotter": 0.0
  }
],
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

```
{
  "generated_utc": "2026-02-27T19:11:20.916791+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```



```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660186984324,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 4,
```

```
    "reps": 1,
    "optimal_point": [
      2.0793985866871343,
      -0.7854077586012247,
      -0.008775764607163653,
      -0.0004570214074722432
    ],
    "hf_bitstring_qn_to_q0": "0101"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000101": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
```

```
      "checked": false,  
      "reason": "no matching bundled reference for these settings"  
    }  
  }  
}
```

```
{
  "generated_utc": "2026-02-27T19:12:12.390067+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
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    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.07024555605672539,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 410,
  "nit": 44,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 8,
```

```
"reps": 2,
"optimal_point": [
  0.20958615555186344,
  0.6402964678561229,
  -0.3674489420589816,
  3.141592653589793,
  0.6703767724935482,
  -1.5573688855566945,
  3.141592653589793,
  -3.141592653589793
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
]
```

```
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```



```
{
  "generated_utc": "2026-02-27T19:12:37.789321+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
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    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": -0.4589682129418412,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 9,
  "nfev": 737,
  "nit": 56,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 12,
```

```
"reps": 3,
"optimal_point": [
  -0.24583103213956803,
  0.6773457281167473,
  0.21072776890562514,
  -3.141592653589793,
  -0.9803637375289989,
  1.9011253396086492,
  2.987329603672344,
  3.1415926535897682,
  -0.3449630497669626,
  1.4850163504218943,
  2.522411939196004,
  3.1415926535896763
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "---skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
```

```
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:14:01.429519+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": -0.631244254159447,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 1,
  "nfev": 1428,
  "nit": 83,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 16,
```



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"reps": 4,
"optimal_point": [
  -0.337878914688048,
  0.9841363720353707,
  -0.570365630550609,
  -1.998496837953423,
  -0.7124840244400124,
  0.3338081139279945,
  -3.141592653589793,
  -3.141592653589793,
  -0.6204631240656452,
  0.42223696160847485,
  -3.141592653589793,
  -3.141592653589793,
  0.5381640085043792,
  0.05212708437099845,
  -2.6300075865555086,
  2.883390501678622
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
```

```
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

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{
  "generated_utc": "2026-02-27T19:16:23.263846+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": -0.6417008874439492,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 6,
  "nfev": 2378,
  "nit": 94,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 24,
```

```
"reps": 6,
"optimal_point": [
  -0.4846418876805521,
  -0.45988948694442866,
  0.37712055851377696,
  3.141592653589793,
  1.160272085090249,
  -0.987248706931722,
  -1.6380267902512167,
  2.7243879421175414,
  -0.04261326565001505,
  0.33903926913669774,
  -1.314584701306428,
  0.1953465059688858,
  -0.7438837671517533,
  0.6583474987075698,
  -0.9249456946990345,
  2.577072468107337,
  -2.1512154891862347,
  -0.26926748921136395,
  -2.4117347878462576,
  -2.8885422168453,
  1.322088374622845,
  0.08991173877762075,
  -3.102371679194239,
  2.4402786291141587
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "---skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.400000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
```

```
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:19:06.429266+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```



```
      "label_xyz": "eeeeze",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeezee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeeeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eexxee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeyyee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeeez",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {

```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": -0.6417010891294433,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 2836,
  "nit": 85,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 32,
```

```
"reps": 8,
"optimal_point": [
  -1.8718727480133148,
  0.13810762945986682,
  -0.506420127592885,
  -1.841572611857384,
  0.2898390636353472,
  -0.046941626271391874,
  1.6658581099370415,
  -0.6489314184425383,
  -0.7017687361549309,
  -0.7689550718246647,
  -0.22150260936312233,
  0.9743179457213369,
  -0.5193335461998918,
  0.18516475285070721,
  1.2976232534475056,
  -0.5333976428043844,
  -0.40818763123051793,
  -0.27834586337816053,
  1.3512552340731865,
  -2.6726079821874356,
  0.8207967532166907,
  -0.3599441880606297,
  -1.8718018774055554,
  -0.694432375520425,
  -0.48201554183830714,
  -0.9463248145691062,
  -0.23915178854407665,
  -1.3635147076644398,
  0.6941858701306456,
  0.24866305278713158,
  -2.4970552358539058,
  3.141592653589793
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
},
```

```
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:22.798058+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
      "label_xyz": "eeeeze",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeezee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeeeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eexxee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeyyee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeeez",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {

```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
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        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660144723856,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 50,
  "nit": 9,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  -0.5086286121291548,
  0.7854138197888982,
  -0.38023359829700215,
  1.173025014089557e-05
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
  "jw_reference": {
```


Appendix Raw Data: artifacts/hh_vqe_proof/case05_retry.json [5/5]

```
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:24.172156+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {

```

```
      "label_xyz": "eeexzx",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeeyzy",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeezee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eexzxe",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeyzye",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezzee",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeeez",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
```

```
      "label_xyz": "exeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883176,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.781966018701314,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  2.079398586344628,
  -0.7854077782482035,
  -0.00877573404898461,
  -0.0004570958985317215
],
"hf_bitstring_qn_to_q0": "0011"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000011": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  }
],
"sanity": {
  "jw_reference": {
```

```
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:26.078234+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeexzx",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeyzy",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexzxe",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyzye",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezzee",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```



```
      "label_xyz": "exeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883176,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660144742868,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 50,
  "nit": 9,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  -0.5086286318090489,
  0.7854137817857628,
  -0.3802332911631325,
  8.280136781446679e-06
],
"hf_bitstring_qn_to_q0": "0011"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000011": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  }
],
"sanity": {
  "jw_reference": {
```

Appendix Raw Data: artifacts/hh_vqe_proof/case06_retry.json [5/5]

```
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:27.870241+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "periodic",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660186984324,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 4,
```

```

    "reps": 1,
    "optimal_point": [
      2.0793985866871343,
      -0.7854077586012247,
      -0.008775764607163653,
      -0.0004570214074722432
    ],
    "hf_bitstring_qn_to_q0": "0101"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000101": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
```

```
      "checked": false,  
      "reason": "no matching bundled reference for these settings"  
    }  
  }  
}
```



```
{
  "generated_utc": "2026-02-27T19:11:29.787498+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "periodic",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660144723856,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 50,
  "nit": 9,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  -0.5086286121291548,
  0.7854138197888982,
  -0.38023359829700215,
  1.173025014089557e-05
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
  "jw_reference": {
```

Appendix Raw Data: artifacts/hh_vqe_proof/case07_retry.json [5/5]

```
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:31.262981+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.2,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
      "label_xyz": "eeeeze",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeezee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeeeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eexxee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeyyee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeeez",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660294405524,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 1,
  "nfev": 64,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 5,
```



```
"reps": 1,
"optimal_point": [
  -0.5086323763462123,
  0.7854405650310585,
  0.4020653424931417,
  -0.14766130173047998,
  0.0005867047537535998
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
```

```
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:33.997682+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.2,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeez",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660112590133,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 63,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 5,
```

```
"reps": 1,
"optimal_point": [
  0.5086119053867596,
  -0.78539771764546,
  -0.16160790454449384,
  -0.01454930588166365,
  -5.503679493239905e-06
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
```

Appendix Raw Data: artifacts/hh_vqe_proof/case08_retry.json [5/5]

```
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:11:35.054320+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.0,
    "g_ep": 0.0,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 11,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.0,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```



```
      "label_xyz": "eeeeze",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeezee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeeeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eexxee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eeyyee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "eezeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    }
  ],
  "ground_state": {
    "exact_energy": -1.2360679774997898,
    "method": "matrix_diagonalization"
  },
  "vqe": {
    "success": true,
```

```

    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 0.38196601131864677,
    "exact_filtered_energy": -1.2360679774997896,
    "best_restart": 2,
    "nfev": 23,
    "nit": 7,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 1,
      "n_dn": 1
    },
    "num_parameters": 2,
    "reps": 1,
    "optimal_point": [
      1.0621832448630615,
      0.7853941250383296
    ],
    "hf_bitstring_qn_to_q0": "0101"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000101": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 1.9999999999999996,
      "energy_trotter": 2.0,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,

```

```
    "energy_exact": 1.9999999999999996,
    "energy_trotter": 2.0,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

