

Dustin Keller

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Objective: Assistant Professor of experimental nuclear physics.

Education

1999-2001 *University of California a Santa Cruz*

Bachelor of Science in Physics

Senior Thesis: *Silicon Microstrip Measurements in the Retinal Readout Project*

2002-2005 *San Jose State University*

Masters of Science Theoretical Physics and Cosmology

Thesis topic: *The Doubly Special Relativity Approach To Gravitation*

2006-2007 *Northern Illinois University*

Took additional graduate courses in physics and started particle physics research at Fermi National Accelerator Laboratory

2007-2010 *Ohio University*

Doctor of Philosophy Experimental Nuclear and Particle Physics

Thesis topic: *U-Spin Symmetry Test of Σ^* Electromagnetic Decay*

Research Experience

2000-2001 *University of California, The Santa Cruz Institute for Particle Physics*

Student research assistant in the high energy particle physics group under Dr. Alan Litke. Worked on application of microstrip detector technology to neurobiology.

2003 - 2005 *San Jose University Physics Department*

Theoretical research in the deformations of the Lorentz Group using κ -hopf algebras to study the reconstruction of general relativity under new postulates.

2006 - 2007 *Fermi National Accelerator Labs and Northern Illinois University*

Student research assistant under Dr. Pushpa Bhatt. Wrote data processing and analysis software for CMS and D0. Contributed to TOPCAFE software package.

Sep 2007 - Apr 2010 *University of Ohio, Physics Department*

Research Assistant in Nuclear and Particle Physics under Dr. Kenneth Hicks, with emphasis in photoproduction of excited state hyperons and analysis of radiative decays of hyperons. PhD research conducted at Thomas Jefferson National Accelerator Labs.

Apr 2010 - Oct 2011 *University of Ohio, Physics Department*

Postdoctoral research in Nuclear and Particle Physics. Worked on research in Hadron Spectroscopy at Jefferson Lab building an analysis framework and developing software for CLAS specific to photoproduction. Contributed to the construction of the Pre-Calorimeter for CLAS12 as well as the development of the cluster reconstruction software.

Jan 2012 - June 2014 *University of Virginia, Physics Department*

Research Associate in Experimental Nuclear Physics. Experimental design as well as data analysis supporting both the development of new experiments and the interpretation and publishing of results from existing experiments. Directly responsible for optimization and development of solid polarized target technologies, and the design and testing of a tensor polarized target. Direct involvement in past and future experiments at Jefferson Lab in Hall A, B, and C, as well as future experiments in collaboration with LANL/Fermi Lab and present experiments at the Duke High Intensity Gamma-Ray Source.

June 2014 - present *University of Virginia, Physics Department*

Research Scientist in Experimental Nuclear Physics. Running and maintaining the UVA Solid Polarized Target Lab with a focus on the development of technology to advance polarization techniques for a broad range of experiments. Design, construction and repair of specialized dilution and evaporation fridges, as well as target inserts used in polarized target experiments. Experimental design which exploits the spin degrees of freedom accessible through the use of a polarized beam and target in all four Halls at Jefferson Lab. Creating and advising student projects in and outside of the lab. Taking a lead role in the design and construction of the cryogenic target insert as well as the testing and maintaining of the fridge and super conducting magnet for the Fermi Lab SeaQuest Drell-Yan project.

Teaching Experience

1999 - 2001 *The Mathematics Engineering Science Achievement (MESA) Center at Cabrillo College*

Section Teacher for Differential Equations, Linear Algebra, Calculus 1,2,3, and Physics 1,2,3. Held weekly sections for problem solutions and reviews.

2002 - 2005 *San Jose University Physics Department*

Teaching assistant for various physics undergraduate classes and labs. Tasked with grading homeworks, projects, lab reports and writing solutions. Held weekly sections for problem solutions and reviews.

2008 *Ohio University Physics Department*

Teaching assistant for graduate particle physics class. Wrote solutions and grading homeworks. Supervision of students: Nate Vermoski completed senior high school project at Jefferson Lab; Wei Tang, a graduate student of Ohio University working on his PhD at Jefferson Lab.

2012-2014 *University Virginia Physics Department*

Create, coordinator, and advise the graduate and undergraduate research in the UVA Solid Polarized Target lab exposing students to nuclear physics research, polarized target technologies such as cryogenics, vacuum techniques, superconducting magnets, microwave generation and guiding, NMR system, computer control and data acquisition, data analysis, statistical techniques, simulation and modeling. Worked as the supervisor to roughly 20 undergraduates and four graduates working on long term project in the UVA Solid Polarized Target lab. Many student projects have led to work being prepared for publication.

