Transition Operators and Transition Strength Functions

Binding energies and excitation spectra are not enough; we need the interaction of the nucleus with external probes, e.g. electroweak operators: E1, M1, E2, Gamow-Teller, etc…

- While the coupling to point nucleons is well known, there are systematic corrections due to effective field theory / meson currents

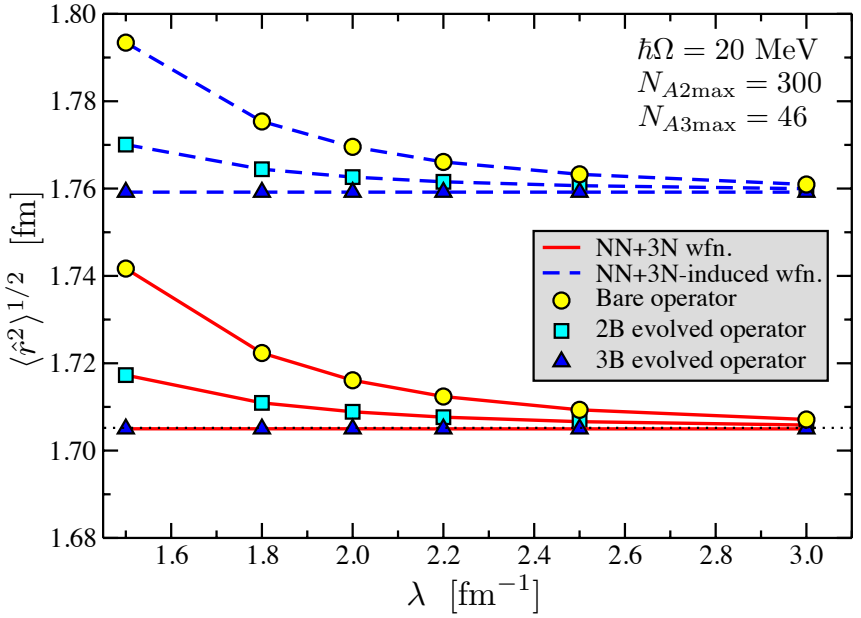
- When we soften the nuclear interaction via SRG or other methods, we should consistently evolve transition operators

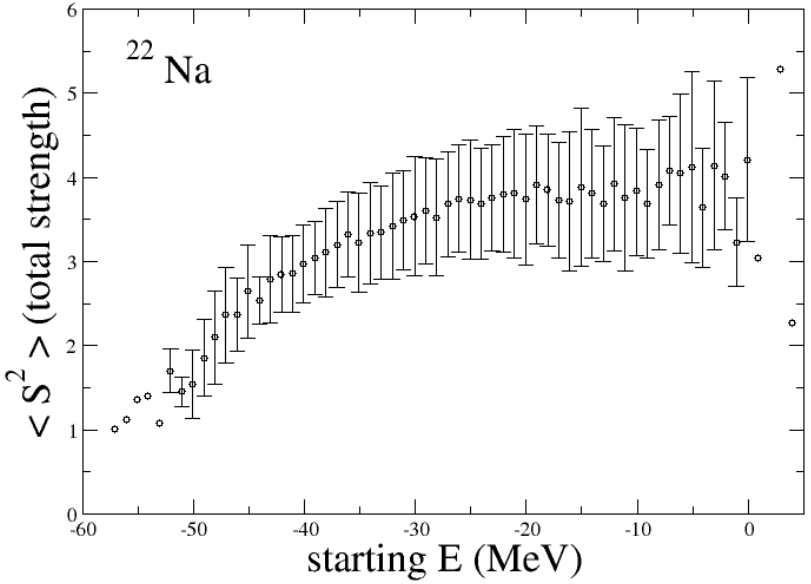
- **Transitions off excited states are difficult to study experimentally but important, for example in nuclear astrophysics and in extraction of level density data; is "Axel-Brink" (the idea that strength functions off excited states are similar to ground state strength functions) reliable?**

Present status

- There have been investigations into proper treatment of electroweak current operators, but more systematic effort is needed *and* routinely applied to many-body calculations

- There have been preliminary calculations of SRG evolved operators with induced higher-order terms





- Axel-Brink is too simple for many transitions; for example, total strength evolves systematically as one goes up in starting energy.

Future challenges

- The community needs systematically-derived EFT operators, at the same level of understanding as interactions, and to be implemented systematically

- More work needs to go into SRG-evolved operators and their convergence, especially two- and three-body terms.

- Can they help us to understanding quenching/effective charges?

- More work needed on the systematics of strength functions from excited states, and the consequences for astrophysics and level densities.

Requirements: faculty/staff + grad students,
high-performance computing resources