Abstract Submitted
for the APR10 Meeting of
The American Physical Society

Design and Performance of Next Generation Cryogenic Dark Matter Detectors JEFF YEN, MATT PYLE, Stanford University, BRUNO SERFASS, University of California Berkeley, PAUL BRINK, BLAS CABRERA, MATT CHERRY, Stanford, NADER MIRABOLFATHI, University of California Berkeley, LARRY NOVAK, Stanford, BERNARD SADOULET, DENNIS SEITZ, KYLE SUNDQVIST, University of California Berkeley, ASTRID TOMADA, Stanford, BETTY YOUNG, Santa Clara University — To achieve the surface electron rejection required for ton scale dark matter searches with germanium, we have demonstrated an advanced interleaved charge and phonon detector. The design's large surface E-fields and small electrodes suppress leakage of surface electrons from ^{109}Cd into the nuclear recoil band to less than 1:3000 for 69% wimp search volume efficiency (after radial fiducial volume cuts), 2 orders of magnitude better than current designs. Assymetries in charge collection between the 4 electrodes allow for charge only z fiducial volume reconstruction, which further suppresses this surface leakage by greater than 1:1000 with 62% total wimp search efficiency. Finally, high fidelity partition and pulse shape information from 6 phonon sensors (3 on each side) allow for full 3D event reconstruction which discriminate against electronic surface events at greater than 1:3000 independent of charge assymetry discrimination with 80% efficiency. In summary, this design should meet the discrimination requirements for experiments probing 10^{-47}cm^2 wimp nucleon cross section scales.

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Date submitted: 26 Oct 2009 Electronic form version 1.4