Some Select Projects (Stationed at Jefferson Lab)

- Wrote software for cluster reconstruction of the Pre-shower Calorimeter (PCAL) prototype for the 12GeV upgrade
- Wrote reconstruction software for reading experimental output of scintillator testing for PCAL using the CODA data acquisition system
- Assisted with PCAL prototype construction and data acquisition setup
- Performed cosmic ray and simulation studies on PCAL prototype
- Wrote reconstruction software for pair-spectrometer used in PCAL prototype beam studies
- Performed photoelectron statistics studies and calibration of PMTs used in PCAL scintillator tests
- Assisted in software package for Scintillation Hodoscope reconstruction used in several CLAS runs

- Wrote software package for Multi-Pixel Photon Counter (MPPC) photoelectron peak reconstruction used by Scintillation Hodoscope
- Performed MPPC gain studies for Scintillation Hodoscope optimization and calibration
- Performed Scintillation Hodoscope disassembly and reassembly with MPPC replacements
- Performed radiation effects studies on MPPCs used in Scintillation Hodoscope
- Configured signal conditioning for NMR system used in polarized target for g_2^p experiment
- Assisted with target installation and operation as polarized target expert for g_2^p and G_e^p

Some Select Projects (Stationed at University of Virginia)

- New target design using selective RF partial saturation with target rotation for maximizing tensor polarization for spin-1 nuclear experiments
- Material and polarization data analysis to developed theory and Monte Carlo of polarization and relaxation mechanisms involved target-beam interactions
- Micro-controller hardware system to autonomously regulate the microwave system control to optimize polarization and FOM for experiment
- New design for Adiabatic Fast Passage in solid polarized targets for fast helicity flip for both spin-1 and spin-1/2
- Fitting theory and software development for polarization extraction of tensor polarized targets
- Multiple testing and cool-down procedural development of the recommissioned LANL supper conducting magnet system for Polarized Target Drell/Yan experiment
- Design cryogenic fridge modifications and adjustments to pumping pipe-out for Polarized Target Drell/Yan experiment
- Design and construct cryogenic target insert for application with the Fermi lab beam for Polarized Target Drell/Yan experiment
- Design and implement survey instrumentation for target, target field, and proton beam interaction point
- Assist in design and construction of the Hall C 12 GeV upgrade Cherenkov detector

Programming Languages and software development

- Languages: C/C++, Fortran, Python, BASIC, TCL, Ruby, XML, HTML, Mathematica, Matlab, ROOT, PAW, Perl, LabView
- Developed several software packages used for reading and analyzing raw ADC and TDC information used by 12GeV Upgrade Pre-Shower group
- Developed kinematic fitting package for drift chamber detection of charged particle as well as electromagnetic calorimeter detection of neutral particles in CLAS
- Developed Multivariate Analyzer package for probabilistic event fitting and Boosted Decision Tree small signal extraction
- Developed several object oriented ROOT base reconstruction and analysis packages
- Developed several object oriented skimming and analysis packages that port ROOT tools into PAW and other Fortran based analysis
- Experience with GEANT based simulations of complex detectors and modification of resolution parameters in Monte Carlo simulations to accurately depict data
- Developed Detector Covariance Feature-Space Expansion for Boosted Decision Tree small signal extraction
- Developed several Monte Carlo simulations for polarized target dynamics in use with nuclear experiments
- Developed polarized target analysis framework and software for data run polarization and uncertainty extraction

Approved Experiments

- E12-06-109 *The Longitudinal Spin Structure of the Nucleon (JLab Hall B)*
Spokespersons: K. Griffioen, M. Holtrop, D. Keller, S. Kuhn, Y. Prok, T. Forest

- HIGS-P-12-16 *Measurement of the Tensor Analyzing Power in Deuteron Photodisintegration (Duke TUNL)*
Spokespersons: D. Keller, P. Seo, B. Norum
- E1039 *The Polarized Drell Yan at Fermilab (Fermilab SeaQuest)*
Spokespersons: A. Klein, D. Keller
- E12-13-011 *The Deuteron Tensor Structure Function b_1 (JLab Hall C)*
Spokespersons: J.P. Chen, N. Kalantarians, D. Keller, E. Long, K. Slifer, P. Solvignon
- E12-14-006 *Wide-angle Compton Scattering (JLab Hall C)*
Spokespersons: D. Day, D. Keller, J. Zhang
- E12-15-005 *Tensor Asymmetry Quasielastic Region (JLab Hall C)*
Spokespersons: D. Day, D. Higinbotham, D. Keller, E. Long, K. Slifer, P. Solvignon

