Suppressing Induced Many-Body Forces by Designed SRG Generators

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- In NCSM size of basis set is determined by particle number (A) and excitation quanta ($N_{max}\hbar\Omega$)

- SRG method with standard generator T_{rel} decouples high and low momenta states allowing accelerated convergence

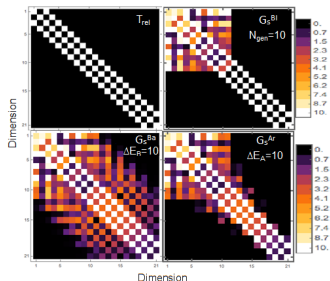- Many-body forces are induced by SRG evolution

■ Investigated three alternative generators.

$$G_s^{Bl} = \begin{cases} T_{rel} + V_{E,E'}, & \text{if } E, E' \leq N_{gen}. \\ T_{rel}, & \text{else.} \end{cases}$$

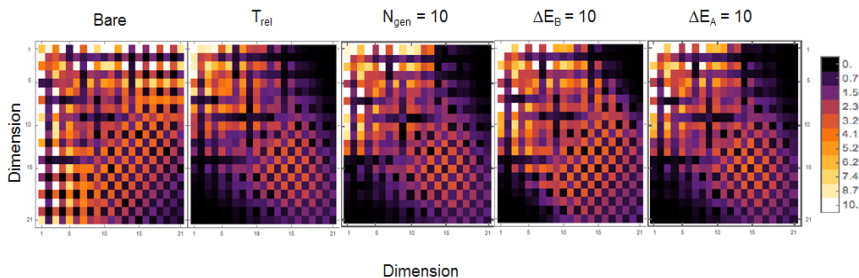$$G_s^{Ba} = T_{rel} + e^{-\left(\frac{(E-E')}{\Delta E_B}\right)^{2n}} V_{E,E'}$$

$$G_s^{Ar} = T_{rel} + e^{-\left(\frac{(E-E')(E+E')}{\Delta E_A^2}\right)^{2n}} V_{E,E'}$$

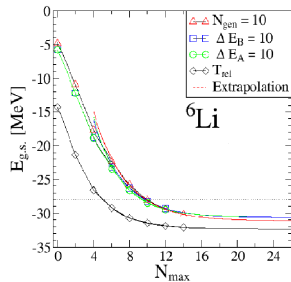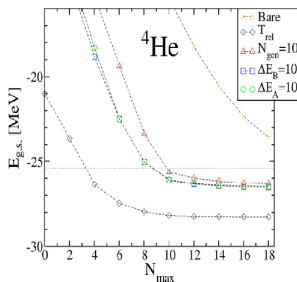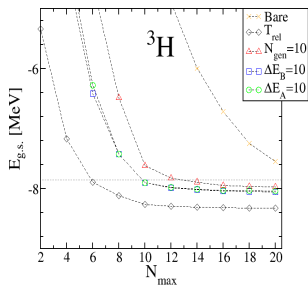Absolute values of matrix elements of generators in the $^3S_1 - ^3D_1$ NN channel

where $E = 2N + L$ is the energy quantum number.

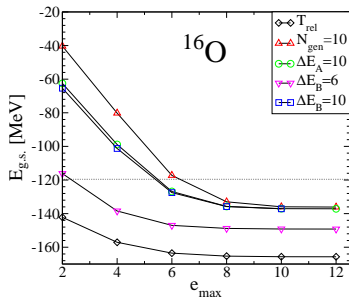NN potentials are evolved with flow parameter $\lambda = 2.0$ fm^{-1} and frequency $\hbar\Omega = 20$ MeV

All three alternate generators show fewer induced many-body forces, however higher N_{max} is required for convergence than with T_{rel}. There is little difference in convergence or induced many-body forces between G_s^{Ar} and G_s^{Ba}

IM-SRG calculations performed for ^{16}O. For increasing ΔE, alternative generators reduce induced many-body contributions.
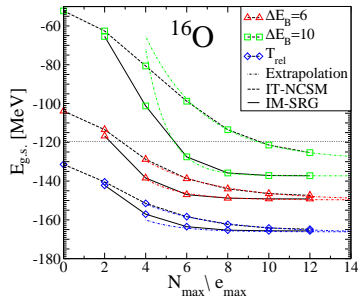
Harder interactions lead to a discrepancy between IM-SRG and IT-NCSM

- Sufficiently small N_{gen} or ΔE achieves comparable convergence to the T_{rel} generator while inducing weaker many-body forces
- Deviations observed for the IT-NCSM and IM-SRG results requires further study
- Next step is to include initial chiral 3N interactions to see if induced 4N interaction is reduced

Thank You!
Merci