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Four-Nucleon Forces in Ab Initio Nuclear Structure

Stefan Schulz[1] **Angelo Calci**[2] **Robert Roth**[1]

[1] *Technische Universität Darmstadt* [2] *TRIUMF, Vancouver*

Why Four-Body Forces?

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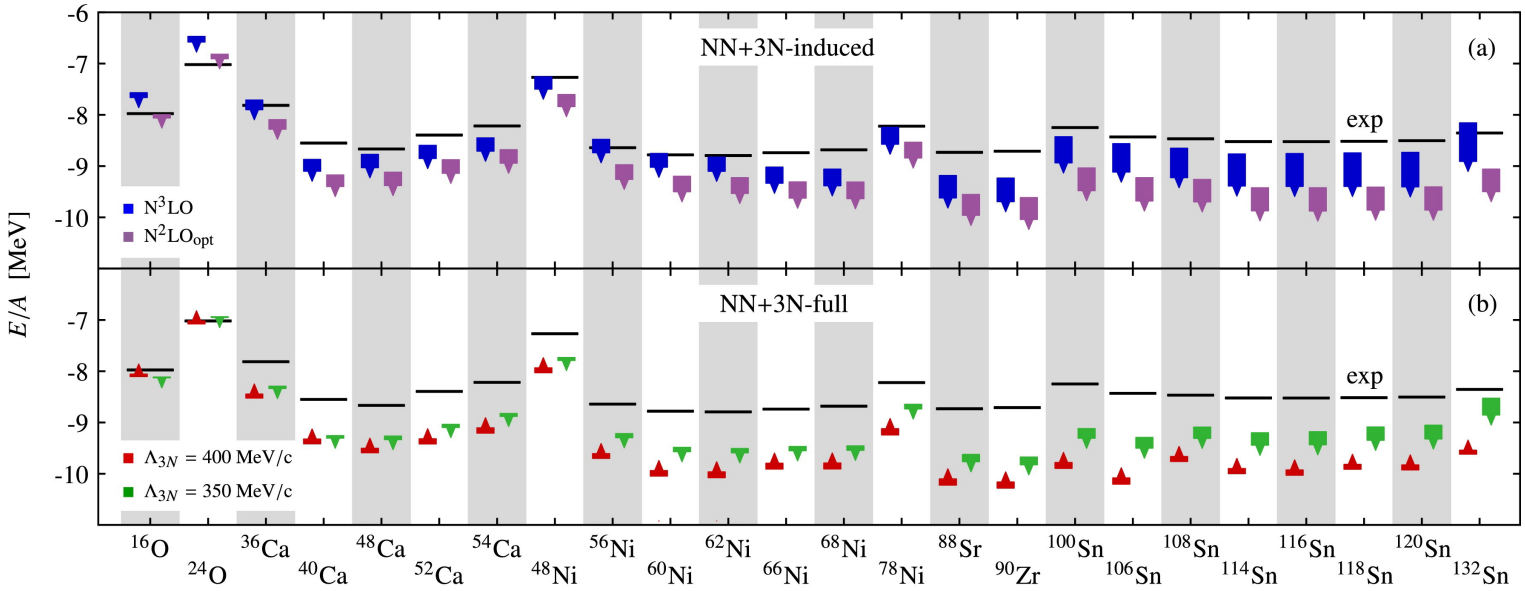

S. Binder et al., Physics Letters B 736, 119 (2014)

- Effect of induced 4N-contributions increases with the number of nucleons
  - Fine-tune interaction
  - Change SRG generator
- Effect of initial 4N-contributions?