```
{
  "generated_utc": "2026-02-27T19:19:19.216264+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 1,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.0,
    "g_ep": 0.0,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "uccsd",
    "initial_state_source": "exact",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 2,
    "num_terms": 4,
    "coefficients_exyz": [
      {
        "label_exyz": "ee",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "ez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "ze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "zz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```

```
{
  "ground_state": {
    "exact_energy": 0.0,
    "method": "matrix_diagonalization"
  },
  "vqe": {
    "success": false,
    "method": "hardcoded_uccsd_notebook_statevector",
    "ansatz": "uccsd",
    "parameterization": "layerwise",
    "energy": null,
    "exact_filtered_energy": null,
    "error": "HardcodedUCCSDLayerwiseAnsatz produced no layer terms"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "exact",
    "amplitudes_qn_to_q0": {
      "00": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.0,
      "energy_trotter": 0.0,
      "n_up_site0_exact": 0.0,
      "n_up_site0_trotter": 0.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.0,
      "energy_trotter": 0.0,
      "n_up_site0_exact": 0.0,
      "n_up_site0_trotter": 0.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
```

```
      "doublon_trotter": 0.0
    },
    "sanity": {
      "jw_reference": {
        "checked": false,
        "reason": "no matching bundled reference for these settings"
      }
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:21:30.367769+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.0,
    "g_ep": 0.0,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "uccsd",
    "initial_state_source": "exact",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 4,
    "num_terms": 11,
    "coefficients_exyz": [
      {
        "label_exyz": "eeee",
        "coeff": {
          "re": 1.0,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
      "label_xyz": "eeze",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezez",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "yyee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zeee",
      "coeff": {
        "re": -0.5,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zeze",
      "coeff": {
        "re": 0.5,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -1.2360679774997898,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
```



```
"method": "hardcoded_uccsd_notebook_statevector",
"ansatz": "uccsd",
"parameterization": "layerwise",
"energy": -0.9999999997218296,
"exact_filtered_energy": -1.2360679774997896,
"best_restart": 0,
"nfev": 18,
"nit": 5,
"message": "Optimization terminated successfully",
"num_particles": {
  "n_up": 1,
  "n_dn": 1
},
"num_parameters": 2,
"reps": 1,
"optimal_point": [
  0.7853900797971544,
  2.026485134688609e-05
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "exact",
  "amplitudes_qn_to_q0": {
    "0101": {
      "re": -0.3717480344601845,
      "im": 0.0
    },
    "0110": {
      "re": -0.6015009550075455,
      "im": 0.0
    },
    "1001": {
      "re": -0.6015009550075457,
      "im": 0.0
    },
    "1010": {
      "re": -0.3717480344601845,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
```

```
"energy_exact": -1.2360679774997898,
"energy_trotter": -1.2360679774997898,
"n_up_site0_exact": 0.5000000000000004,
"n_up_site0_trotter": 0.5000000000000001,
"n_dn_site0_exact": 0.4999999999999999,
"n_dn_site0_trotter": 0.4999999999999983,
"doublon_exact": 0.27639320225002123,
"doublon_trotter": 0.27639320225002106
},
{
  "time": 0.0,
  "fidelity": 1.0,
  "energy_exact": -1.2360679774997898,
  "energy_trotter": -1.2360679774997898,
  "n_up_site0_exact": 0.5000000000000004,
  "n_up_site0_trotter": 0.5000000000000001,
  "n_dn_site0_exact": 0.4999999999999999,
  "n_dn_site0_trotter": 0.4999999999999983,
  "doublon_exact": 0.27639320225002123,
  "doublon_trotter": 0.27639320225002106
}
],
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

Appendix Raw Data: artifacts/hh_vqe_proof/hh_vqe_proof_summary.csv [1/1]

```
id,L,ordering,boundary,omega0,g_ep,dv,run,success,energy,exact_filtered_energy,abs_err,tol,passed,output_json
case01,1,blocked,open,0.5,0.2,0.0,primary,True,0.24999999999999967,0.25,3.3306690738754696e-16,0.001,True,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case01.json
case02,1,interleaved,open,0.5,0.2,0.0,primary,True,0.24999999999999967,0.25,3.3306690738754696e-16,0.001,True,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case02.json
case03,1,blocked,open,0.8,0.0,0.0,primary,True,0.4,0.4,0.0,0.001,True,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case03.json
case04,1,blocked,open,0.0,0.3,0.0,primary,True,0.0,0.0,0.0,0.001,True,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case04.json
case05,2,blocked,open,0.4,0.15,0.0,retry,True,0.7819660144723856,-0.839512764388319,1.6214787788607046,0.001,False,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case05_retry.json
case06,2,interleaved,open,0.4,0.15,0.0,retry,True,0.7819660144742868,-0.839512764388319,1.6214787788626057,0.001,False,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case06_retry.json
case07,2,blocked,periodic,0.4,0.15,0.0,retry,True,0.7819660144723856,-0.839512764388319,1.6214787788607046,0.001,False,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case07_retry.json
case08,2,blocked,open,0.4,0.15,0.2,retry,True,0.7819660112590133,-0.839512764388319,1.6214787756473323,0.001,False,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/case08_retry.json
```

Appendix Raw Data: artifacts/hh_vqe_proof/hh_vqe_proof_summary.md [1/1]

```
# HH VQE Proof Summary

## Acceptance Rule
`abs_err <= max(1e-3, 1e-3*abs(E_exact_filtered))` and `vqe.success == true`

Overall result (8-case HH sweep): **FAIL**

| case | L | ordering | boundary | omega0 | g_ep | dv | E_vqe | E_exact_filtered | abs_err | tol | pass | run |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| case01 | 1 | blocked | open | 0.500 | 0.200 | 0.000 | 0.250000000000 | 0.250000000000 | 3.331e-16 | 1.000e-03 | PASS | primary |
| case02 | 1 | interleaved | open | 0.500 | 0.200 | 0.000 | 0.250000000000 | 0.250000000000 | 3.331e-16 | 1.000e-03 | PASS | primary |
| case03 | 1 | blocked | open | 0.800 | 0.000 | 0.000 | 0.400000000000 | 0.400000000000 | 0.000e+00 | 1.000e-03 | PASS | primary |
| case04 | 1 | blocked | open | 0.000 | 0.300 | 0.000 | 0.000000000000 | 0.000000000000 | 0.000e+00 | 1.000e-03 | PASS | primary |
| case05 | 2 | blocked | open | 0.400 | 0.150 | 0.000 | 0.781966014472 | -0.839512764388 | 1.621e+00 | 1.000e-03 | FAIL | retry |
| case06 | 2 | interleaved | open | 0.400 | 0.150 | 0.000 | 0.781966014474 | -0.839512764388 | 1.621e+00 | 1.000e-03 | FAIL | retry |
| case07 | 2 | blocked | periodic | 0.400 | 0.150 | 0.000 | 0.781966014472 | -0.839512764388 | 1.621e+00 | 1.000e-03 | FAIL | retry |
| case08 | 2 | blocked | open | 0.400 | 0.150 | 0.200 | 0.781966011259 | -0.839512764388 | 1.621e+00 | 1.000e-03 | FAIL | retry |

## Controls
- HH Hubbard-limit control (`omega0=0,g=0`, L=2): FAIL (E_vqe=0.381966011319, E_exact_filtered=-1.236067977500, abs_err=1.618e+00, tol=1.236e-03)
- Non-HH `uccsd` pipeline smoke (`L=2`): PASS

## Case05 Depth Check (diagnostic)
| reps | E_vqe | E_exact_filtered | abs_err | success |
|---|---|---|---|---|
| 2 | 0.070245556057 | -0.839512764388 | 9.098e-01 | True |
| 3 | -0.458968212942 | -0.839512764388 | 3.805e-01 | True |
| 4 | -0.631244254159 | -0.839512764388 | 2.083e-01 | True |
| 6 | -0.641700887444 | -0.839512764388 | 1.978e-01 | True |
| 8 | -0.641701089129 | -0.839512764388 | 1.978e-01 | True |

## Artifact Paths
- Summary CSV:
`/Users/jakestrobels/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/hh_vqe_proof_summary.csv`
- Summary MD:
`/Users/jakestrobels/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof/hh_vqe_proof_summary.md`
- Case JSON directory: `/Users/jakestrobels/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof`
```

```
{
  "generated_utc": "2026-02-27T19:35:44.140509+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 1,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.5,
    "g_ep": 0.2,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 3,
    "num_terms": 7,
    "coefficients_exyz": [
      {
        "label_exyz": "eee",
        "coeff": {
          "re": 1.0,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```

```
      "label_xyz": "xez",
      "coeff": {
        "re": -0.1,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xze",
      "coeff": {
        "re": -0.1,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zee",
      "coeff": {
        "re": -0.25,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": 0.17984378812835755,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.24999999999999967,
  "exact_filtered_energy": 0.25,
  "best_restart": 2,
  "nfev": 4,
  "nit": 1,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 0
  },
  "num_parameters": 3,
  "reps": 1,
  "optimal_point": [
    0.018043080779231543,
    0.40206457366636006,
    -0.14766195556539888
  ],
  "hf_bitstring_qn_to_q0": "01"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
```

```
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "001": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.25,
      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.25,
      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:35:45.250920+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 1,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.5,
    "g_ep": 0.2,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 3,
    "num_terms": 7,
    "coefficients_exyz": [
      {
        "label_exyz": "eee",
        "coeff": {
          "re": 1.0,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```