Presentations

- “Wide-Angle Compton Scattering and Polarized Observables”, Invited Talk at ECT* Work Shop on Probing Transverse Nucleon Structure at High Momentum Transfer, April 18-22, 2016 Trento Italy
- “Spin-1 target in Hadronic Physics”, Invited Talk at 82nd Annual Meeting of the APS Southeastern Section, November 18-21, 2015 Mobile, AL
- “Quadrupole Polarization from Selective Semi-saturation”, International Workshop on Polarized Sources, Targets and Polarimetry, Sept. 16 2015, Bochum Germany
- “Techniques of Uncertainty Reduction and Signal Extraction in Nuclear Physics”, March 31, 2015, UVA Nuclear Seminar, Charlottesville Virginia
- “Some Developments on Polarized Targets for Nuclear Experiments”, Invited Talk at The 4th International Workshop on Nucleon Structure at Large Bjorken X, November 19, 2014, Laboratori Nazionali di Frascati Italy
- “Tensor Polarization Optimization and Measurement for Solid Spin 1 Targets”, Contributing Talk at the International SPIN SYMPOSIUM October 24, 2014 Beijing China
- “Tensor Polarization Optimized in Solid Polarized Targets”, Invited Talk at the Tensor Spin Observables Workshop March 12, 2014, Jefferson Lab, Newport News Virginia
- “EM Decays of the Low-Lying Excited-state Hyperons in the Strange Sector”, Invited Talk at the Mississippi State Physics Colloquium April 3, 2014, Starkville, Mississippi
- “Uncertainty minimization of solid polarized targets”, Contributing Talk, International Workshop on Polarized Sources, Targets and Polarimetry, Sept. 12, 2013, Charlottesville Virginia
- “Measurement of the b_1 structure function in Hall C”, Invited Talk at Hall C Summer Workshop, Aug. 15, 2013, Newport News Virginia
- “Branching Ratio of the radiative decay of the $\Sigma^{*+}(1385)$ ”, Contributing Talk, APS Feb, 2010, Washington DC
- “Radiative Decay of the Σ^{*+} using g11 data: neutron detection”, CLAS Collaboration Meeting, Jefferson Lab Nov. 10, 2009, Newport News Virginia
- “Scintillator and Wave-Length-Shifting fiber gluing and yield results”, 12 GeV Upgrade - CLAS Collaboration Meeting, Jefferson Lab March 20, 2009, Newport News Virginia
- “Scintillator Testing and use in the Pre-Show Calorimeter Results”, 12 GeV Upgrade - CLAS Collaboration Meeting, Jefferson Lab Dec. 9, 2009, Newport News Virginia
- “Simulations and Measurements of the Pre-Shower Calorimeter Prototype Detector”, 12 GeV Upgrade - CLAS Collaboration Meeting, Jefferson Lab June 16, 2008, Newport News Virginia
- “Branching Ratio of the $\Sigma^{*0} \rightarrow \Lambda\gamma$ ”, Contributing Talk, APS March, 2008, St. Louis, Missouri
- “Simulations and reconstruction of the Pre-Shower Calorimeter Prototype Detector”, 12 GeV Upgrade - CLAS Collaboration Meeting, Jefferson Lab Sept 29, 2007, Newport News Virginia
- Multiple Talks in CLAS Hadron Spectroscopy Working Group on *radiative decays, small signal extraction, and kinematic fitting*

Conference Proceedings

- D. Keller, “Quadrupole Polarization from Selective Semisaturation”, Proceedings of Science, International Workshop on Polarized Sources, Targets and Polarimetry, PSTP2015, in press. (2015)

- D. Keller, “First steps in tensor polarization measurement using the DMR line-shape”, The 21st International Symposium on Spin, Int.J.Mod.Phys.Conf.Ser. 40 (2016) 1, 1660105
- D. Keller, “Investigation into tensor polarization enhancement in solid polarized targets”, Tensor Polarized Solid Target Workshop, J.Phys.Conf.Ser. 543 (2014) 1, 012015
- D. Keller, Proceedings of Science, International Workshop on Polarized Sources, Targets and Polarimetry, PoS PSTP2013, 010 (2013).
- K. Hicks and D. Keller (for the LEPS Collaboration). *Photoproduction of the Σ^{*-} resonance from the neutron* Proceedings of the Sendai 2008 International Conference, Int.J.Mod.Phys. E19 (2010) 2363-2368
- K. Hicks, D. Keller, and W. Tang (for the CLAS Collaboration). *Electromagnetic production of hyperon resonances* AIP Conf.Proc. 1374 (2011) 177-180

