

Timothy Paul Smith

Adjunct Associate Professor

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Current Position: 2013 - present *Dartmouth College* - Adjunct Associate Professor

Writing and Teaching. Recently I have published a book for the general public on the sizes of things in nature.

Current Position: 2014 - present *Consultant - Mevion Corporation* - Cancer Treatment Research

Developing GEANT simulation of a proton cyclotron. This 230 MeV accelerator is being build for cancer treatment. I have modeled accelerator designs, secondary radiation, monitoring algorithms and patient treatment.

Past Position: 2002 - 2013 *Dartmouth College* - Research Assistant Professor

Active member of BLAST collaboration. Mentoring student, analyzing BLAST data. Developed prototype software for data acquisition system for JLab / GlueX experiment.

Past Position: 1998 - 2002 *MIT - Bates Laboratory* - Research Scientist.

I was head of computers and software development for the BLAST project. This included leading a group of physicists in writing simulations, display, control, calibration, on-line analysis and off-line reconstruction software, as well as developing the experimental database.

Research Interest

I have recently become involved in the design of a proton accelerator for cancer treatment. I bring to this field twenty-five years of experience modeling nuclear physics experiments. My primary focus has been on the shape of a proton beam as it passes through the accelerator, as well as through the healthy and cancerous sections of the patient. I have also been able to contribute by calculating secondary radiation doses, as well as algorithms for analyzing data from beam monitors in real time.

It has been an good experience using my skill helping to treat people with life threatening cancer.

Teaching Interest

I have developed a new course, originally entitled, "Physics, Technology and the 21st Century", which is aimed towards non-majors. It is designed to de-mystify modern physics discussing quantum mechanics, relativity and radiation as they effect new technologies and look at their social impacts. This course was offered on an experimental basis in 2008 and 2009 and due to that successful trial it has been moved to the permanent catalogue as "Physics For Future Leaders" (P5) and was offered in 2012, 2014 and 2016.

Recently I have also taught WRIT42, "The Art of Science Writing" (WRIT42 - 2014) as well as "Energy and the Environment" (ENVS 12 - 2011 & 2012). There is overlap between this and the physics-society class described above, as well as my own interest in the environment and writing.

In addition, I have taught a number of course since arriving at Dartmouth, including Introductory Physics (P3 & P4) for non-majors and for honors students (P14), Intro Quantum Mechanics (p24 & p42), Statistical Mechanics (P43), Particle and Nuclear Physics (P72), and graduate Quantum Mechanics II (P103).

Writing Interest

I think physicist should do more to bring their field before the public eye. It is important to share our curiosity and our new insights. Towards this end I have published magazine articles ("The Anatomy of a Neutron", (republished in four languages) and "Worlds Within Worlds") and a book ("Hidden Worlds"). In addition I have a a new book with Oxford University Press. It is entitled, "How Big is Big: The Sizes of Everything and Why" (2013).

Education

B. A.	Physics	State University of New York - College at Geneseo	1982
M. S.	Physics	University of Lowell	1987
Ph. D.	Physics	University of Massachusetts at Lowell	1990

Dissertation: Weak Decays of Charmed and B Mesons

Publications

Medical Physics - Conference Contribution

“Optimization of Lateral Penumbra in Pencil Beam Scanning Treatments”, J. Cooley, T. Smith, D. Catanzano, S. Hansen, T. Zwart, *Particle Therapy Co-Operative Group - Conference* 55 (2016).

Book and Magazine Articles

“How Big is Big: The Sizes of Everything and Why”, Timothy Paul Smith, *Oxford University Press*, 2013.

“Fish, Tides, and Turbines”, Timothy Paul Smith, *Natural History Magazine*, Dec 2013 - Jan 2014.

“Anatomia del neutrone”, Timothy Paul Smith, *Le Scienze*, February 2012.

“L’ anatomie du Neutron - Comment suivre le manège des quarks”, Timothy Paul Smith, *Pour la Science*, June 2011.

“Return To The High Peaks”, Timothy Paul Smith, *Adirondac*, July/August 2011.

“Living With Wind; Gathering impressions of the newest power technology”, William Smith, Timothy Paul Smith, *Appalachia* Summer/Fall 2011.

“Reise ins Innere des Neutron” (Travel to the Interior of the Neutron), Timothy Paul Smith, *Spektrum der Wissenschaft*, March 2011.