```
      "label_xyz": "xez",
      "coeff": {
        "re": -0.1,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xze",
      "coeff": {
        "re": -0.1,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zee",
      "coeff": {
        "re": -0.25,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": 0.17984378812835755,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.24999999999999967,
  "exact_filtered_energy": 0.25,
  "best_restart": 2,
  "nfev": 4,
  "nit": 1,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 0
  },
  "num_parameters": 3,
  "reps": 1,
  "optimal_point": [
    0.018043080779231543,
    0.40206457366636006,
    -0.14766195556539888
  ],
  "hf_bitstring_qn_to_q0": "01"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
```

```
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "001": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.25,
      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.25,
      "energy_trotter": 0.25,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:35:46.077786+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 1,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.8,
    "g_ep": 0.0,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 3,
    "num_terms": 5,
    "coefficients_exyz": [
      {
        "label_exyz": "eee",
        "coeff": {
          "re": 1.3,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {

```

```
      "label_xyz": "zee",
      "coeff": {
        "re": -0.4,
        "im": 0.0
      }
    }
  ],
  "ground_state": {
    "exact_energy": 0.3999999999999999,
    "method": "matrix_diagonalization"
  },
  "vqe": {
    "success": true,
    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 0.4,
    "exact_filtered_energy": 0.4,
    "best_restart": 0,
    "nfev": 3,
    "nit": 1,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 1,
      "n_dn": 0
    },
    "num_parameters": 2,
    "reps": 1,
    "optimal_point": [
      0.00036904600724477226,
      0.08962366125254097
    ],
    "hf_bitstring_qn_to_q0": "01"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "001": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
```

```

    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 0.4,
    "energy_trotter": 0.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 0.0,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 0.0,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 0.4,
    "energy_trotter": 0.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 0.0,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 0.0,
    "doublon_trotter": 0.0
  }
],
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

```
{
  "generated_utc": "2026-02-27T19:35:46.887717+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 1,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.0,
    "g_ep": 0.3,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 3,
    "num_terms": 6,
    "coefficients_exyz": [
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        "label_exyz": "eee",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
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      {
        "label_exyz": "ezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {

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      "label_xyz": "xez",
      "coeff": {
        "re": -0.15,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xze",
      "coeff": {
        "re": -0.15,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.3,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.0,
  "exact_filtered_energy": 0.0,
  "best_restart": 0,
  "nfev": 3,
  "nit": 1,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 0
  },
  "num_parameters": 2,
  "reps": 1,
  "optimal_point": [
    0.00036904600724477226,
    0.08962366125254097
  ],
  "hf_bitstring_qn_to_q0": "01"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "001": {
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      "re": 1.0,
      "im": 0.0
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
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      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 0.0,
      "energy_trotter": 0.0,
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      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 0.0,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 0.0,
      "doublon_trotter": 0.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```



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{
  "generated_utc": "2026-02-27T19:35:48.395183+00:00",
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  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
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        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
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          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
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      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660186984324,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  2.0793985866871343,
  -0.7854077586012247,
  -0.008775764607163653,
  -0.0004570214074722432
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
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    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
  "jw_reference": {
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```
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

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{
  "generated_utc": "2026-02-27T19:35:50.426452+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
"label_xyz": "eeeeze",
"coeff": {
  "re": -0.5,
  "im": 0.0
},
{
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  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeze",
  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eexxee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
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  "label_xyz": "eeyyee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
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{
  "label_xyz": "eezeze",
  "coeff": {
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    "im": 0.0
  }
},
{
  "label_xyz": "exeeez",
  "coeff": {
    "re": -0.075,
    "im": 0.0
  }
},
{
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660144723856,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 50,
  "nit": 9,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```



```
"reps": 1,
"optimal_point": [
  -0.5086286121291548,
  0.7854138197888982,
  -0.38023359829700215,
  1.173025014089557e-05
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
  "jw_reference": {
```

```
    "checked": false,  
    "reason": "no matching bundled reference for these settings"  
  }  
}
```

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{
  "generated_utc": "2026-02-27T19:35:52.074260+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeze",
        "coeff": {
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        }
      },
      {
        "label_exyz": "eeeezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      },
      {

```

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    "label_xyz": "eeexzx",
    "coeff": {
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      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeyzy",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexzxe",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezzee",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
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    },
    {
      "label_xyz": "xeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883176,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.781966018701314,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  2.079398586344628,
  -0.7854077782482035,
  -0.00877573404898461,
  -0.0004570958985317215
],
"hf_bitstring_qn_to_q0": "0011"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000011": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  }
],
"sanity": {
  "jw_reference": {
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```
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```

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{
  "generated_utc": "2026-02-27T19:35:54.330874+00:00",
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeezz",
        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```



```
    "label_xyz": "eeexzx",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeyzy",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexzxe",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezzee",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883176,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660144742868,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 50,
  "nit": 9,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  -0.5086286318090489,
  0.7854137817857628,
  -0.3802332911631325,
  8.280136781446679e-06
],
"hf_bitstring_qn_to_q0": "0011"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000011": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.3999999999999999,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 8.105908442490586e-31,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 1.6881656465029814e-31,
    "doublon_trotter": 0.0
  }
],
"sanity": {
  "jw_reference": {
```

```
    "checked": false,  
    "reason": "no matching bundled reference for these settings"  
  }  
}
```

```
{
  "generated_utc": "2026-02-27T19:35:55.930092+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 2,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "periodic",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
"label_xyz": "eeeeze",
"coeff": {
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  "im": 0.0
},
{
  "label_xyz": "eeezee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeze",
  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eexxee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeyyee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eezeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
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  "label_xyz": "eezeze",
  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "exeeez",
  "coeff": {
    "re": -0.075,
    "im": 0.0
  }
},
{
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660186984324,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 4,
```

```
"reps": 1,
"optimal_point": [
  2.0793985866871343,
  -0.7854077586012247,
  -0.008775764607163653,
  -0.0004570214074722432
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
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    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
  "jw_reference": {
```



```
    "checked": false,  
    "reason": "no matching bundled reference for these settings"  
  }  
}
```

```
{
  "generated_utc": "2026-02-27T19:35:57.915658+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "periodic",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```

```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
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    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660144723856,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 50,
  "nit": 9,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  },
  "num_parameters": 4,
```

```
    "reps": 1,
    "optimal_point": [
      -0.5086286121291548,
      0.7854138197888982,
      -0.38023359829700215,
      1.173025014089557e-05
    ],
    "hf_bitstring_qn_to_q0": "0101"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000101": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.4000000000000001,
      "energy_trotter": 2.4,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
```

```
    "checked": false,  
    "reason": "no matching bundled reference for these settings"  
  }  
}
```

```
{
  "generated_utc": "2026-02-27T19:35:59.927264+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.2,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
          "re": 1.8,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
    "label_xyz": "eeeeze",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeezee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeeeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexxee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eeyyee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeee",
    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eezeze",
    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "exeeez",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
```



```
      "label_xyz": "exezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zezeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660294405524,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 1,
  "nfev": 64,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 5,
```

```
"reps": 1,
"optimal_point": [
  -0.5086323763462123,
  0.7854405650310585,
  0.4020653424931417,
  -0.14766130173047998,
  0.0005867047537535998
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
"sanity": {
```

```
    "jw_reference": {  
      "checked": false,  
      "reason": "no matching bundled reference for these settings"  
    }  
  }  
}
```

```
{
  "generated_utc": "2026-02-27T19:36:02.126572+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.2,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 6,
    "num_terms": 17,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeee",
        "coeff": {
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          "im": 0.0
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          "im": 0.0
        }
      },
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          "im": 0.0
        }
      },
      {
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        }
      },
      {