Internal Publication

- D. Keller, *Systematics of small spin-1 tensor asymmetries with a solid polarized target* JLAB-TN-15-014.
- D. Keller, *Uncertainty in DNP Target Data for E08-007* JLAB-TN-12-051.
- D. Keller, *EC photon corrections and Covariance* CLAS-Note 2011-004.
- D. Keller, *Neutron Covariance in the Electromagnetic Calorimeter* CLAS-Note 2011-001.
- D. Keller, *Techniques in Kinematic Fitting* CLAS-Note 2010-025.
- M. Yurov, S. Stepanyan, D. Keller, *Scintillation Hodoscope Reconstruction software package and Calibration procedures* CLAS-Note 2009-019.
- D. Keller, M. Yurov, K. Hicks, S. Stepanyan, *Scintillator Testing for Use in The Pre-Shower Calorimeter* CLAS-Note 2009-018.
- D. Keller, M. Yurov, K. Hicks, S. Stepanyan, H. Voskanyan, *Simulations and Measurements of Pre-Shower Calorimeter Prototype Detector* CLAS-Note 2008-010.

Primary-Author Publications

- D. Keller *Modeling Quadrupole Polarization Enhancement for Solid Polarized Targets*, Eur. Phys. J. **A**, (submitted) (2016).
- D. Keller *New Measurements of Enhanced Tensor Polarized Targets for Nuclear Experiments*, NIM A, (submitted) (2016).
- D. Keller *et al*(The CLAS Collaboration). *Radiative decays of the (1520) excited-state hyperon*, Phys. Rev. D (Under Internal Review) (2016).
- D. Keller and K. Hicks *U-spin predictions of the transition magnetic moments of the electromagnetic decay of the $\Sigma(1385)$ baryons*, Eur. Phys. J. **A49**, 53 (2013).
- D. Keller *Uncertainty minimization in NMR measurements of dynamic nuclear polarization of proton target for nuclear physics experiments*, NIM A **728**, 133-144 (2013).
- W. Tang, K. Hicks, D. Keller *et al*(The CLAS Collaboration). *Cross section for the $\gamma p \rightarrow K^{*+}\Lambda$ and $\gamma p \rightarrow K^{*+}\Sigma^0$ reaction measured at CLAS*, Phys. Rev. C **87** 065204 (2013).
- D. Keller *et al*(The CLAS Collaboration). *Branching ratio of the electromagnetic decay of the Σ^+* , Phys. Rev. D **85**, 052004 (2012).
- D. Keller *et al*(The CLAS Collaboration). *Electromagnetic Decay of Σ^0 Excited State Hyperon*, Phys. Rev. D **83**, 072004 (2011) arXiv:1103.5701.
- K. Hicks, D. Keller *et al*(The LEPS Collaboration). *Cross Sections and Beam Asymmetry for $K^+\Sigma^{*-}$ Photoproduction from the Deuteron at $E_\gamma=1.5-2.4$ GeV* Phys. Rev. Lett. **102**, 012501 (2009) arXiv:0812.0771.
- D. Keller. *The Doubly Special Relativity Approach to Gravitation* (San Jose State U.). UMI-14-36918, 2006. 66pp. M.S. Thesis

Some Selected from 68 Collaboration Publications

- M.E. McCracken *et al*(The CLAS Collaboration). *Search for baryon-number and lepton-number violating decays of hyperons using the CLAS detector at Jefferson Laboratory* Phys. Rev. D **92** 7, 072002, (2015).

