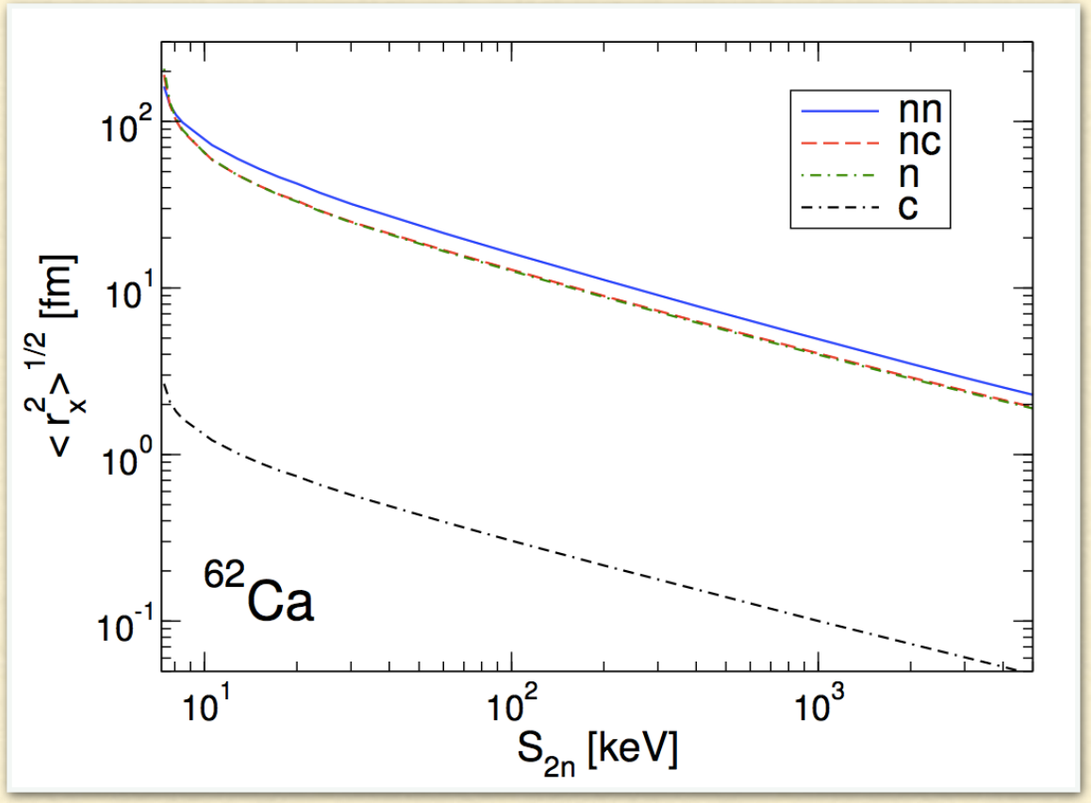
AB INITIO + SYSTEMATIC REACTION THEORY=?

Matter radii in ^{62}Ca



- *Ab initio* excellent for physics from r≃1 fm to ≃6 fm
- Many reactions, e.g. ^{7}Be(p,γ)^{8}B and halo nuclei dominated by physics at longer distances
  - Role of continuum
  - Clustering

Can be difficult for *ab initio*

- Long-range physics (e.g. in $\langle O \rangle_{halo}$) depends on only a few short-range numbers, obtainable *ab initio*

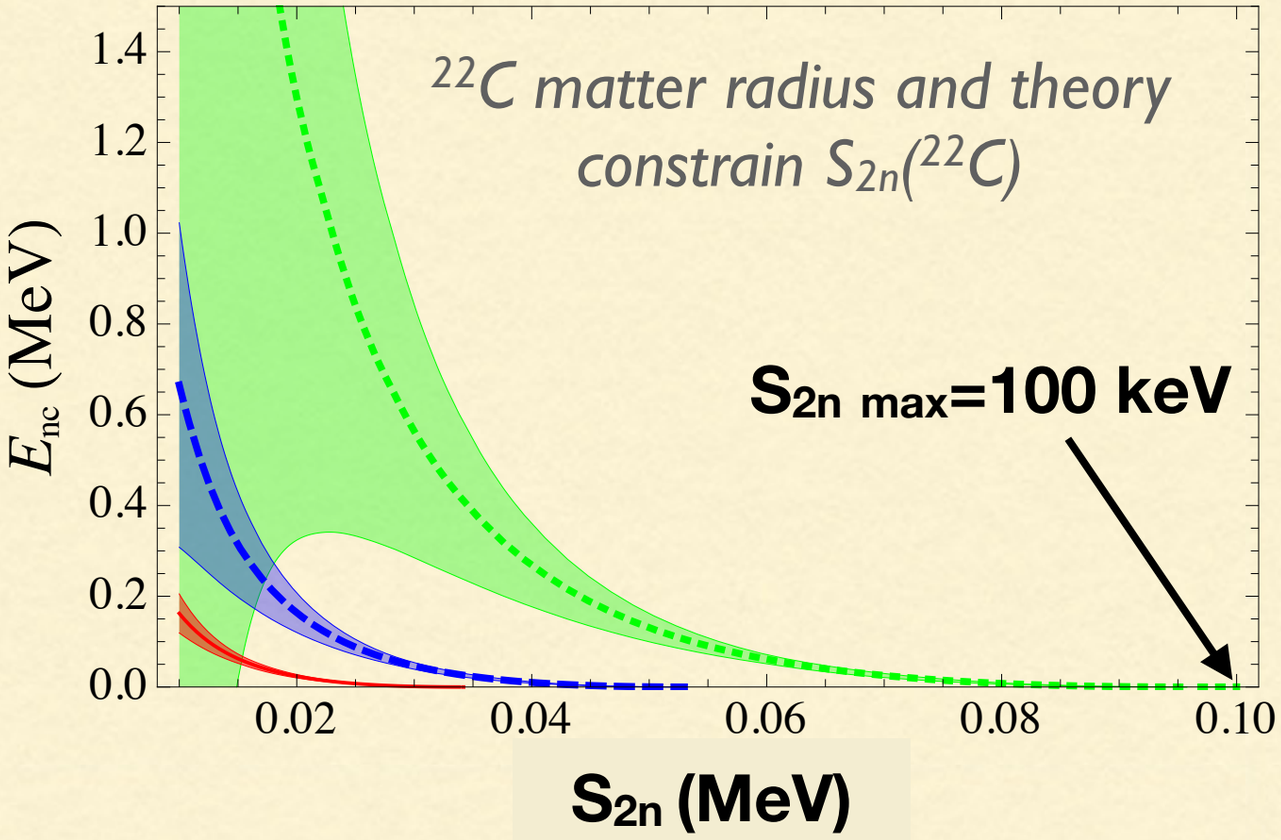
$$\langle O \rangle = \langle O \rangle_{\text{core}} + \langle O \rangle_{\text{halo}}$$