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    "im": 0.0
  }
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  "coeff": {
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    "im": 0.0
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  "coeff": {
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    "im": 0.0
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},
{
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  "coeff": {
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    "im": 0.0
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},
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    "im": 0.0
  }
},
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  "coeff": {
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    "im": 0.0
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},
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  "coeff": {
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    "im": 0.0
  }
},
{
```

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        "im": 0.0
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},
"ground_state": {
  "exact_energy": -0.8395127643883173,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
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  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": 0.7819660112590133,
  "exact_filtered_energy": -0.839512764388319,
  "best_restart": 5,
  "nfev": 63,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 1,
    "n_dn": 1
  }
},
"num_parameters": 5,
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"optimal_point": [
  0.5086119053867596,
  -0.78539771764546,
  -0.16160790454449384,
  -0.01454930588166365,
  -5.503679493239905e-06
],
"hf_bitstring_qn_to_q0": "0101"
},
"qpe": {
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  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
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"initial_state": {
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    "000101": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
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    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
    "energy_trotter": 2.4,
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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  },
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.4000000000000001,
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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
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"sanity": {
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    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```



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{
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  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 27,
    "coefficients_exyz": [
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        "coeff": {
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        }
      },
      {
        "label_exyz": "eeeeeeeez",
        "coeff": {
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          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeexx",
        "coeff": {
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          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
"label_xyz": "eeeeeeze",
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  "im": 0.0
},
{
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  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeeyye",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
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  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeexeee",
  "coeff": {
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    "im": 0.0
  }
},
{
  "label_xyz": "eeeeyeee",
  "coeff": {
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    "im": 0.0
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},
{
```



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    {
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    },
    {
      "label_xyz": "exeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
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      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
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      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
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      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zeeeeee",
      "coeff": {
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        "im": 0.0
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    }
  ]
},
"ground_state": {
  "exact_energy": -1.7081302393665212,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
```

```

    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 1.7325578938880626,
    "exact_filtered_energy": -1.224909692047456,
    "best_restart": 2,
    "nfev": 118,
    "nit": 22,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 2,
      "n_dn": 1
    },
    "num_parameters": 4,
    "reps": 1,
    "optimal_point": [
      0.7421290135600819,
      -0.785400273618669,
      0.14694423618271835,
      0.00014432790614685024
    ],
    "hf_bitstring_qn_to_q0": "001011"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000001011": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
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      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.6,
      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {

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```
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.6,
    "energy_trotter": 2.6,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
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}
}
```

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  "generated_utc": "2026-02-27T19:36:39.273793+00:00",
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  "settings": {
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    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 27,
    "coefficients_exyz": [
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        "coeff": {
          "re": 2.7,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeez",
        "coeff": {
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          "im": 0.0
        }
      },
      {
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        }
      },
      {
        "label_exyz": "eeeeeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

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"label_xyz": "eeeeeeze",
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  "coeff": {
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    "im": 0.0
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{
```



```

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    "coeff": {
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      "im": 0.0
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  {
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    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.2,
      "im": 0.0
    }
  },
  {
    "label_xyz": "xeeeeezee",
    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.075,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.2,
      "im": 0.0
    }
  }
],
"ground_state": {
  "exact_energy": -1.7081302393665212,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
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    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 1.0336365336817326,
    "exact_filtered_energy": -1.224909692047456,
    "best_restart": 7,
    "nfev": 91,
    "nit": 17,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 2,
      "n_dn": 1
    },
    "num_parameters": 4,
    "reps": 1,
    "optimal_point": [
      -2.0382215349445603,
      0.7856822481869358,
      -0.4590642569719321,
      9.092424251176331e-06
    ],
    "hf_bitstring_qn_to_q0": "001011"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000001011": {
        "re": 1.0,
        "im": 0.0
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    }
  },
  "trajectory": [
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      "time": 0.0,
      "fidelity": 1.0,
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      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  {
```

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    "time": 0.0,
    "fidelity": 1.0,
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    "energy_trotter": 2.6,
    "n_up_site0_exact": 1.0,
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    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

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{
  "generated_utc": "2026-02-27T19:36:52.980038+00:00",
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    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 27,
    "coefficients_exyz": [
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        "label_exyz": "eeeeeeeeee",
        "coeff": {
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          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
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        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
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        "coeff": {
          "re": 0.5,
          "im": 0.0
        }
      }
    ]
  }
}
```

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},
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    "re": -0.5,
    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
  }
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    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
  }
},
{
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  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
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  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeexxee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
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{
```

```
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  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
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      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": -0.5,
      "im": 0.0
    }
  },
  {
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    "coeff": {
      "re": 0.5,
      "im": 0.0
    }
  },
  {
    "label_xyz": "eexeeeeez",
    "coeff": {
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      "im": 0.0
    }
  },
  {
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    "coeff": {
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      "im": 0.0
    }
  },
  {
```

```
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        "im": 0.0
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    },
    {
      "label_xyz": "exeeeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ],
  "ground_state": {
    "exact_energy": -1.7081302393665185,
    "method": "matrix_diagonalization"
  },
  "vqe": {
    "success": true,
```



```

    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 1.7325578951799376,
    "exact_filtered_energy": -1.2249096920474658,
    "best_restart": 4,
    "nfev": 59,
    "nit": 11,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 2,
      "n_dn": 1
    },
    "num_parameters": 4,
    "reps": 1,
    "optimal_point": [
      -0.742135203984308,
      0.7853913950821059,
      -0.5703680072147456,
      0.0002653846737613703
    ],
    "hf_bitstring_qn_to_q0": "000111"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
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  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000000111": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
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      "fidelity": 1.0,
      "energy_exact": 2.6,
      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.8781899231710597e-30,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 2.1257346784861706e-30,
      "doublon_trotter": 0.0
    },
    {

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    "energy_trotter": 2.6,
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    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.8781899231710597e-30,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 2.1257346784861706e-30,
    "doublon_trotter": 0.0
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  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

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{
  "generated_utc": "2026-02-27T19:37:17.743484+00:00",
  "pipeline": "hardcoded",
  "settings": {
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    "t": 1.0,
    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "interleaved",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 27,
    "coefficients_exyz": [
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        "coeff": {
          "re": 2.7,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeeze",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
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        "coeff": {
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      }
    ]
  }
}
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{
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    "im": 0.0
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    "im": 0.0
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  "coeff": {
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    "im": 0.0
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    "im": 0.0
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    "im": 0.0
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    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
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{
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    },
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      "coeff": {
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        "im": 0.0
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    {
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    },
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        "im": 0.0
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  ],
  "ground_state": {
    "exact_energy": -1.7081302393665185,
    "method": "matrix_diagonalization"
  },
  "vqe": {
    "success": true,
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    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 1.0336364853393647,
    "exact_filtered_energy": -1.2249096920474658,
    "best_restart": 7,
    "nfev": 91,
    "nit": 17,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 2,
      "n_dn": 1
    },
    "num_parameters": 4,
    "reps": 1,
    "optimal_point": [
      -2.038230106274015,
      0.7856565047614067,
      -0.45903081807008467,
      3.031999625605075e-06
    ],
    "hf_bitstring_qn_to_q0": "000111"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000000111": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
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      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.8781899231710597e-30,
      "n_dn_site0_trotter": 0.0,
      "doublon_exact": 2.1257346784861706e-30,
      "doublon_trotter": 0.0
    },
    {

```

```
    "time": 0.0,
    "fidelity": 1.0,
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    "energy_trotter": 2.6,
    "n_up_site0_exact": 1.0,
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    "n_dn_site0_exact": 1.8781899231710597e-30,
    "n_dn_site0_trotter": 0.0,
    "doublon_exact": 2.1257346784861706e-30,
    "doublon_trotter": 0.0
  }
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
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```



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  "generated_utc": "2026-02-27T19:37:31.143785+00:00",
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    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "periodic",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 31,
    "coefficients_exyz": [
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      {
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          "im": 0.0
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      },
      {
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          "im": 0.0
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      },
      {

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    "label_xyz": "eeeeeeze",
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      "im": 0.0
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    "im": 0.0
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{
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},
{
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  "coeff": {
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    "im": 0.0
  }
},
{
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    "re": -0.075,
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},
{
  "label_xyz": "ezeeeeeeeee",
  "coeff": {
    "re": -0.2,
    "im": 0.0
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},
{

```

```
      "label_xyz": "xeeeeezee",
      "coeff": {
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        "im": 0.0
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    },
    {
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    },
    {
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      "coeff": {
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    }
  ]
},
"ground_state": {
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  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": -0.5213263933580516,
  "exact_filtered_energy": -1.319138557788035,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 2,
    "n_dn": 1
  },
  "num_parameters": 4,
  "reps": 1,
  "optimal_point": [
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    0.1379647670744197,
    -0.00877512473768108,
    -0.00020789969806923566
  ],
  "hf_bitstring_qn_to_q0": "001011"
},
"qpe": {
  "success": false,
  "method": "qpe skipped",
  "energy_estimate": null,
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    "num_evaluation_qubits": 6,
    "shots": 1024
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    "amplitudes_qn_to_q0": {
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        "re": 1.0,
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    }
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  "trajectory": [
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      "time": 0.0,
      "fidelity": 1.0,
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      "energy_trotter": 2.6,
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      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
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      "fidelity": 1.0,
      "energy_exact": 2.6000000000000001,
      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
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  }
}
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  "generated_utc": "2026-02-27T19:37:54.212967+00:00",
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    "u": 2.0,
    "dv": 0.0,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "periodic",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
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    "num_terms": 31,
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        "coeff": {
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          "im": 0.0
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          "im": 0.0
        }
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        }
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      {
        "label_exyz": "eeeeeeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

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  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
  }
},
{
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  "coeff": {
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    "im": 0.0
  }
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```

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      "im": 0.0
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    "coeff": {
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    }
  },
  {