- M. Mestayer *et al*(The CLAS Collaboration). *Strangeness Suppression of qq Creation Observed in Exclusive Reactions* Phys. Rev. Lett. **113** 15, 152004, (2014).
- H. Seraydaryan *et al*(The CLAS Collaboration). *ϕ -meson photoproduction on Hydrogen in the neutral decay mode* Phys. Rev. C **89** 5, 055206, (2014).
- M. Moteabbed *et al*(The CLAS Collaboration). *Demonstration of a novel technique to measure two-photon exchange effects in elastic ep scattering* Phys. Rev. C **88** 025210, (2013).
- I. Bedlinsky *et al*(The CLAS Collaboration). *Demonstration of a novel technique to measure two-photon exchange effects in elastic ep scattering* Phys. Rev. Lett. **109** 112001, (2012).
- A. Daniel *et al*(The CLAS Collaboration). *Measurement of the nuclear multiplicity ratio for K0s hadronization at CLAS* Phys. Rev. Lett. B **706** 26-31, (2011).
- S. Anefalos Pereira *et al*(The CLAS Collaboration). *Differential cross section of $\gamma n \rightarrow K^+ \Sigma^-$ on bound neutron with incident photons from 1.1 to 3.6 GeV* Phys. Rev. Lett. B **688**:289-293, (2010).
- M.E. McCracken *et al*(The CLAS Collaboration). *Differential cross section and recoil polarization measurements for the $\gamma p \rightarrow K^+ \Lambda$ using CLAS at Jefferson Lab* Phys. Rev. C **81**, 025201 (2010).
- I.G. Aznauryan *et al*(The CLAS Collaboration). *Electroexcitation of nucleon resonances from CLAS data on single pion electroproduction* Phys. Rev. C **80**, 055203 (2009).
- M. Williams *et al*(The CLAS Collaboration). *Differential cross sections for the reactions $\gamma p \rightarrow p\eta$ and $\gamma p \rightarrow \eta'$* Phys. Rev. C **80**, 045213 (2009).
- M. Williams *et al*(The CLAS Collaboration). *Partial wave analysis of the reaction $\gamma p \rightarrow p\omega$ and the search for nucleon resonances.* Phys. Rev. C **80**, 065209 (2009).
- M. Williams *et al*(The CLAS Collaboration). *Differential cross sections and spin density matrix elements for the reaction $\gamma p \rightarrow p\omega$.* Phys. Rev. C **80**, 065208 (2009).
- R. Nasseripour *et al*(The CLAS Collaboration). *Photodisintegration of ^4He into $p+t$.* Phys. Rev. C **80**, 044603 (2009).
- X. Qian *et al*(The CLAS Collaboration). *The extraction of $\phi - N$ total cross section from $d(\gamma, pK^+K^-)n$.* Phys. Lett. B **680**, 417 (2009).
- M. Battaglieri *et al*(The CLAS Collaboration). *Photoproduction of $\pi^+\pi^-$ meson pairs on the proton.* Phys. Rev. D **80**, 072005 (2009).
- W. Chen *et al*(The CLAS Collaboration). *A measurement of the differential cross section for the reaction $\gamma n \rightarrow \pi^- p$ from deuterium.* Phys. Rev. Lett. **103**, 012301 (2009).
- M. Dugger *et al*(The CLAS Collaboration). *π^+ photoproduction on the proton for photon energies from 0.725 to 2.875 GeV.* Phys. Rev. C **79**, 065206 (2009).
- J. Lachniet *et al*(The CLAS Collaboration). *A Precise Measurement of the Neutron Magnetic Form Factor GM_n in the Few-GeV 2 Region.* Phys. Rev. Lett. **102**, 192001 (2009).
- M. Battaglieri *et al*(The CLAS Collaboration). *First measurement of direct $f_0(980)$ photoproduction on the proton.* Phys. Rev. Lett. **102**, 102001 (2009).
- S. A. Morrow *et al*(The CLAS Collaboration). *Exclusive ρ^0 electroproduction on the proton at CLAS.* Eur. Phys. J. A **39**, 5 (2009).
- Angela S. Biselli *et al*(The CLAS Collaboration). *First measurement of target and double spin asymmetries for polarized-e polarized-p $e \rightarrow p\pi^0$ in the nucleon resonance region above the $\Delta(1232)$* Phys. Rev. C **78**, 045204 (2008).
- I. G. Aznauryan *et al*(The CLAS Collaboration). *Electroexcitation of the Roper resonance for $1.7 < Q^2 < 4.5 - \text{GeV}^2$ in $ep \rightarrow en\pi^+$* Phys. Rev. C **78**, 045209 (2008).
- J. P. Santoro *et al*(The CLAS Collaboration). *Electroproduction of $\phi(1020)$ mesons at $1.4 < Q^2 < 3.8\text{GeV}^2$ measured with the CLAS spectrometer* Phys. Rev. C **78**, 025210 (2008).
- K. Park *et al*(The CLAS Collaboration). *Cross sections and beam asymmetries for $ep \rightarrow en\pi^+$ in the nucleon resonance region for $1.7 \leq Q^2 \leq 4.5 - (\text{GeV})^2$.* Phys. Rev. C **78**, 025210 (2008).

References

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