ab initio

few-body reaction theory

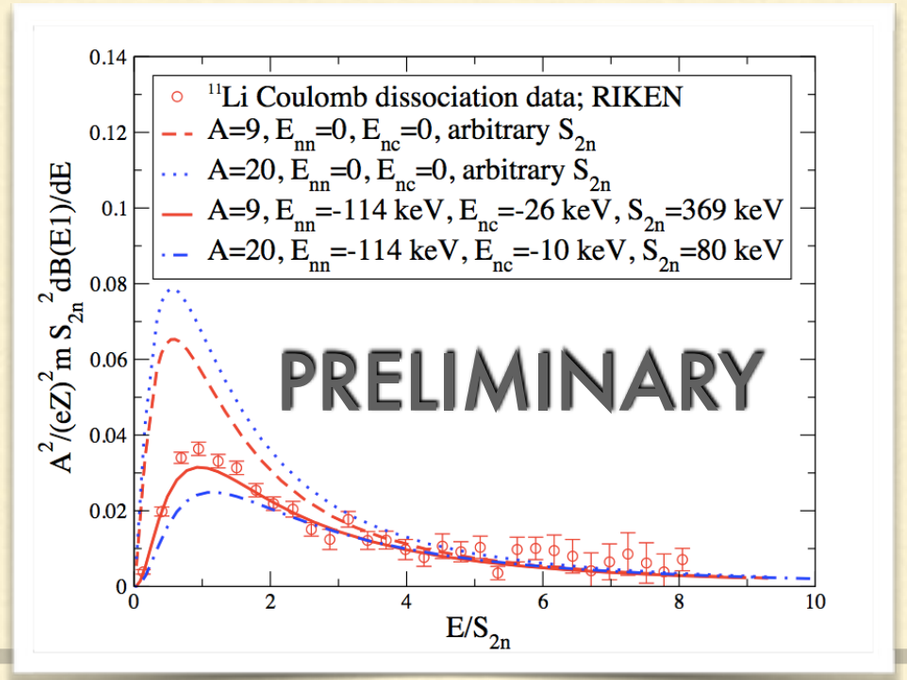
THE BENEFITS OF AN EFT

SYSTEMATICALLY IMPROVABLE, CONTROLLED



- Two-nucleon halos: ^{22}C Coulomb dissociation and radius.
- Connects halos to Efimov physics and other weakly-bound ("unitary limit") systems. Observables show universal scaling.

- Halo EFT: a systematic reaction theory. Useful in systems with scale separation. Observables given in expansion in R_{core}/R_{halo}
- Implies error estimates and tighter constraints in cluster models and R-matrix.
- Applied to one-nucleon halos: Coulomb dissociation of ^{11}Be, ^{19}C. And to $^{7}Li(n,\gamma)^{8}Li$, $^{7}Be(p,\gamma)^{8}B$ with *ab initio* ANCs.



WHAT'S NEXT?

FUTURE

- Understand what *ab initio* input beyond ANCs is most useful: overlaps? short-distance pieces of matrix elements?
- Three-body reactions: tough for direct *ab initio* computation. Need to incorporate information and parameterize short-distance physics systematically.
- Improvements in R-matrix? E.g. extension of fitted R-matrix to three-body systems.
- Extend to sd-shell nuclei

NEEDS

- Person-power: of course!
- Communication: *ab initio*↔EFT,

  EFT↔traditional reaction theory,

  EFT & *ab initio*↔experiment.
- Broad training for students and post-docs:
  - continuation of TALENT
  - collaborations that cross standard structure/reactions and traditionalist/EFT boundaries.