```



```
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        "im": 0.0
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    },
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      "coeff": {
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        "im": 0.0
      }
    },
    {
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      "coeff": {
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        "im": 0.0
      }
    }
  ]
},
"ground_state": {
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  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
  "method": "hardcoded_hh_hva_notebook_statevector",
  "ansatz": "hh_hva",
  "parameterization": "layerwise",
  "energy": -0.5213263933580516,
  "exact_filtered_energy": -1.319138557788035,
  "best_restart": 3,
  "nfev": 54,
  "nit": 10,
  "message": "Optimization terminated successfully",
  "num_particles": {
    "n_up": 2,
    "n_dn": 1
  },
  "num_parameters": 4,
  "reps": 1,
  "optimal_point": [
    2.1988921555175818,
    0.1379647670744197,
    -0.00877512473768108,
    -0.00020789969806923566
  ],
  "hf_bitstring_qn_to_q0": "001011"
},
"qpe": {
  "success": false,
  "method": "qpe skipped",
  "energy_estimate": null,
  "phase": null,
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    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000001011": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.6000000000000001,
      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    },
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.6000000000000001,
      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],
  "sanity": {
    "jw_reference": {
      "checked": false,
      "reason": "no matching bundled reference for these settings"
    }
  }
}
```

```
{
  "generated_utc": "2026-02-27T19:38:08.042188+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 3,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.2,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 27,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeeeee",
        "coeff": {
          "re": 2.7,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
"label_xyz": "eeeeeeze",
"coeff": {
  "re": -0.5,
  "im": 0.0
},
{
  "label_xyz": "eeeeexxe",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeeyye",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezeez",
  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeexeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeyeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
```



```
      "label_xyz": "eezeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeeeeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ]
},
"ground_state": {
  "exact_energy": -1.7081302393665212,
  "method": "matrix_diagonalization"
},
"vqe": {
  "success": true,
```



```

    "method": "hardcoded_hh_hva_notebook_statevector",
    "ansatz": "hh_hva",
    "parameterization": "layerwise",
    "energy": 1.5497083318876408,
    "exact_filtered_energy": -1.224909692047456,
    "best_restart": 2,
    "nfev": 102,
    "nit": 16,
    "message": "Optimization terminated successfully",
    "num_particles": {
      "n_up": 2,
      "n_dn": 1
    },
    "num_parameters": 5,
    "reps": 1,
    "optimal_point": [
      1.188290399252713,
      -2.3559793434579013,
      0.031621662350426946,
      -0.27914613767719815,
      -0.010318582493134706
    ],
    "hf_bitstring_qn_to_q0": "001011"
  },
  "qpe": {
    "success": false,
    "method": "qpe_skipped",
    "energy_estimate": null,
    "phase": null,
    "skipped": true,
    "reason": "--skip-qpe enabled",
    "num_evaluation_qubits": 6,
    "shots": 1024
  },
  "initial_state": {
    "source": "hf",
    "amplitudes_qn_to_q0": {
      "000001011": {
        "re": 1.0,
        "im": 0.0
      }
    }
  },
  "trajectory": [
    {
      "time": 0.0,
      "fidelity": 1.0,
      "energy_exact": 2.6,
      "energy_trotter": 2.6,
      "n_up_site0_exact": 1.0,
      "n_up_site0_trotter": 1.0,
      "n_dn_site0_exact": 1.0,
      "n_dn_site0_trotter": 1.0,
      "doublon_exact": 1.0,
      "doublon_trotter": 1.0
    }
  ],

```

```
{
  "time": 0.0,
  "fidelity": 1.0,
  "energy_exact": 2.6,
  "energy_trotter": 2.6,
  "n_up_site0_exact": 1.0,
  "n_up_site0_trotter": 1.0,
  "n_dn_site0_exact": 1.0,
  "n_dn_site0_trotter": 1.0,
  "doublon_exact": 1.0,
  "doublon_trotter": 1.0
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
}
```

```
{
  "generated_utc": "2026-02-27T19:38:30.290437+00:00",
  "pipeline": "hardcoded",
  "settings": {
    "L": 3,
    "t": 1.0,
    "u": 2.0,
    "dv": 0.2,
    "omega0": 0.4,
    "g_ep": 0.15,
    "n_ph_max": 1,
    "boson_encoding": "binary",
    "boundary": "open",
    "ordering": "blocked",
    "t_final": 0.0,
    "num_times": 2,
    "suzuki_order": 2,
    "trotter_steps": 1,
    "term_order": "sorted",
    "vqe_ansatz": "hh_hva",
    "initial_state_source": "hf",
    "skip_qpe": true
  },
  "hamiltonian": {
    "num_qubits": 9,
    "num_terms": 27,
    "coefficients_exyz": [
      {
        "label_exyz": "eeeeeeeeee",
        "coeff": {
          "re": 2.7,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeeez",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeexx",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {
        "label_exyz": "eeeeeeeeyy",
        "coeff": {
          "re": -0.5,
          "im": 0.0
        }
      },
      {

```

```
"label_xyz": "eeeeeeze",
"coeff": {
  "re": -0.5,
  "im": 0.0
},
{
  "label_xyz": "eeeeexxe",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeeyye",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeezeez",
  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeexeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeeyeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
```

```
"label_xyz": "eeeezeeee",
"coeff": {
  "re": -0.5,
  "im": 0.0
},
{
  "label_xyz": "eeeezeeze",
  "coeff": {
    "re": 0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeexxeeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eeeyyeeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eezezeeee",
  "coeff": {
    "re": -0.5,
    "im": 0.0
  }
},
{
  "label_xyz": "eezezeeze",
  "coeff": {
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  "coeff": {
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    "im": 0.0
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},
{
  "label_xyz": "eexeezeee",
  "coeff": {
    "re": -0.075,
    "im": 0.0
  }
},
{
```

```
      "label_xyz": "eezeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeeeeeeze",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "exeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "ezeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeeeeezee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "xeezeeee",
      "coeff": {
        "re": -0.075,
        "im": 0.0
      }
    },
    {
      "label_xyz": "zeeeeee",
      "coeff": {
        "re": -0.2,
        "im": 0.0
      }
    }
  ],
  "ground_state": {
    "exact_energy": -1.7081302393665212,
    "method": "matrix_diagonalization"
  },
  "vqe": {
    "success": true,
```

```
"method": "hardcoded_hh_hva_notebook_statevector",
"ansatz": "hh_hva",
"parameterization": "layerwise",
"energy": 1.0336362321225616,
"exact_filtered_energy": -1.224909692047456,
"best_restart": 9,
"nfev": 58,
"nit": 9,
"message": "Optimization terminated successfully",
"num_particles": {
  "n_up": 2,
  "n_dn": 1
},
"num_parameters": 5,
"reps": 1,
"optimal_point": [
  -2.0383402246600544,
  0.7854007441502157,
  0.035805697284318955,
  -0.19244028448941256,
  -0.0003542780500001494
],
"hf_bitstring_qn_to_q0": "001011"
},
"qpe": {
  "success": false,
  "method": "qpe_skipped",
  "energy_estimate": null,
  "phase": null,
  "skipped": true,
  "reason": "--skip-qpe enabled",
  "num_evaluation_qubits": 6,
  "shots": 1024
},
"initial_state": {
  "source": "hf",
  "amplitudes_qn_to_q0": {
    "000001011": {
      "re": 1.0,
      "im": 0.0
    }
  }
},
"trajectory": [
  {
    "time": 0.0,
    "fidelity": 1.0,
    "energy_exact": 2.6,
    "energy_trotter": 2.6,
    "n_up_site0_exact": 1.0,
    "n_up_site0_trotter": 1.0,
    "n_dn_site0_exact": 1.0,
    "n_dn_site0_trotter": 1.0,
    "doublon_exact": 1.0,
    "doublon_trotter": 1.0
  }
],
```

```
{
  "time": 0.0,
  "fidelity": 1.0,
  "energy_exact": 2.6,
  "energy_trotter": 2.6,
  "n_up_site0_exact": 1.0,
  "n_up_site0_trotter": 1.0,
  "n_dn_site0_exact": 1.0,
  "n_dn_site0_trotter": 1.0,
  "doublon_exact": 1.0,
  "doublon_trotter": 1.0
},
"sanity": {
  "jw_reference": {
    "checked": false,
    "reason": "no matching bundled reference for these settings"
  }
}
```