Framework

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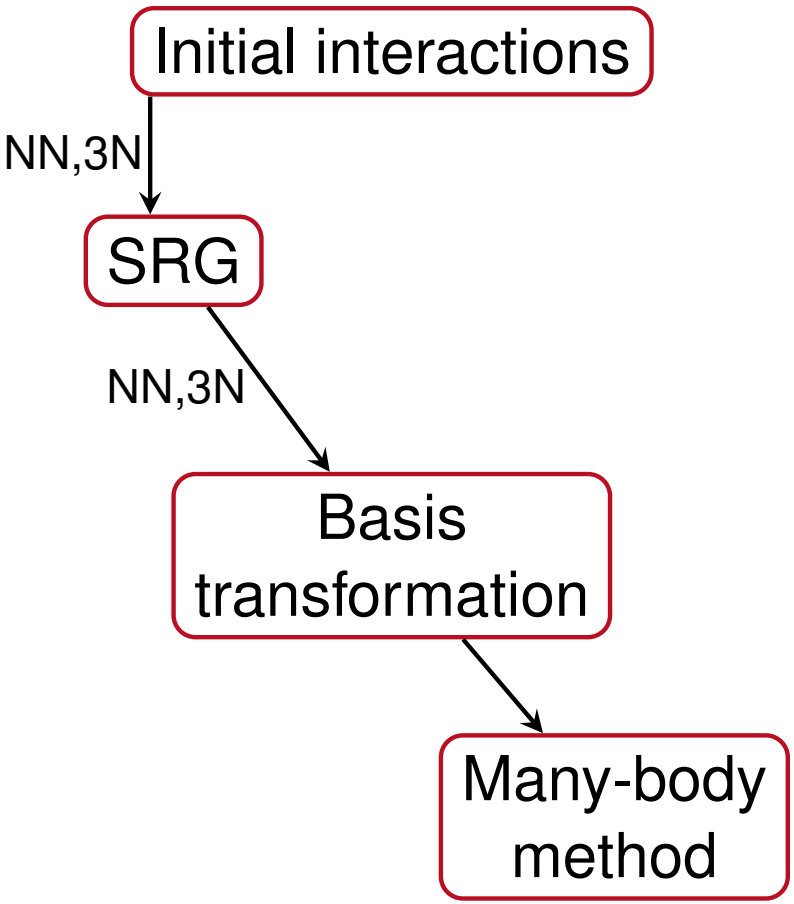

Framework

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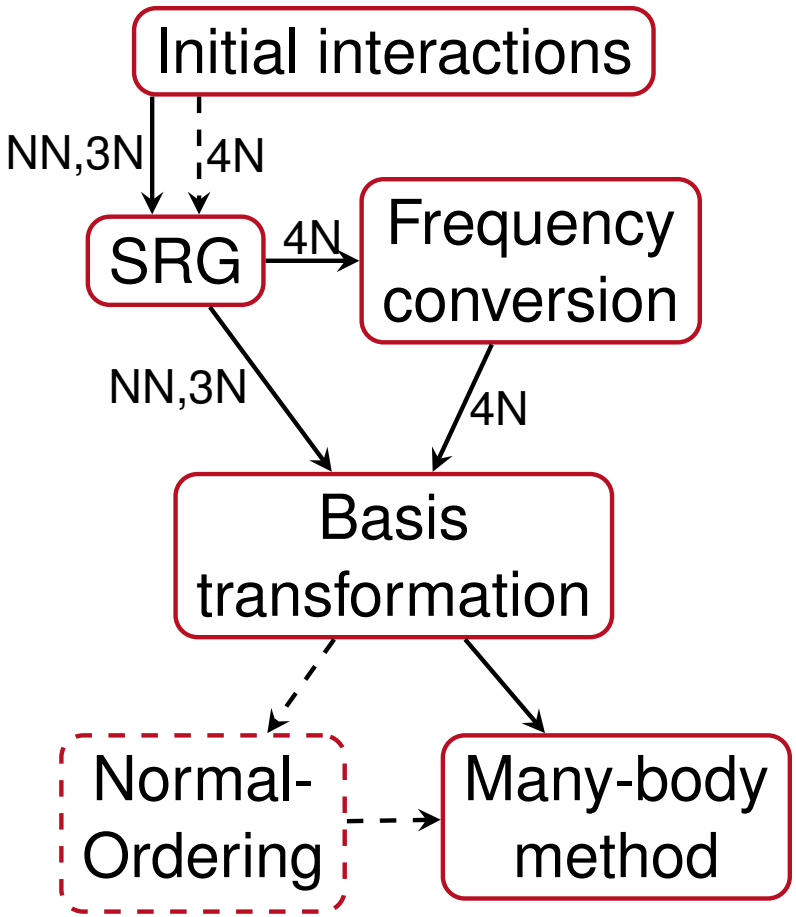

