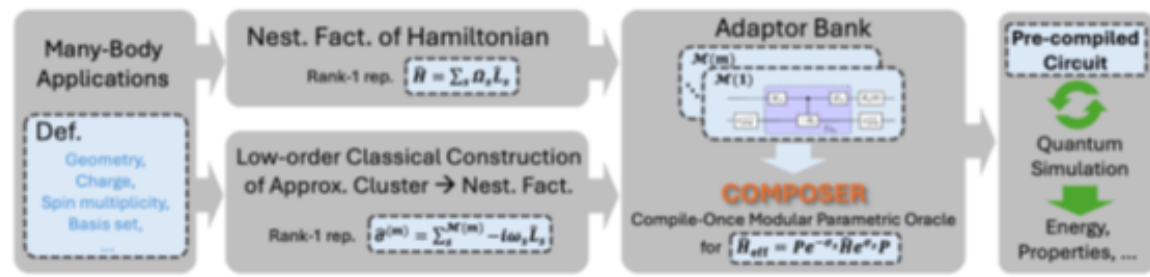


Compile-Once Block Encodings for Masked Similarity-Transformed Effective Hamiltonians



Schematic workflow for quantum simulation using COMPOSER. The two-qubit circuit topology is fixed in a one-time synthesis pass; subsequent updates to active-space masks or truncation masks re-dial numerical weights, rotation angles, and classical masks inside the fixed branch library.

B. Peng, Y. Liu, K. Kowalski, "Compile-Once Block Encodings for Masked Similarity-Transformed Effective Hamiltonians,"
<https://doi.org/10.1002/qute.70410> (2026).

Scientific Achievement

Development of COMPOSER, a compile-once modular parametric oracle for similarity-encoded effective many-body operators.

Significance and Impact

Single and tunable circuit can be used in simulations corresponding to various active spaces.

Research Details

- COMPOSER provides a practical bridge from nested low-rank tensor factorizations to hardware-native, mask-aware block encodings for simulations of many-body systems.
- Beyond downfolded Hamiltonian simulation, the same mask-aware interface is immediately applicable to non-orthogonal subspace solvers that require repeated evaluation of Hamiltonian and overlap matrix elements

Compile-Once Block Encodings for Masked Similarity-Transformed Effective Hamiltonians

- **NQISRC Intellectual Role:** *Collaborator*
- **NQISRC Funding Role:** *Majority*
- **Explanation of Funding Institution Contributions**
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