

Calcium Radius Experiment (CREX) Workshop



Welcome!

CREX at Jefferson Laboratory uses parity violating electron scattering to accurately determine the neutron radius of ^{48}Ca .

Workshop Organizers

- **Bob Michaels**
- K. Kumar
- W. Nazarewicz
- J. Piekarewicz
- Thanks to JLAB and Bob McKeown for their support, and thank you for coming!

CREX Workshop Goal

- Discuss physics motivation for CREX and develop a strengthened physics case for a revised proposal.
- **PAC 39 Recommendation:**
 - The experiment is conditionally approved, with a C2 status.
 - The proponents should return to a future PAC with a proposal that makes a stronger case demonstrating how the ^{48}Ca result will test microscopic models.

Program

- Sunday: experiment
- Monday morning: introductory lectures
- Monday afternoon: nuclear structure
- Monday evening: dinner
- Tuesday morning: astrophysics
- Tuesday afternoon: discussion

Your active participation in these discussions is a crucial part of the workshop! Speak up!

Theory Questions



- Is the current design of CREX and the projected error on A_{PV} well-matched to make an important and unique contribution to nuclear structure and nuclear astrophysics?
- Can precise data on ^{48}Ca reduce theoretical uncertainties of low E couplings of nuclear models and discriminate between models?
- How well does CREX, in addition to PREX, allow us to predict R_n all across periodic table? in particular for atomic parity?
- What is best way to constrain L (density dep of symmetry E) from R_n measurements? What is needed accuracy?
- What can we learn from a second measurement at higher Q^2 to constrain the surface thickness of the neutron density in addition to R_n ?
- Are radiative corrections / coulomb distortions really under control? How can this be verified?

Experimental Questions

- Is improved accuracy beyond CREX for ^{48}Ca worthwhile? This might be feasible at Mainz if the motivation is compelling.
- What is the importance and significance of improving the $A_{\text{PV}}(^{208}\text{Pb})$ beyond PREX-II? A factor of 2 better at Mainz may be possible.
- Is a “Super Septum” feasible (that gets to smaller angles) to do “Super PREX” at JLAB and measure $R_n(^{208}\text{Pb})$ to $\pm 0.5\%$ at 2.2 GeV.
- At the Q of CREX, what are the relative rates and sizes of PV asymmetries on the first few excited states of ^{48}Ca ? Presently CREX accepts a small fraction of events up to 5 MeV of inelasticity.
- What potential PREX and CREX results would motivate new A_{PV} measurements at other Q points in ^{48}Ca or ^{208}Pb or in new nuclei?
- Does the surprising measurement of a small A_n in PREX-I motivate dedicated new measurements of A_n on ^{208}Pb or other nuclei, and or at other energies? **Yes.**
- Is there a scenario where the results of PREX-II and CREX, assuming they achieve their proposed errors, form a pair of definitive measurements that provide the necessary information for nuclear structure and nuclear astrophysics being sought?