

Dustin Keller

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Objective: Nuclear/High-Energy Physicist: Staff Scientist

Education

1999-2001 *University of California at 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 Assistant 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 Lab and Northern Illinois University*

HEP 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 Lab.

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-shower calorimeter for CLAS12 as well as the development of the cluster reconstruction software.

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

Postdoctoral Research in Nuclear and Particle Physics. Designing and proposing experiments to run at Jefferson lab or other particle physics facilities. 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 cryogenic refrigerators, as well as target inserts used in polarized target experiments. Experimental design which exploit the spin degrees of freedom accessible through the use of a polarized beam and target in all four Halls at Jefferson Lab.

June 2014 - Nov 2017 *University of Virginia, Physics Department*

Research Scientist in Nuclear and Particle Physics. Propose, plan, defend and lead experimental studies of the structure of nucleons and nuclei, mainly, but not exclusively, using polarization degrees of freedom. A primary focus on guiding and advancing the groups research program at Jefferson Laboratory, Fermilab and other facilities. Advance physics analysis and software techniques. Continuing to head research and development of the groups polarized target laboratory while also creating and advising graduate and undergrad student projects in and outside of the lab. Teaching and mentoring post-docs and students on large scale software and hardware projects.

Nov 2017 - present *University of Virginia, Physics Department*

Principal Scientist in Nuclear and Particle Physics. Innovation and development of techniques and instrumentation used to exploit spin physics. Explore new ideas in theory and phenomenology that can be investigated experimentally. Propose, plan, defend and lead the experimental effort of these investigations. Assist in the preparation of budgets for the groups contract continuation and renewal proposals as needed while allocating resources to the groups various research activities in order to maximize the output of high quality science. Head the direction of the groups primary research focus. Primary leadership in experimental and Collaboration efforts. Co-lead initiative between UVA Nuclear Phenomenology and Data Science Institute to use machine learning in nucleon tomography. Also continuing to create and advise student projects while mentoring post-docs and students on large scale software and hardware projects.

Teaching Experience

1999 - 2001 *The Mathematics Engineering Science Achievement (MESA) 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 and coordinate the groups research direction 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 many undergraduates and several graduates working on long term project in the groups lab. Along with the graduate students many undergrad projects have led to work being prepared for publications, technical notes and proceedings.

Some Recent Select Projects

- In leadership role in several collaborative efforts to propose experiments exploiting spin degrees of freedom and quark-gluon structure of nucleons
 - Proposed multiple experiments with collaborators and have ongoing projects to study 3D Structure of the Nucleon such as WACS, TCS and the Longitudinal Spin Structure of the Nucleon
 - Proposed experiments to study the internal nucleon spin contributions to macroscopic nuclear effects such as short range correlation in the quasielastic region and the spin-1 tensor structure function
 - Working on projects to use spin degrees of freedom to provide information on the quantum numbers of exotics states such as the LOI to study Target Helicity Correlations in GlueX for Hall D at JLab and the proposal to measure the Tensor Analyzing Power in the Deuteron Photodisintegration experiment to run in TUNL at Duke
- Original invention or designs for multiple hardware devices needed for either proposal approval or experimental operation (some of which pending UVA patent)
 - Raster system to be used in the high intensity photon source at JLab in several experiments
 - Spinning RF-modulated target system used for tensor polarization enhancement
 - High powered supercooled refrigerator used for high beam intensity with dynamically polarized targets
 - Optimized-Q and Rolling Adiabatic Fast Passage system for solid polarized target which can be optimized for fast helicity target flips for spin-1 and spin-1/2
 - Measurement technology using RF Semi-saturation for CW-NMR for spin-1 nuclear resonance
- Development on the intensity frontier
 - Work with in collaboration to design a high intensity polarized photon source for JLab Hall C and Hall D (publication pending)
 - Design a target system to be used with worlds highest photon intensity beam
 - Tensor polarization enhancement devices to be used in high charged beam intensity along with measurement technology
 - Construction of target system for worlds highest proton beam intensity on a dynamic nuclear polarized target
 - Partial Design of polarized target system for the second generation of the Dukes High Intensity Gamma Source
- Co-lead in the UVA 3D-Imaging Initiative with the Data Science Institute
 - Involved in organizing a consortium interested in using techniques in Machine Learning to construct femtographical layers of information on the nucleon structure
 - Involvement in algorithm development and computational extensions of GDP-TMD phenomenology in order to use artificial intelligence to propose new types of experiments
 - Involved in four different experiments that intend to extract information to be used in 3D-Imaging
- Hardware-software system to autonomously regulate the microwave frequency and polarization system to optimize the FOM of polarized target experiments
- Design and build many different types of cryogenic systems such as dilution frozen spin and high power evaporation systems
- Assist in design and construction of several Hall C and Hall B detector systems: Cherenkov, ECal, PCal, Hodoscope, and Start-Counter