Appendix Raw Data: artifacts/hh_vqe_proof_L1_L3/hh_vqe_L1_L3_summary.csv [1/1]

```
id,L,ordering,boundary,omega0,g_ep,dv,run,ok,succesenergy,exact_filtered_energy,abs_err,tol,passed,restarts_used,maxiter_used,output_json
L1_case01,1,blocked,open,0.5,0.2,0.0,primary,True,True,0.24999999999999967,0.25,3.3306690738754696e-16,0.001,True,5,200,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L1_case01.json
L1_case02,1,interleaved,open,0.5,0.2,0.0,primary,True,True,0.24999999999999967,0.25,3.3306690738754696e-16,0.001,True,5,200,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L1_case02.json
L1_case03,1,blocked,open,0.8,0.0,0.0,primary,True,True,0.4,0.4,0.0,0.001,True,5,200,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L1_case03.json
L1_case04,1,blocked,open,0.0,0.3,0.0,primary,True,True,0.0,0.0,0.0,0.001,True,5,200,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L1_case04.json
L2_case01,2,blocked,open,0.4,0.15,0.0,retry,True,True,0.7819660144723856,-0.839512764388319,1.6214787788607046,0.001,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L2_case01_retry.json
L2_case02,2,interleaved,open,0.4,0.15,0.0,retry,True,True,0.7819660144742868,-0.839512764388319,1.6214787788626057,0.001,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L2_case02_retry.json
L2_case03,2,blocked,periodic,0.4,0.15,0.0,retry,True,True,0.7819660144723856,-0.839512764388319,1.6214787788607046,0.001,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L2_case03_retry.json
L2_case04,2,blocked,open,0.4,0.15,0.2,retry,True,True,0.7819660112590133,-0.839512764388319,1.6214787756473323,0.001,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L2_case04_retry.json
L3_case01,3,blocked,open,0.4,0.15,0.0,retry,True,True,1.0336365336817326,-1.224909692047456,2.2585462257291886,0.001224909692047456,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L3_case01_retry.json
L3_case02,3,interleaved,open,0.4,0.15,0.0,retry,True,True,1.0336364853393647,-1.2249096920474658,2.2585461773868305,0.001224909692047466,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L3_case02_retry.json
L3_case03,3,blocked,periodic,0.4,0.15,0.0,retry,True,True,-0.5213263933580516,-1.319138557788035,0.7978121644299834,0.001319138557788035,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L3_case03_retry.json
L3_case04,3,blocked,open,0.4,0.15,0.2,retry,True,True,1.0336362321225616,-1.224909692047456,2.2585459241700176,0.001224909692047456,False,10,400,/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/L3_case04_retry.json
```

```
# HH VQE L=1..3 Verdict

Overall tolerance verdict: **FAIL**

- Cases run: 12
- Passed: 4
- Failed: 8

Artifacts:
- CSV:
`/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/hh_vqe_L1_L3_summary.csv`
- PDF plots:
`/Users/jakestrobel/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_proof_L1_L3/hh_vqe_L1_L3_comparison_plots.pdf`
```

Appendix Raw Data: artifacts/hh_vqe_termwise_diagnostic/prior_L2_L3_layerwise_vs_termwise.csv [1/1]

