

Curriculum Vitae

Benjamin P. Luce, Ph. D.

Associate Professor of Physics, Lyndon State College
P.O. Box 919, 1001 College Drive, Lyndonville, VT 05851
Contact: (802) 279-7838 (cell), ben.luce@lyndonstate.edu

Summary

- Physicist with extensive experience in modeling and simulation of complex physical systems, and with renewable energy technology, education, and policy. Currently focusing on renewable energy resources and technologies, agricultural energy issues, and various topics in physics, including aspects of Relativity Theory.

Current Positions

- Professor of Physics, Lyndon State College,
2008-present (currently Associate Professor). Chair of the Sustainability Studies Program.
- Chapter Chair, Faculty Federation, Lyndon State College.
- Chair, Reappointment, Promotion, and Tenure Committee, Lyndon State College.
- Member, American Association of Physics Teachers.
- Instructor, Vermont Science Institute.

Formal Education

- Ph.D. Physics, Clarkson University, New York, 1993.
- M.S. Physics, Clarkson University, New York, 1991.
- B.S. Physics/B.S. Sound Recording Technology, State University of New York at Fredonia, 1989. (1989 SUNY Fredonia Phi Beta Kappa Award Recipient)
- Courses in Electricity, Physics, Psychology, Mathematics, Erie Community College, 1982-1983.
- Coursework in C++ & Geology, University of New Mexico Los Alamos, 2000.

Previous Positions

- Energy Scientist/Webmaster, Vermont Energy Education Program, 2008-2010.
- Energy Committee, Northeast Vermont Development Association, 2011-2012.
- Board Member, Northwoods Stewardship Center, 2008-2010.
- New Mexico Solar Energy Association; President, 1999-2004; Vice President, 2004-2007.
Recipient: NMSEA Outstanding Contributions Award, 2001.
- New Mexico Coalition for Clean Affordable Energy; Founding Member, 1997-2000;
Co-Chair/Chair/Director, 2000-2007.
Recipient: Climate Change Leadership Institute “Climate Courage Award”, 2007.
- Appointments by Governor Bill Richardson:
 - Chair; Distributed Solar Task Force, 2004.
 - Western Governors Association Solar Task Force, 2005.
 - Western Governors Association Advanced Coal Task Force, 2005.
 - Electricity Transmission Task Force, 2004.
 - Concentrating Solar Task Force, 2004.
 - Climate Change Advisory Group, 2006.
- Commissions, Boards, Working Groups:
 - NM Sustainable Energy Collaborative (convened by NM Energy Dept.), 2001-2002.
 - New Mexico Project Power Working Group (appointed by City of Santa Fe), 2001.
 - Rebuild New Mexico (hosted by City of Albuquerque), 2004.
 - Sustainable Santa Fe Commission, 2007.
 - Santa Fe Green Code Working Group, 2007.
- Los Alamos National Laboratory:
 - Staff Member, 1996-2007.
 - Renewable Energy Program Manager, 2002-2004.
 - Postdoctoral Fellow, 1993-1996.
 - LANL Outstanding Performance Award, 1996
- Undergraduate Research in Nonlinear Systems, Univ. of Tenn./Oakridge National Laboratory, 1989.
- Undergraduate Research, High Energy Physics Group, SUNY at Stony Brook, summer 1988.

References available on request.

Teaching Experience

- **Lyndon State College: Full-time Physics Professor at Lyndon, 2008-Present.** I've taught Physics I-III (Classical Mechanics, Thermodynamics, Fluid Dynamics, and Electricity & Magnetism), Modern Physics (Special Relativity, Nonrelativistic Quantum Theory), Electricity & Electronics, History of Science, Energy & Environment, and Physics for the Environment. I oversee many student research projects, advise students in the Sustainability Studies Major, and oversee the continuing development of this program. For my teaching work I've also developed specialized software for student visualization of physics problems (PhyVi) and for production of high quality homework assignments and exam material (PhyKAT).
- **Vermont Science Initiative:** I've taught two courses for VSI now: One course on History of Science in 2011, and a course on energy for VSI's 2014 Science and Engineering Academy.
- **Teaching Assistant, Clarkson University, 1989-1991.** I taught one "recitation" session per week in undergraduate physics, one hour apiece to four classes of about 30 each. I maintained office hours, provided one-on-one tutoring, and graded tests.
- **Tutoring (paid) at the "Learning Center" of the State University of New York at Fredonia, 1985-1988.** I tutored other students in mathematics and physics on both a scheduled and a walk-in basis.
- **Presentations on renewable energy to roughly 10,000 New Mexico Students with the SunChaser Program of the New Mexico Solar Energy Association, 1998-2006.** I visited schools all over the state, often at my own expense, often returning several years in a row to the same schools. Each visit would typically consist of 3-6 sessions, one hour apiece. I would bring many demonstration devices, many of which I constructed, to provide hands-on interactions with solar electric devices, solar cooking, passive solar design, hydrogen fuel cells, etc. In the course of this I developed a question-based approach that became the standard practice of the Association: I called this the "Energy Pathways" approach, wherein students were led by questions to trace the path of energy from its ultimate sources in the Sun or underground through to end uses and radiation into space, with discussion of environmental impacts, costs, and other factors along the way.
- **Developed teacher resource materials for the New Mexico Solar Energy Association, published by the State of New Mexico, 2007.** Besides the "Energy Pathways" approach (previous bullet), I created a comprehensive resource manual for teachers that covered all aspects of renewable energy and some aspects of conventional energy sources. An edited version of this was published by the State of New Mexico as part of their "Schools with Sol" program.
- **Presentations on renewable energy to adults in New Mexico (1998-2007) and New England (2008-2013).** I've made hundreds of presentations on renewable energy to a diverse set of audiences, ranging from professional associations to governmental officials to citizen groups. My presentations utilize extensive graphical components (overhead projectors and later PowerPoint).