Programming Languages and software development

- Languages: Most programming languages or interpreter frameworks used in particle physics and hardware control
- Developed many software packages used for reading and analyzing raw ADC and TDC detector information
- Developed multiple algorithms and applications using supervise and unsupervised machine learning
- Experience with many simulations packages integrating complex detector geometries and other applications

Approved Experiments

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

- HIGS-P-12-16 *Tensor Analyzing Power in Deuteron Photodisintegration (Duke TUNL)* [Full Approval]
Cospokespersons: D. Keller (Contact), P. Seo, B. Norum
- E1039 *SeaQuest with a Transversely Polarized Target (Fermilab SeaQuest)* [Full Approval]
Cospokespersons: A. Klein, D. Keller (Contact)
- E12-13-011 *The Deuteron Tensor Structure Function b_1 (JLab Hall C)* [C1 Approval]
Cospokespersons: J.P. Chen, N. Kalantarians, D. Keller, E. Long, K. Slifer, P. Solvignon
- E12-14-006 *Initial State Helicity Correlations in WACS (JLab Hall C)* [Full Approval (withdrawn)]
Cospokespersons: D. Day, D. Keller (Contact), J. Zhang
- E12-15-005 *Tensor Asymmetry Quasielastic Region (JLab Hall C)* [C1 Approval]
Cospokespersons: D. Day, D. Higinbotham, D. Keller, E. Long, K. Slifer, P. Solvignon
- E12-17-008 *Polarization Observables in Wide-Angle Compton Scattering (JLab Hall C)* [C1 Approval]
Cospokespersons: D. Day, D. Hamilton, D. Keller, G. Niculescu, B. Wojtsekhowski, J. Zhang
- E12-18-005 *Time-like Compton Scattering (JLab Hall C)* [C2 Approval]
Cospokespersons: M. Boer, D. Keller, V. Tadevosyan

Deferred Proposals and Letters of Intent

- Proposal PR12-16-009 *Longitudinal/Transverse Asymmetries in WACS (JLab Hall C)*
Cospokespersons: D. Day, D. Keller (Contact), J. Zhang
- LOI 12-16-005 *Target Helicity Correlations in GlueX (JLab Hall D)*
Cospokespersons: D. Keller (Contact), W.K. Brooks