L	n_qubits	hamiltonian_terms	E_exact_filtered	ansatz	num_params	E_vqe	abs_err	success	nit	nfev	best_restart	runtime_s
2	6	17	-0.839512764388319	layerwise	4	0.7819660144723856	1.6214787788607046	True	9	50	5	1.3584890365600586
2	6	17	-0.839512764388319	termwise	16	-0.6084496308013204	0.2310631335869986	True	63	1080	7	9.961367130279541
3	9	27	-1.224909692047456	layerwise	4	1.0336365336817326	2.2585462257291886	True	17	91	7	20.46782422065735
3	9	27	-1.224909692047456	termwise	26	-1.0733768681383047	0.15153282390915135	True	86	2326	7	568.7388389110565

```
[
  {
    "L": 2,
    "hamiltonian_terms": 17,
    "n_qubits": 6,
    "exact_filtered_energy": -0.839512764388319,
    "layerwise": {
      "num_params": 4,
      "energy": 0.7819660144723856,
      "abs_err": 1.6214787788607046,
      "success": true,
      "nit": 9,
      "nfev": 50,
      "best_restart": 5,
      "runtime_s": 1.3584890365600586
    },
    "termwise": {
      "num_params": 16,
      "energy": -0.6084496308013204,
      "abs_err": 0.2310631335869986,
      "success": true,
      "nit": 63,
      "nfev": 1080,
      "best_restart": 7,
      "runtime_s": 9.961367130279541
    },
    "total_runtime_s": 11.323782920837402
  },
  {
    "L": 3,
    "hamiltonian_terms": 27,
    "n_qubits": 9,
    "exact_filtered_energy": -1.224909692047456,
    "layerwise": {
      "num_params": 4,
      "energy": 1.0336365336817326,
      "abs_err": 2.2585462257291886,
      "success": true,
      "nit": 17,
      "nfev": 91,
      "best_restart": 7,
      "runtime_s": 20.46782422065735
    },
    "termwise": {
      "num_params": 26,
      "energy": -1.0733768681383047,
      "abs_err": 0.15153282390915135,
      "success": true,
      "nit": 86,
      "nfev": 2326,
      "best_restart": 7,
      "runtime_s": 568.7388389110565
    },
    "total_runtime_s": 589.4093523025513
  }
]
```

```
[
  {
    "case": {
      "id": "L2_blk_open_dv0",
      "L": 2,
      "ordering": "blocked",
      "boundary": "open",
      "dv": 0.0
    },
    "hamiltonian_terms": 17,
    "n_qubits": 6,
    "exact_filtered_energy": -1.2360679774997896,
    "tol": 0.0012360679774997896,
    "results": {
      "layerwise_primary": {
        "ansatz": "layerwise",
        "num_params": 2,
        "energy": 0.38196601131864677,
        "success": true,
        "nit": 7,
        "nfev": 23,
        "best_restart": 2,
        "runtime_s": 0.43862390518188477,
        "abs_err": 1.6180339888184363,
        "pass": false,
        "stage": "primary"
      },
      "layerwise": {
        "ansatz": "layerwise",
        "num_params": 2,
        "energy": 0.3819660112503458,
        "success": true,
        "nit": 6,
        "nfev": 21,
        "best_restart": 5,
        "runtime_s": 0.2864570617675781,
        "abs_err": 1.6180339887501354,
        "pass": false,
        "stage": "retry"
      },
      "termwise_primary": {
        "ansatz": "termwise",
        "num_params": 16,
        "energy": -0.999999621592747,
        "success": true,
        "nit": 21,
        "nfev": 361,
        "best_restart": 2,
        "runtime_s": 2.0802841186523438,
        "abs_err": 0.23606835590704256,
        "pass": false,
        "stage": "primary"
      },
      "termwise": {
        "ansatz": "termwise",
        "num_params": 16,
```

```
    "energy": -0.999999621592747,
    "success": true,
    "nit": 21,
    "nfev": 361,
    "best_restart": 2,
    "runtime_s": 4.370491027832031,
    "abs_err": 0.23606835590704256,
    "pass": false,
    "stage": "retry"
  }
},
"improvement_abs_err": 1.3819656328430927
},
{
  "case": {
    "id": "L2_int_open_dv0",
    "L": 2,
    "ordering": "interleaved",
    "boundary": "open",
    "dv": 0.0
  },
  "hamiltonian_terms": 17,
  "n_qubits": 6,
  "exact_filtered_energy": -1.2360679774997896,
  "tol": 0.0012360679774997896,
  "results": {
    "layerwise_primary": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 0.3819660113186836,
      "success": true,
      "nit": 7,
      "nfev": 23,
      "best_restart": 2,
      "runtime_s": 0.15414905548095703,
      "abs_err": 1.6180339888184732,
      "pass": false,
      "stage": "primary"
    },
    "layerwise": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 0.3819660112503449,
      "success": true,
      "nit": 6,
      "nfev": 21,
      "best_restart": 5,
      "runtime_s": 0.2941310405731201,
      "abs_err": 1.6180339887501345,
      "pass": false,
      "stage": "retry"
    },
    "termwise_primary": {
      "ansatz": "termwise",
      "num_params": 16,
      "energy": -0.9999996640912805,
```

```
      "success": true,
      "nit": 16,
      "nfev": 276,
      "best_restart": 4,
      "runtime_s": 2.012221097946167,
      "abs_err": 0.2360683134085091,
      "pass": false,
      "stage": "primary"
    },
    "termwise": {
      "ansatz": "termwise",
      "num_params": 16,
      "energy": -0.9999996640912805,
      "success": true,
      "nit": 16,
      "nfev": 276,
      "best_restart": 4,
      "runtime_s": 3.8592441082000732,
      "abs_err": 0.2360683134085091,
      "pass": false,
      "stage": "retry"
    }
  },
  "improvement_abs_err": 1.3819656753416254
},
{
  "case": {
    "id": "L2_blk_periodic_dv0",
    "L": 2,
    "ordering": "blocked",
    "boundary": "periodic",
    "dv": 0.0
  },
  "hamiltonian_terms": 17,
  "n_qubits": 6,
  "exact_filtered_energy": -1.2360679774997896,
  "tol": 0.0012360679774997896,
  "results": {
    "layerwise_primary": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 0.38196601131864677,
      "success": true,
      "nit": 7,
      "nfev": 23,
      "best_restart": 2,
      "runtime_s": 0.15018010139465332,
      "abs_err": 1.6180339888184363,
      "pass": false,
      "stage": "primary"
    },
    "layerwise": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 0.3819660112503458,
      "success": true,
```

```
      "nit": 6,
      "nfev": 21,
      "best_restart": 5,
      "runtime_s": 0.2919790744781494,
      "abs_err": 1.6180339887501354,
      "pass": false,
      "stage": "retry"
    },
    "termwise_primary": {
      "ansatz": "termwise",
      "num_params": 16,
      "energy": -0.999999621592747,
      "success": true,
      "nit": 21,
      "nfev": 361,
      "best_restart": 2,
      "runtime_s": 2.075800657272339,
      "abs_err": 0.23606835590704256,
      "pass": false,
      "stage": "primary"
    },
    "termwise": {
      "ansatz": "termwise",
      "num_params": 16,
      "energy": -0.999999621592747,
      "success": true,
      "nit": 21,
      "nfev": 361,
      "best_restart": 2,
      "runtime_s": 4.398046970367432,
      "abs_err": 0.23606835590704256,
      "pass": false,
      "stage": "retry"
    }
  },
  "improvement_abs_err": 1.3819656328430927
},
{
  "case": {
    "id": "L2_blk_open_dv02",
    "L": 2,
    "ordering": "blocked",
    "boundary": "open",
    "dv": 0.2
  },
  "hamiltonian_terms": 17,
  "n_qubits": 6,
  "exact_filtered_energy": -1.6360679774997893,
  "tol": 0.0016360679774997894,
  "results": {
    "layerwise_primary": {
      "ansatz": "layerwise",
      "num_params": 3,
      "energy": -0.018033988733782425,
      "success": true,
      "nit": 7,
```



```

    "nfev": 31,
    "best_restart": 4,
    "runtime_s": 0.20657920837402344,
    "abs_err": 1.618033988766007,
    "pass": false,
    "stage": "primary"
  },
  "layerwise": {
    "ansatz": "layerwise",
    "num_params": 3,
    "energy": -0.018033988733782425,
    "success": true,
    "nit": 7,
    "nfev": 31,
    "best_restart": 4,
    "runtime_s": 0.4196150302886963,
    "abs_err": 1.618033988766007,
    "pass": false,
    "stage": "retry"
  },
  "termwise_primary": {
    "ansatz": "termwise",
    "num_params": 16,
    "energy": -1.3999996255006673,
    "success": true,
    "nit": 15,
    "nfev": 258,
    "best_restart": 4,
    "runtime_s": 2.0765349864959717,
    "abs_err": 0.23606835199912202,
    "pass": false,
    "stage": "primary"
  },
  "termwise": {
    "ansatz": "termwise",
    "num_params": 16,
    "energy": -1.3999996255006673,
    "success": true,
    "nit": 15,
    "nfev": 258,
    "best_restart": 4,
    "runtime_s": 4.0880749225616455,
    "abs_err": 0.23606835199912202,
    "pass": false,
    "stage": "retry"
  }
},
"improvement_abs_err": 1.3819656367668849
},
{
  "case": {
    "id": "L3_blk_open_dv0",
    "L": 3,
    "ordering": "blocked",
    "boundary": "open",
    "dv": 0.0
  }
}
```

```
},
"hamiltonian_terms": 27,
"n_qubits": 9,
"exact_filtered_energy": -1.820089374374787,
"tol": 0.001820089374374787,
"results": {
  "layerwise_primary": {
    "ansatz": "layerwise",
    "num_params": 2,
    "energy": 2.0000000000536935,
    "success": true,
    "nit": 1,
    "nfev": 3,
    "best_restart": 0,
    "runtime_s": 1.1702630519866943,
    "abs_err": 3.8200893744284805,
    "pass": false,
    "stage": "primary"
  },
  "layerwise": {
    "ansatz": "layerwise",
    "num_params": 2,
    "energy": 0.4336362308543957,
    "success": true,
    "nit": 10,
    "nfev": 36,
    "best_restart": 6,
    "runtime_s": 4.146225929260254,
    "abs_err": 2.2537256052291825,
    "pass": false,
    "stage": "retry"
  },
  "termwise_primary": {
    "ansatz": "termwise",
    "num_params": 26,
    "energy": -1.4142134647091233,
    "success": true,
    "nit": 16,
    "nfev": 434,
    "best_restart": 2,
    "runtime_s": 43.87698483467102,
    "abs_err": 0.40587590966566367,
    "pass": false,
    "stage": "primary"
  },
  "termwise": {
    "ansatz": "termwise",
    "num_params": 26,
    "energy": -1.6666664930745578,
    "success": true,
    "nit": 26,
    "nfev": 707,
    "best_restart": 7,
    "runtime_s": 103.19790005683899,
    "abs_err": 0.15342288130022919,
    "pass": false,
  }
```

```
      "stage": "retry"
    }
  },
  "improvement_abs_err": 2.1003027239289533
},
{
  "case": {
    "id": "L3_int_open_dv0",
    "L": 3,
    "ordering": "interleaved",
    "boundary": "open",
    "dv": 0.0
  },
  "hamiltonian_terms": 27,
  "n_qubits": 9,
  "exact_filtered_energy": -1.8200893743747877,
  "tol": 0.0018200893743747877,
  "results": {
    "layerwise_primary": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 2.0000000000536935,
      "success": true,
      "nit": 1,
      "nfev": 3,
      "best_restart": 0,
      "runtime_s": 1.1655831336975098,
      "abs_err": 3.8200893744284814,
      "pass": false,
      "stage": "primary"
    },
    "layerwise": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 0.4336362308522492,
      "success": true,
      "nit": 10,
      "nfev": 36,
      "best_restart": 6,
      "runtime_s": 4.336238145828247,
      "abs_err": 2.2537256052270367,
      "pass": false,
      "stage": "retry"
    },
    "termwise_primary": {
      "ansatz": "termwise",
      "num_params": 26,
      "energy": -1.6666663558229802,
      "success": true,
      "nit": 34,
      "nfev": 925,
      "best_restart": 0,
      "runtime_s": 55.21712589263916,
      "abs_err": 0.1534230185518075,
      "pass": false,
      "stage": "primary"
    }
  }
}
```

```
    },
    "termwise": {
      "ansatz": "termwise",
      "num_params": 26,
      "energy": -1.6666665619163332,
      "success": true,
      "nit": 22,
      "nfev": 597,
      "best_restart": 9,
      "runtime_s": 97.0142867565155,
      "abs_err": 0.15342281245845446,
      "pass": false,
      "stage": "retry"
    }
  },
  "improvement_abs_err": 2.1003027927685824
},
{
  "case": {
    "id": "L3_blk_periodic_dv0",
    "L": 3,
    "ordering": "blocked",
    "boundary": "periodic",
    "dv": 0.0
  },
  "hamiltonian_terms": 31,
  "n_qubits": 9,
  "exact_filtered_energy": -1.9095159661559513,
  "tol": 0.0019095159661559513,
  "results": {
    "layerwise_primary": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": 0.8393487997909108,
      "success": true,
      "nit": 9,
      "nfev": 29,
      "best_restart": 2,
      "runtime_s": 3.3681650161743164,
      "abs_err": 2.748864765946862,
      "pass": false,
      "stage": "primary"
    },
    "layerwise": {
      "ansatz": "layerwise",
      "num_params": 2,
      "energy": -1.1213262781912539,
      "success": true,
      "nit": 7,
      "nfev": 24,
      "best_restart": 7,
      "runtime_s": 6.558241128921509,
      "abs_err": 0.7881896879646975,
      "pass": false,
      "stage": "retry"
    }
  },
}
```

```
"termwise_primary": {
  "ansatz": "termwise",
  "num_params": 30,
  "energy": -1.9999999977653924,
  "success": true,
  "nit": 15,
  "nfev": 469,
  "best_restart": 1,
  "runtime_s": 67.4202938079834,
  "abs_err": 0.09048403160944107,
  "pass": false,
  "stage": "primary"
},
"termwise": {
  "ansatz": "termwise",
  "num_params": 30,
  "energy": -1.9999999977653924,
  "success": true,
  "nit": 15,
  "nfev": 469,
  "best_restart": 1,
  "runtime_s": 135.512925863266,
  "abs_err": 0.09048403160944107,
  "pass": false,
  "stage": "retry"
}
},
"improvement_abs_err": 0.6977056563552564
},
{
  "case": {
    "id": "L3_blk_open_dv02",
    "L": 3,
    "ordering": "blocked",
    "boundary": "open",
    "dv": 0.2
  },
  "hamiltonian_terms": 27,
  "n_qubits": 9,
  "exact_filtered_energy": -2.420089374374786,
  "tol": 0.002420089374374786,
  "results": {
    "layerwise_primary": {
      "ansatz": "layerwise",
      "num_params": 3,
      "energy": -0.1663637711986175,
      "success": true,
      "nit": 8,
      "nfev": 36,
      "best_restart": 3,
      "runtime_s": 3.3644940853118896,
      "abs_err": 2.2537256031761688,
      "pass": false,
      "stage": "primary"
    },
    "layerwise": {
```

```
    "ansatz": "layerwise",
    "num_params": 3,
    "energy": -0.1663637711986175,
    "success": true,
    "nit": 8,
    "nfev": 36,
    "best_restart": 3,
    "runtime_s": 7.086652994155884,
    "abs_err": 2.2537256031761688,
    "pass": false,
    "stage": "retry"
  },
  "termwise_primary": {
    "ansatz": "termwise",
    "num_params": 26,
    "energy": -2.2666665343161125,
    "success": true,
    "nit": 35,
    "nfev": 951,
    "best_restart": 1,
    "runtime_s": 80.87490105628967,
    "abs_err": 0.15342284005867368,
    "pass": false,
    "stage": "primary"
  },
  "termwise": {
    "ansatz": "termwise",
    "num_params": 26,
    "energy": -2.26666656669361,
    "success": true,
    "nit": 32,
    "nfev": 871,
    "best_restart": 7,
    "runtime_s": 166.6953899860382,
    "abs_err": 0.1534228076811761,
    "pass": false,
    "stage": "retry"
  }
},
"improvement_abs_err": 2.1003027954949927
}
```