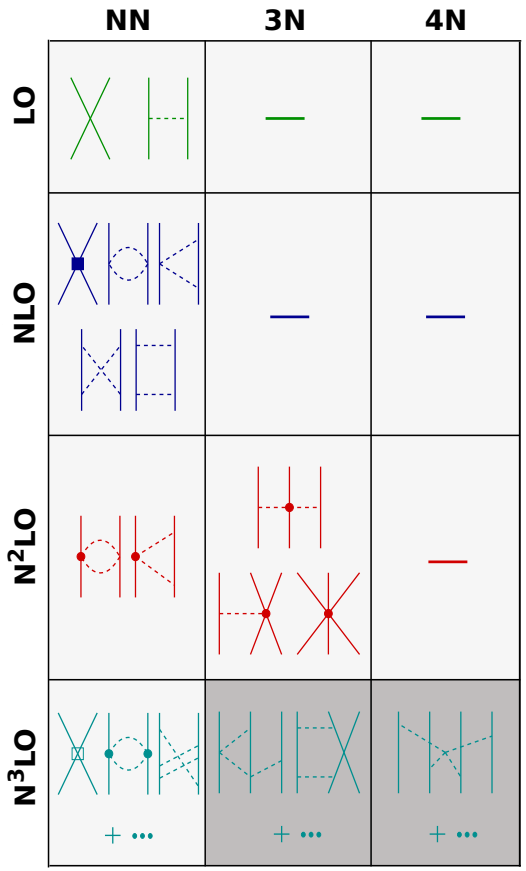

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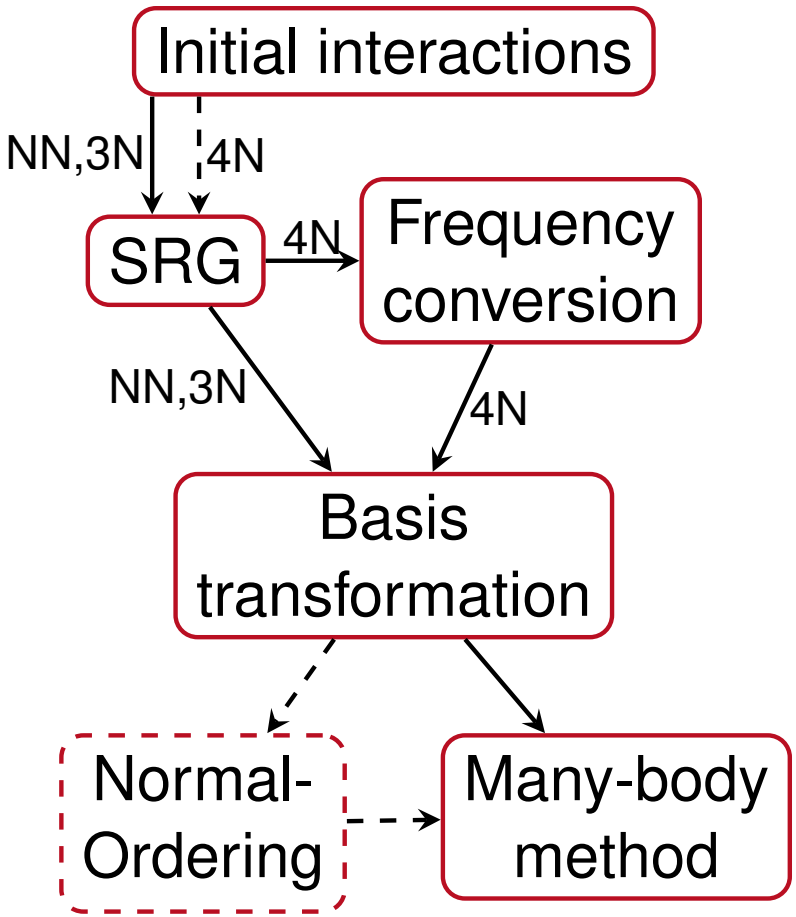