“The Anatomy of a Neutron”, Timothy Paul Smith, *American Science (Sigma Xi)*, **98** Nov-Dec 2010, 478-485.

“Hidden World: Hunting for Quarks in Ordinary Matter”, Timothy Paul Smith, *Princeton University Press*, January 2003.

“Worlds Within Worlds: Delicately Disassembling the Nuclear Universe”, Timothy Paul Smith, *The Sciences (The New York Academy of Science)* July/August 1996 p. 28.

Academic Articles:

“The Role of Mesons in the Electromagnetic Form Factors of the Nucleon,” C. Crawford *et al.*, *Phys. Rev.* **C82**, 045211 (2010).

“The BLAST experiment,” The BLAST Collaboration (D. Hasell *et al.*), *Nucl. Instrum. Meth.* A **603**, 247 (2009).

“Magnetic Field Measurements Of The Blast Spectrometer,” The BLAST Collaboration (K. A. Dow *et al.*), *Nucl. Instrum. Meth.* A **599**, 146 (2009).

“The Charge Form Factor of the Neutron at Low Momentum Transfer from the ${}^2\text{H}(\vec{e}, e'n)p$ Reaction,” The BLAST Collaboration (E. Geis *et al.*), *Phys. Rev. Lett.* **101**, 042501 (2008).

“Measurement of the proton electric to magnetic form factor ratio from ${}^1\vec{H}(\vec{e}, e'p)$,” The BLAST Collaboration (C. B. Crawford *et al.*), *Phys. Rev. Lett.* **98**, 052301 (2007).

“Proton elastic form factor ratios to $Q^2 = 3.5\text{-GeV}^2$ by polarization transfer,” The Jefferson Lab Hall A Collaboration (V. Punjabi *et al.*), *Phys. Rev. C* **71**, 055202 (2005) [Erratum-ibid. *C* **71**, 069902 (2005)]

“Exclusive photoproduction of the Cascade (Ξ) hyperons,” The CLAS Collaboration (J. W. Price *et al.*), *Phys. Rev. C* **71**, 058201 (2005)

“Measurement of the Generalized Polarizabilities of the Proton in Virtual Compton Scattering at $Q^2 = 0.92$ and 1.76 GeV^2 ”, G. Laveissiere, JLab Hall A Collab., *Phys. Rev. Lett.* **93**, 122001 (2004).

“Basic Instrumentation for Hall A at Jefferson Lab”, JLab Hall A Collab., *Nucl. Instrum. Meth. A* **522**, 294-346 (2004).

“Dynamics of the quasielastic ${}^{16}\text{O}(e, e'p)$ reaction at $Q^2 \sim 0.8(\text{GeV}/c)^2$ ”, The Jefferson Lab Hall A Collaboration (K. G. Fissum, *et al.*), *Phys. Rev. C* **70**, 034606 (2004).

“Backward electroproduction of π^0 mesons on protons in the region of nucleon resonances at four momentum transfer squared $Q^2 = 1.0\text{GeV}^2$ ”, The Jefferson Lab Hall A Collaboration (G. Laveissiere, *et al.*), *Phys. Rev. C* **69**, 045203 (2004).

“Tensor polarization of the ϕ meson photoproduced at high t ”, The CLAS Collaboration (K. McCormick, *et al.*), *Phys. Rev. C* **69**, 032203 (2004).

“Observation of an Exotic Baryon with $S = +1$ in Photoproduction from the Proton”, The CLAS Collaboration (V. Kubarovsky *et al.*), *Phys. Rev. Lett.* **92**, 032001 (2004).

“ $ep \rightarrow ep\pi^0$ reaction studied in the $\Delta(1232)$ mass region using polarization asymmetries”, The CLAS Collaboration (A. Biselli, *et al.*), *Phys. Rev. C* **68**, 035202 (2003).

“Measurement of the Proton Spin Structure Function $g_1(x, Q^2)$ for Q^2 from 0.15 to 1.6 GeV^2 with CLAS”, The CLAS Collaboration (R. Fatemi *et al.*), *Phys. Rev. Lett.* **91**, 222002 (2003).

“Photoproduction of the ω Meson on the Proton at Large Momentum Transfer”, The CLAS Collaboration (M. Battaglieri *et al.*), *Phys. Rev. Lett.* **90**, 022002 (2003).