Appendix Raw Data: artifacts/hh_vqe_zero_holstein_L2_L3/hh_zero_holstein_summary.csv [1/1]

case_id	L	ordering	boundary	dv	n_qubits	ham_terms	E_exact_filtered	tol	E_vqe_layerwise	abs_err_layerwise	pass_layerwise	stage_layerwise	num_params_layerwise	nfev_layerwise	nit_layerwise	E_vqe_termwise	abs_err_termwise	pass_termwise	stage_termwise	num_params_termwise	nfev_termwise	nit_termwise	improvement_abs_err
L2_blk_open_dv0	2	blocked	open	0.0	6,17	-1.2360679774997896	0.0012360679774997896	0.3819660112503458	1.6180339887501354	False	retry	2,21,6	-0.999999621592747	0.23606835590704256	False	retry	16,361,21	1.3819656328430927					
L2_int_open_dv0	2	interleaved	open	0.0	6,17	-1.2360679774997896	0.0012360679774997896	0.3819660112503449	1.6180339887501345	False	retry	2,21,6	-0.9999996640912805	0.2360683134085091	False	retry	16,276,16	1.3819656753416254					
L2_blk_periodic_dv0	2	blocked	periodic	0.0	6,17	-1.2360679774997896	0.0012360679774997896	0.3819660112503458	1.6180339887501354	False	retry	2,21,6	-0.999999621592747	0.23606835590704256	False	retry	16,361,21	1.3819656328430927					
L2_blk_open_dv02	2	blocked	open	0.2	6,17	-1.6360679774997893	0.0016360679774997894	-0.018033988733782425	1.618033988766007	False	retry	3,31,7	-1.3999996255006673	0.23606835199912202	False	retry	16,258,15	1.3819656367668849					
L3_blk_open_dv0	3	blocked	open	0.0	9,27	-1.820089374374787	0.001820089374374787	0.4336362308543957	2.2537256052291825	False	retry	2,36,10	-1.6666664930745578	0.15342288130022919	False	retry	26,707,26	2.1003027239289533					
L3_int_open_dv0	3	interleaved	open	0.0	9,27	-1.8200893743747877	0.0018200893743747877	0.4336362308522492	2.2537256052270367	False	retry	2,36,10	-1.6666665619163332	0.15342281245845446	False	retry	26,597,22	2.1003027927685824					
L3_blk_periodic_dv0	3	blocked	periodic	0.0	9,31	-1.9095159661559513	0.0019095159661559513	-1.1213262781912539	0.7881896879646975	False	retry	2,24,7	-1.9999999977653924	0.09048403160944107	False	retry	30,469,15	0.6977056563552564					
L3_blk_open_dv02	3	blocked	open	0.2	9,27	-2.420089374374786	0.002420089374374786	-0.1663637711986175	2.2537256031761688	False	retry	3,36,8	-2.26666656669361	0.1534228076811761	False	retry	26,871,32	2.1003027954949927					

```
# HH Zero-Holstein Verdict (L=2,3)

- Cases: 8
- Layerwise pass count: 0/8
- Term-wise pass count: 0/8
- Cases where term-wise improves abs error: 8/8

- JSON:
~/Users/jakestrobels/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_zero_holstein_L2_L3/hh_zero_holstein_full_results.json`
- CSV:
~/Users/jakestrobels/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_zero_holstein_L2_L3/hh_zero_holstein_summary.csv`
- PDF:
~/Users/jakestrobels/Downloads/Testing-For-Trying-Again-main_copy-testforatestcuziknothing/artifacts/hh_vqe_zero_holstein_L2_L3/hh_zero_holstein_comparison_plots.pdf`
```



```
{
  "summary": {
    "num_cases": 1,
    "pass_count": 1,
    "fail_count": 0,
    "max_abs_err": 1.683665619145458e-07,
    "settings": {
      "L": "2",
      "orderings": "blocked",
      "boundaries": "open",
      "J": 1.0,
      "U": 4.0,
      "dv": 0.0,
      "g": 0.0,
      "omega0": 0.0,
      "n_ph_max": 1,
      "boson_encoding": "binary",
      "vqe_reps": 2,
      "vqe_restarts": 2,
      "vqe_maxiter": 80,
      "seed": 123,
      "tol": "auto(|E_exact|*1e-3)"
    }
  },
  "cases": [
    {
      "case": {
        "case_id": "L2_blocked_open_dv0p0",
        "L": 2,
        "ordering": "blocked",
        "boundary": "open",
        "J": 1.0,
        "U": 4.0,
        "dv": 0.0,
        "omega0": 0.0,
        "g": 0.0,
        "n_ph_max": 1,
        "boson_encoding": "binary",
        "reps": 2,
        "restarts": 2,
        "maxiter": 80,
        "seed": 220
      },
      "num_particles": {
        "n_up": 1,
        "n_dn": 1
      },
      "n_qubits": 6,
      "ham_terms": 11,
      "ansatz": "hh_termwise",
      "parameterization": "termwise",
      "num_params": 22,
      "exact_energy_filtered": -0.8284271247461902,
      "vqe_energy": -0.8284269563796283,
      "abs_err": 1.683665619145458e-07,
      "rel_err": 1.683665619145458e-07,
    }
  ]
}
```

```
"tol": 0.0008284271247461902,
"pass": true,
"vqe": {
  "success": true,
  "message": "Optimization terminated successfully",
  "best_restart": 0,
  "nfev": 338,
  "nit": 14,
  "runtime_s": 1.5752441668882966
}
}
}
```

Appendix Raw Data: artifacts/hh_vqe_zero_holstein_smoke/smoke_termwise_L2_summary.csv [1/1]

case_id,L,boundary,ordering,n_up,n_dn,J,U,g,omega0,dv,n_ph_max,boson_encoding,n_qubits,ham_terms,ansatz,parameterization, reps,num_params, restarts,maxiter,seed,best_restart,nfev,nit, runtime_s, success,E_exact_filtered,E_vqe_termwise,abs_err,rel_err,tol,pass
L2_blocked_open_dv0p0,2,open,blocked,1,1,1.0,4.0,0.0,0.0,0.0,1,binary,6,11,hh_termwise,termwise,2,22,2,80,220,0,338,14,1.5752441668882966,True,-0.8284271247461902,-0.8284269563796283,1.683665619145458e-07,1.683665619145458e-07,0.0008284271247461902,True