Breakout Group C- Nuclear Structure/Many Body Calculations

- Available ab initio methods
  - Coupled cluster (with symmetry breaking and restoration) – 76Ge will be difficult
  - In-Medium GCM
  - Valence-space IMSRG – 100Mo will be difficult
  - No-core shell model – limited to A~16
  - Quantum Monte Carlo – limited to A~12, only method that doesn't use HO basis.
  - Self-consistent Green's function – no 0vBB published so far
  - Symmetry adapted NCSM – Near-term limited to A~48. Interesting for benchmarking.
- What developments are needed in these methods, and what are prospects for uncertainties?
  - IMSRG methods need to explore impacts of IMSRG(3).
  - Coupled cluster – shape coexistence and triaxiality are more challenging, need more work.

- How can we best utilize phenomenological methods (shell model, RPA, DFT, etc)?
  - Identify correlations between 0vBB and other observables for which data exist.
  - The correlations are in principle different for each many-body method. So they must be independently checked, but the phenomenological methods can tell us where to look.
  - If phenomenological models are fit precisely to specific data, this may introduce spurious correlations or suppress physical ones. So these models should explore parameter values away from the optimum.
- Discussion of SRCs and OPE
  - Alessandro Lovato presented an approach fitting a contact in a shell-model calculation to the result of a QMC calculation. Then this contact was used in a shell-model calculation of a heavier nucleus, and the result was in agreement with other ab initio results.
  - This can be potentially understood as the leading term of an OPE for a short-distance operator
  - However, the 0vBB operator is not purely short-distance, and it’s not clear how long-range correlations beyond the model space are captured in the Lovato et al approach.
  - It is possible (?) that an explanation lies in the tensor part of the interaction.