“Measurement of Inclusive Spin Structure Functions of the Deuteron”, The CLAS Collaboration (J. Yun *et al.*), *Phys. Rev. C* **67**, 055204 (2003).

“The CEBAF large acceptance spectrometer (CLAS)”, The CLAS Collaboration (B. A. Mecking, *et al.*), *Nucl. Instrum. Meth. A* **503**, 513 (2003).

“ η Photoproduction on the Proton for photon energies from 0.75-GeV to 1.95-GeV”, The CLAS Collaboration (M. Dugger *et al.*), *Phys.Rev.Lett.* **89**, 222002 (2002)

“ Q^2 Dependence of Quadrupole Strength in the $\gamma^* p \rightarrow \Delta^+(1232) \rightarrow p\pi^0$ Transition”, The CLAS Collaboration (K. Joo, *et al.*), *Phys. Rev. Lett.* **88**, 122001 (2002).

“First Measurement of the Double Spin Asymmetry in $\vec{e}\vec{p} \rightarrow e' \pi^+n$ Resonance Region”, The CLAS Collaboration (R. De Vita *et al.*), *Phys.Rev.Lett.* **88**, 082001 (2002)

“Spin-Flipping Polarized Electrons”, V. S. Morozov *et al.*, *Phys. Rev. ST Accel. Beams* **4**, 104002 (2001).

“The CLAS Start Counter”, S. Taylor, S. Ahmad, J. Distelbrink, G. S. Mutchler, E. Smith and T. Smith, *Nucl. Instrum. Meth. A* **462**, 484 (2001).

“Photoproduction of the ρ^0 Meson on the Proton at Large Momentum Transfer”, The CLAS Collaboration (M. Battaglieri, *et al.*), *Phys. Rev. Lett.* **87**, 172002 (2001).

“Electroproduction of the $\Lambda(1520)$ hyperon”, The CLAS Collaboration (S.P. Barrow, *et al.*). *Phys. Rev. C* **64**, 044601 (2001).

“The $ep \rightarrow e'p\eta$ Reaction at and Above the $S_{11}(1535)$ Baryon Resonance”, The CLAS Collaboration (R. Thompson, *et al.*), *Phys. Rev. Lett.* **86** 1702 (2001).

“Dynamics of the $O^{16}(e, e'p)$ Cross-Section at High Missing Energies.” The Jefferson Lab Hall A Collaboration (N. Liyanage *et al.*). *Phys. Rev. Lett.***86**, 5670 (2001).

“Dynamical Relativistic Effects in Quasielastic 1p-Shell Proton Knockout from ^{16}O ”, The Jefferson Lab Hall A Collaboration (J. Gao, *et al.*), *Phys. Rev. Lett.* **84** (2000) 3265-9.

“Polarization transfer in the $O^{16}(\vec{e}, e'\vec{p})^{15}N$ reaction.”, The Jefferson Lab Hall A Collaboration (S. Malov, *et al.*), *Phys. Rev. C* **62** (2000) 057302.

“ G_{E_P}/G_{M_P} Ratio by Polarized Transfer in Polarized $e p \rightarrow e \vec{p}$ ”, The Jefferson Lab Hall A Collaboration (M.K. Jones *et al.*), *Phys. Rev. Lett.***84** (2000) 1398-1402.

“The Time-of-Flight System for CLAS.” The CLAS TOF Collaboration, *NIM A* **432** (1999) 265-298.

“Measurements of the Deuteron Elastic Structure Function $A(Q^2)$ for $0.7 \leq Q^2 \leq 6.0(GeV/c)^2$ at Jefferson Laboratory”, The Jefferson Lab Hall A Collaboration (L.C. Alexa *et al.*). *Phys. Rev. Lett.* **82** (1999) 1374-1378.

“An Intermediate-Energy Experimental Test of Bell’s Inequality with Recoil Polarimeters”, Timothy Paul Smith, *Found. Phys. Lett.* (Oct. 1997).

“The $^{12}C(e, e'p)$ and $^{12}C(e, e'pp)$ reactions in the Δ -resonance region”, A. Zondervan, *et al.*, *Nuc. Phys.* **A 587** (1995) 697-720.