Presentations

- “Polarized Drell-Yan Experiment”, Invited Talk Sea-Quest Collaboration Meeting, Fermilab, Nov 14, 2018 Batavia, IL
- “Sea-Quest Polarized Target Status”, Invited Talk Sea-Quest Collaboration Meeting, Fermilab, June 14, 2018 Batavia, IL
- “Rotating Target Technology”, Invited Talk Compact Photon Source Meeting, Jefferson Lab, Jan 22, 2018 Newport New, VA
- “Super Cooled Fridge for High Polarization”, Invited Talk Hall B Meeting, Jefferson Lab, Jan 27, 2018 Newport New, VA
- “Polarized Target System For Drell-Yan”, Invited Talk Sea-Quest Meeting, Nov 20, 2017 Sante Fe, NM
- “Microwave Irradiation Simulations and SC-coils”, Invited Talk Hall B Meeting, Jefferson Lab, Jun 6, 2017 Newport New, VA
- “Polarized Target Status for E1039”, Invited Talk Sea-Quest Meeting, April 16, 2017 Fermilab, IL
- “Polarized WACS with High Intensity Photon Source”, Invited Talk at the University of New Hampshire Nuclear Seminar, Feb 21, 2017 Durham, NH
- “Solid-state Polarized Targets for Nuclear Physics”, Invited Talk at the University of New Hampshire Physics Colloquium, Feb 20, 2017 Durham, NH
- “UVA approved and proposed experiments in WACS”, Invited Talk at HIPS Workshop on Probing Transverse Nucleon Structure at High Momentum Transfer, Feb 6, 2017, Trento Italy
- “Tensor polarization optimization and measurement for solid spin 1 targets”, Invited Talk at the 22nd International Spin Symposium, Sept 25, 2016 Urbana-champaign IL
- “Upcoming Solid Polarized Target Experiments at JLAB and TUNL”, Invited Talk at 83rd annual meeting of Southeastern Section of the APS (SESAPS), Nov 11, 2016 Charlottesville Va
- “E1039 Target for Polarized Drell-Yan”, Invited Talk at E906/E1039 Collaboration meeting, June 15, 2016, Fermilab, Batavia, IL
- “Wide-Angle Compton Scattering and Polarized Observables”, Invited Talk at ECT* Workshop 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”, Contributed 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”, Contributed 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 $\Sigma^{*+}(1385)$ ”, Contributed 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 $\Sigma^{*0} \rightarrow \Lambda\gamma$ ”, Contributed 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, “The Polarized Drell-Yan Target System for Fermilabs Intensity Frontier”, 23rd International Spin Symposium, in press (2018)
- D. Day, D. Keller, D. Perera, J. Zhang, “A Pure Photon Beam for Use with Solid Polarized Targets”, Workshop on High-Intensity Photon Sources (HIPS2017), Apr 3, 2017, C17-02-06.2, p. 3-7
- D. Keller, “The UVa approved and proposed experiments”, Workshop on High-Intensity Photon Sources (HIPS2017), Apr 3, 2017, C17-02-06.2, p. 34-39
- D. Keller, “Tensor polarization optimization and measurement for solid spin-1 targets”, 22nd International Spin Symposium, in press (2016)
- D. Keller, “Optimization in Tensor Polarization Targets”, Proceedings of Science, International Workshop on Polarized Sources, Targets and Polarimetry, PoS PSTP2015(2016)014
- 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, “Investigation into polarization uncertainty minimization of solid polarized targets”, 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

- M. Worcester, D. Keller, *Microwave Studies for Dynamic Nuclear Polarization with COMSOL Multiphysics* CLAS-Note 2018-031.
- J. Pond, M. Worcester, D. Keller, *Introduction to Microwave Simulations with COMSOL Multiphysics* CLAS-Note 2017-010.
- 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 *New Measurements of Enhanced Tensor Polarized Targets for Nuclear Experiments*, NIM A, (In press) (2018).
- D. Keller and J. Higgins *A Compact Frozen Spin Refrigerator Design*, J. of Low Temp. Phys., (In press) (2018).
- S. Chandavar, J. T. Goetz, K. Hicks, D. Keller, *et al*(The CLAS Collaboration). *Double K_0^s Photoproduction off the Proton at CLAS*, Phys. Rev. C **97**, 025203 (2018)
- D. Keller *Modeling alignment enhancement for solid polarized targets*, Eur. Phys. J. **A53** 7, 155 (2017).
- D. Keller *et al*(The CLAS Collaboration). *Radiative decays of the (1520) excited-state hyperon*, Phys. Rev. D (Under Internal Review) (2018).
- 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

Selected from 150 Collaboration Publications

- N. Hirlinger Saylor *et al*(The CLAS Collaboration). *Measurement of Unpolarized and Polarized Cross Sections for Deeply Virtual Compton Scattering on the Proton at Jefferson Laboratory with CLAS* CLAS Collaboration Phys. Rev. C **98** no.4, 045203, (2018).

- M. Hattawy *et al*(The CLAS Collaboration). *First Exclusive Measurement of Deeply Virtual Compton Scattering off ^4He : Toward the 3D Tomography of Nuclei* Phys. Rev. Lett **119** 7, 202004, (2017).
- P. Collins *et al*(The CLAS Collaboration). *Photon beam asymmetry Σ in the reaction $\bar{\gamma}p \rightarrow p\omega$ for $E_\gamma = 1.152$ to 1.876 GeV* Phys. Rev. Lett **B773** 112-120, (2017).
- R. Dickson *et al*(The CLAS Collaboration). *Photoproduction of the $f_1(1285)$ Meson* Phys. Rev. C **93** 6, 065202, (2016).
- 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 $ep \rightarrow e n \pi^+$* 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 $1.7 \leq Q^2 \leq 4.5 - (GeV)^2$* . Phys. Rev. C **78**, 025210 (2008).

References

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