Similarity Renormalization Group

- Soften interaction for subsequent many-body calculation
- Induces many-body forces
- Limitation on model-space size for evolution in 4N space
- Frequency conversion to enhance convergence w.r.t the SRG model space

Framework

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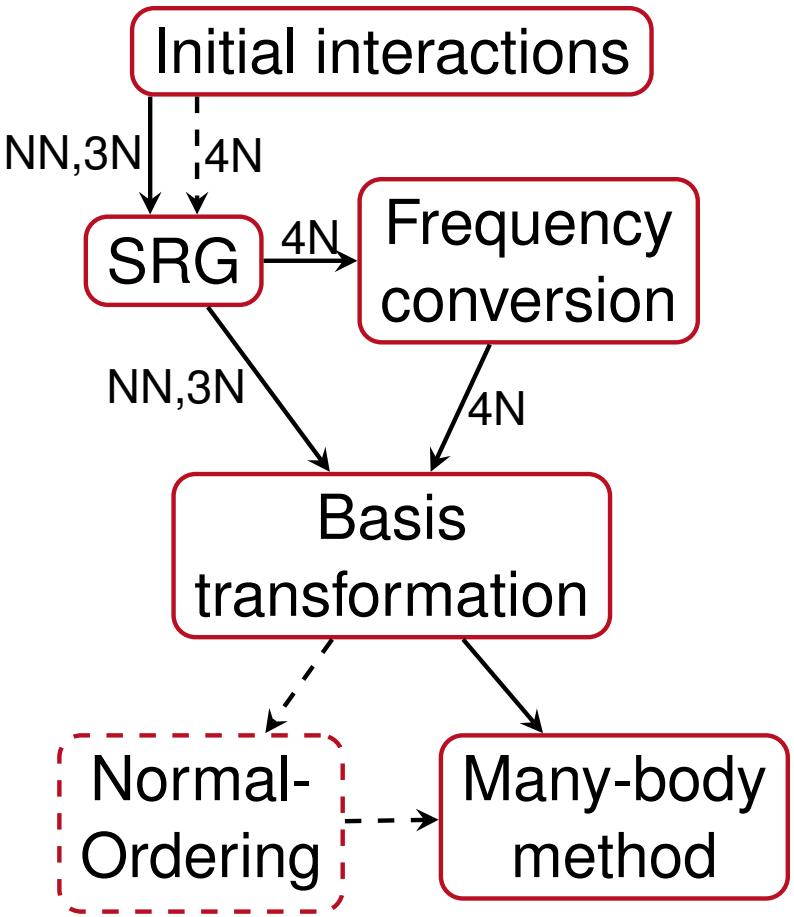