“Analysis of sparsely distributed data: an application of the extended maximum-likelihood method”, Timothy Paul Smith, F. W. Hersman and Albert Zondervan, *Nucl. Instr. and Meth.* **A 334** (1993) 537-542.

Invited Talks:

“Hidden Worlds: Hunting for Quarks in Ordinary Matter”, *Clark University, Department of Physics Colloquium*, February 26, 2004.

“Hidden Worlds: Hunting for Quarks in Ordinary Matter”, *University of Massachusetts - Lowell, Department of Physics Colloquium*, October 16, 2003.

“Hidden Worlds”, Public Lecture Series, *Jefferson Lab, Newport News, VA*, February 26, 2003.

“Hidden Worlds: Quarks Inside of Protons and Neutrons”, *University of New Hampshire, Department of Physics Colloquium*, November 11, 2000.

“Open Source Software in a Scientific Research Environment”, *American Medical Informatics Association, Los Angeles*, November 2000.

“Object Oriented Programming for Spectrometers such as BLAST”, *Jefferson Lab User Workshop, Newport News VA*, June 25, 1999.

Published Conference Proceedings:

“An Online Reconstruction CPU Farm for the BLAST Experiment at MIT-Bates Lab” Timothy Paul Smith and Ben Yoder, Feb 2000. Published in CHEP200, *Padua 2000, Computing in High Energy and Nuclear Physics*, pp. 246-249.

“Two new track finding algorithms for Large Acceptance Spectrometers”, Timothy Paul Smith, F. W. Hersman and Maurik Holtrop, Sept. 1998. Published in CHEP '98, *Chicago 1998, Computing in High Energy and Nuclear Physics*.

“Nonleptonic Decays of Charmed-Mesons in the Spectator Model as constrained by Momentum-Space Wavefunctions”, T.P. Smith, K.J. Sebastian . Published in “Montreal 1989, Weak and Electromagnetic Interactions in Nuclei”, 669-671. The International Symposium on Weak and Electromagnetic Interactions in Nuclei (WEIN-89), Montreal, Quebec, Canada, 15-19 May 1989.

Contributed Papers and Articles:

“Status of BLAST Root Based Software”, Timothy Paul Smith and Ben Yoder, *Second Root Users Workshop, CERN, Geneva, Switzerland*, February 3-5, 2000.

“Root and the BLAST project at MIT/Bates Lab.: An Application in Nuclear Physics”, *US HENP Root Users Workshop, FermiLab*, March 23-25, 1999.

Software Libraries and Internal Reports:

“blastmc - The BLAST GEANT / Monte Carlo Simulation”, Timothy Paul Smith, et al.
<http://blast.lns.mit.edu/software/GEANT>

“BlastLib - The BLAST Raw Data and Reconstruction Library”, Timothy Paul Smith, et al.
<http://blast.lns.mit.edu/software/BlastSoftware>

“A ‘Coupled-Paddle’ Design for the Start Counter of CLAS”, Timothy Paul Smith, Jan Distelbrink, George Briggs, *CLAS-NOTE 95-003*,
ftp://ftp.cebaf.gov/pub/clas/notes/clas_notes95/note95-003.ps.gz

“The Trigger Manager for Hall A”, Timothy Paul Smith, *Hall A notes*,
<ftp://ftp.cebaf.gov/pub/halla/doc/TrigMang.ps>

Other Publications:

“A Seasonal Variation in Soluble Uric Acid Concentration in *Littoriana saxatilis* (olivi)”, Delmont C. Smith and Timothy Paul Smith, *Hydrobiologia*. **378** 187-191, (1998).

Funded Grants:

“Software Support for BLAST”, from MIT-Bates Lab, 2002-2004.

“Intermediate Energy Physics at Dartmouth”, NSF-REU, 2004-5.

“PCI-based Data Acquisition and Control Support for the JLab CODA Toolkit”, from Jefferson Lab, 2003-4.

“Support for the JLab Data Acquisition (CODA): PCI-CAMAC, PCI-VME and Linux in the Front End”, from Jefferson Lab, 2004-5.

“The Analysis of BLAST Data”, from UNH, 2004-5.

Experimental Collaborations:

CLAS - Jefferson Lab, Newport News, VA.

Hall A - Jefferson Lab, Newport News, VA.

BLAST - MIT-Bates Lab., Middleton, MA.

GlueX - Jefferson Lab, Newport News, VA.