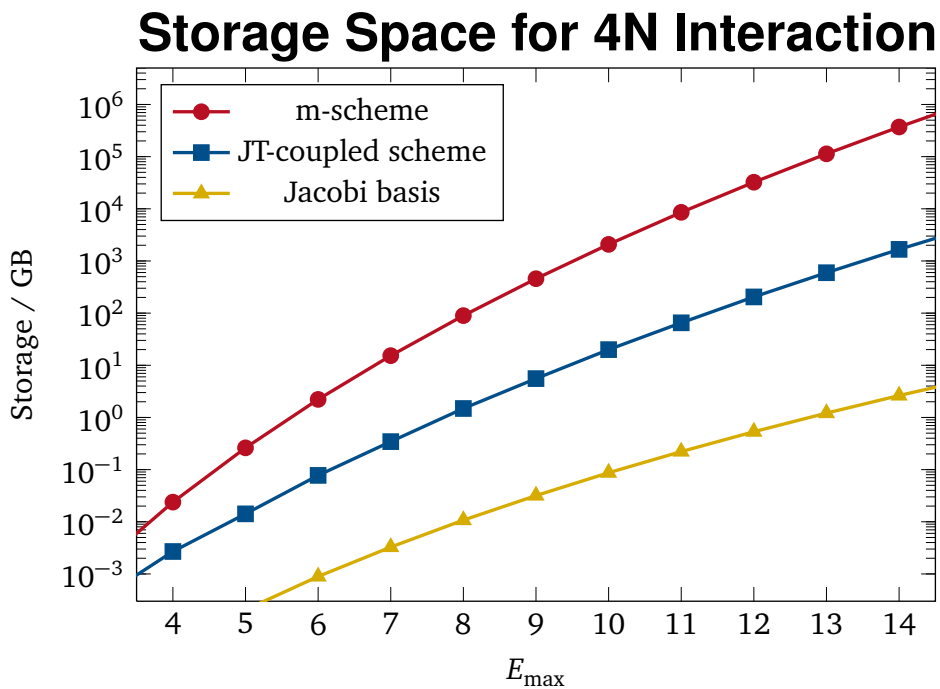

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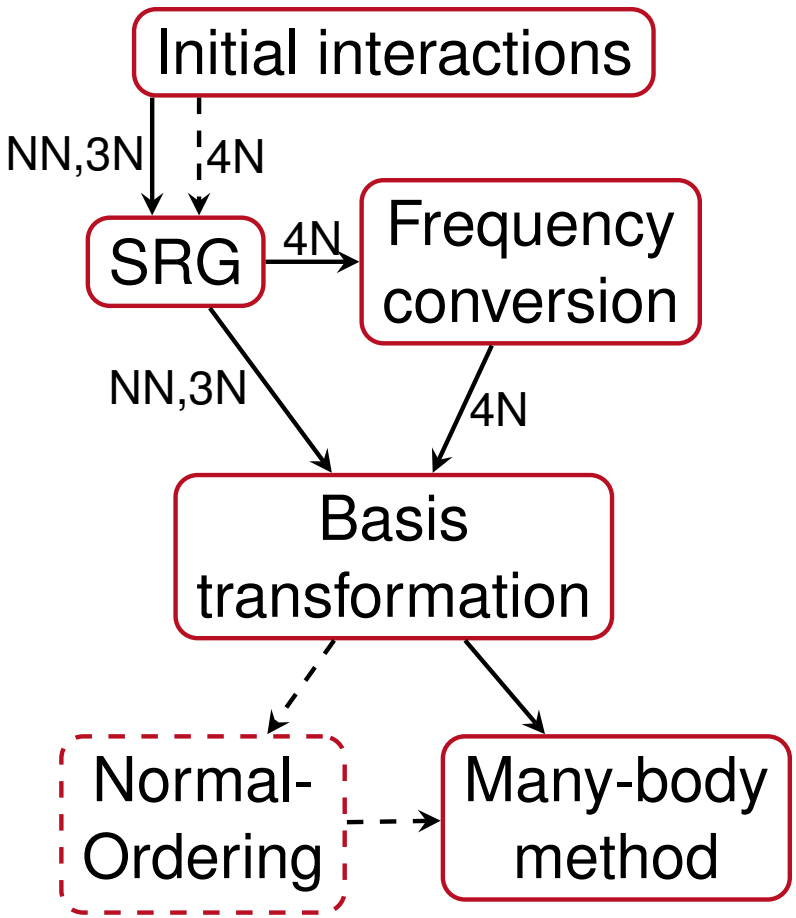
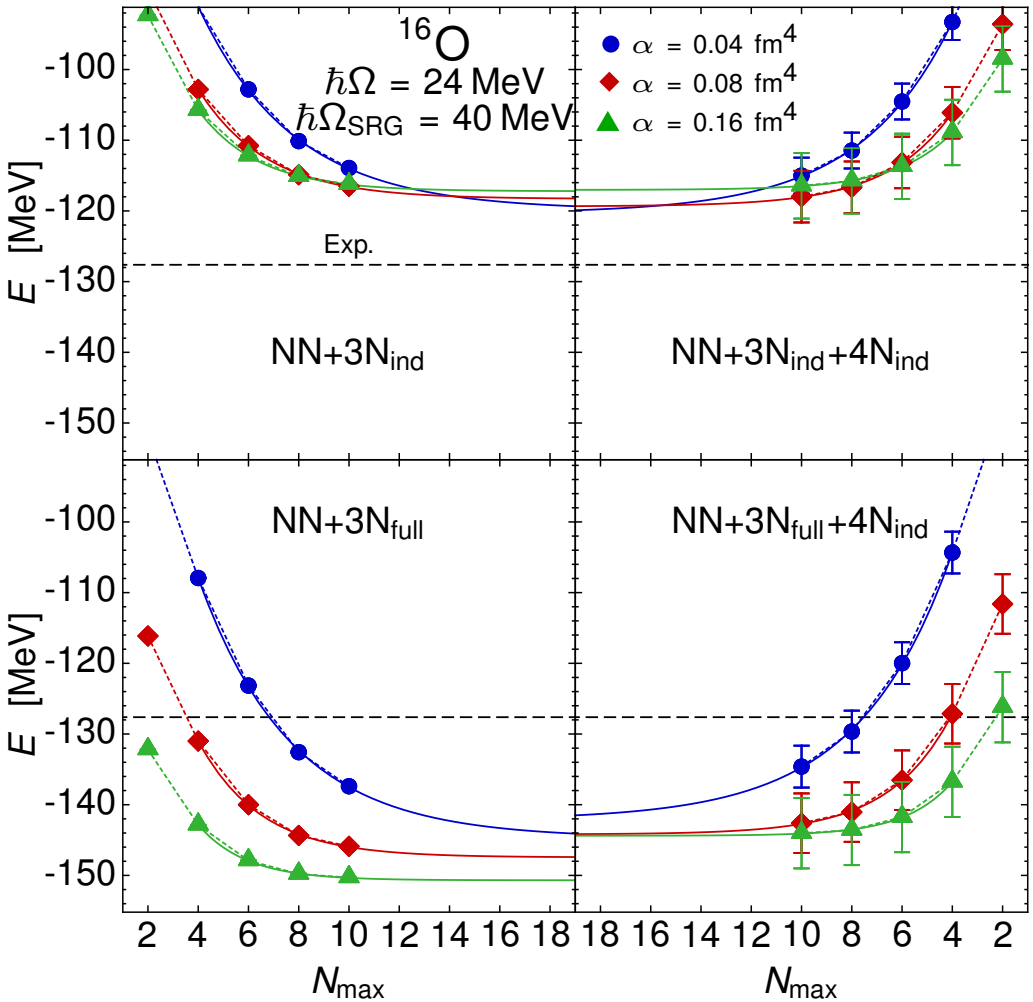


Many-Body Method

- IT-NCSM
  - Exact calculations for given Hamiltonian
  - Inclusion of explicit 4N contributions
- Normal-Ordering (planned)

Results on 4N Induced Contributions



A. Calci, Ph.D. thesis, Technische Universität Darmstadt (2014)

- IT-NCSM calculation with 4N contributions
- Reduced flow-parameter dependence
- Limiting factor: SRG model-space
  - Extrapolation necessary
  - Only partial waves with $J \leq 1$