- **Presentations on Buddhism at Los Alamos High School, 2006 & 2007:** I presented the history and basic ideas underlying Buddhism.

Research Experience

In recent years I've conducted extensive research on renewable energy, investigated many aspects of existing and emerging technologies, with particular focus on resource potentials and the performance of various technologies specifically in the Northeast. I am presently focused on the computer modeling of innovative approaches to heating greenhouses and other aspects of greenhouse energy management.

In my earlier work, I pioneered the application of dynamical systems theory to a variety of complex physical phenomenon described by nonlinear partial differential equations, including fiber optical pulse propagation, fluid convection, microwave heating, bioremediation, and ocean current circulation. I also conducted research in carbon sequestration, fuel synthesis, renewable energy technology, and energy program development.

Publications

- Scaling of Turbulent Spike Amplitudes in the Complex Ginzburg-Landau Equation, B. P. Luce and C.R. Doering, Physics Letters A, Volume 178, pp. 92-98 (1993).
- Homoclinic Explosions in the Complex Ginzburg-Landau Equation, B. P. Luce, Physica D, 84 553-581 (1995).
- Recovery of Solitons with Nonlinear Amplifying Loop Mirrors, Gabitov, D. D. Holm, B. P. Luce, and A. Mattheus, Optics Lett. 20, No. 24, 2490-2492 (1995).
- Nonlinear Amplification of Solitons in High Dispersion Fiber Transmission Systems, I. Gabitov, D. D. Holm, B. P. Luce, and A. Mattheus, in "Nonlinear Evolution Equations and Dynamical Systems-NEEDS '94", 259-265, published by World Scientific (1995).
- Melnikov Methods for PDEs: Applications to Perturbed Nonlinear Schroedinger Equations, G. Cruz-Pacheco, D. Levermore, and B. P. Luce, CNLS Newsletter, No. 114 (1995).
- Power-Packed Dynamical Systems Software, Book Review, B. P. Luce, Complexity 1, Springer-Verlag, 47 (1995).
- Low-noise Picosecond Soliton Transmission Using Concatenated Nonlinear Amplifying Loop Mirrors, I. Gabitov, D. D. Holm, and B. P. Luce, JOSA B 14, No. 7, 1850-1855 (1997).
- On the Relationship of Periodic Wavetrains and Solitary Waves of Complex Ginzburg-Landau Type Equations, G. Cruz-Pacheco, and B. P. Luce, Physics Letters A 236, 391-402 (1997).
- Power Enhancement with Super-Gaussian Sliding-Frequency Guiding Filters, B. P. Luce, Optics Lett. 23, No. 10, 765-767 (1998).
- Nonlinear waves and solitons in physical systems, R. Camassa, J. M. Hyman, B. P. Luce, Physica D 123, 1-20 (1998).

- Observation of chirped soliton dynamics at 1.55 microns in a single-mode optical fiber with frequency-resolved optical gating, F. G. Omenetto, B. P. Luce, D. Yarotsky and A. J. Taylor, Optics Lett. 24, No. 20, 1392-1394 (1999).
- Genetic algorithm pulse shaping for optimum femtosecond propagation in optical fibers, F. G. Omenetto, B. P. Luce, A. J. Taylor, JOSA B 16, No. 11, 2005-2009 (1999).
- Ultrafast Soliton Dynamics, F. G. Omenetto, B. P. Luce, D. Yarotsky and A. J. Taylor, Special December 1999 issue of Optics and Photonics News, OSA, (1999), invited contribution.
- Femtosecond Soliton Dynamics, F.G. Omenetto, B.P. Luce, and A.J. Taylor, IEEE-LEOS Newsletter {\\bf 13}(6), (1999), invited contribution.
- Femtosecond pulse delivery through single-mode optical fiber with adaptive shaping, F. G. Omenetto, A. J. Taylor, B. P. Luce, M. D. Moores, and D. H. Reitze, , CLEO 2001 Technical Digest (OSA, Washington, 2001), paper CTuU2.
- Shaping, propagation and characterization of ultrafast pulses in optical fibers, F. G. Omenetto, J. W. Nicholson, B. P. Luce, D. Yarotski, and A. J. Taylor.. Applied Physics B, 70(Supplement):S143-S148, 2000.
- Global Bifurcation of Shilnikov Type in a Double-Gyre Ocean Model, B. T. Nadiga and B. P. Luce, Journal of Physical Oceanography, v. 31, pp 2669-2690, 2001.
- Modeling Thermal Front Dynamics in Microwave Heating, G. Mercado, B. P. Luce, J. Xin, IMA J. Appl. Math. 67. 419–439, 2002.
- Oscillatory Dynamics of the Biologically Active Zone in in Situ Bioremediation, B. P. Luce and R. E. Murray, Water Resources Research, v. 38, no. 10, 2002.
- Renewable Energy Incentives in New Mexico and Bordering States, B. P. Luce, Proceedings of the 2002 Decision Makers Tour, Sponsored by the New Mexico Bureau of Geology and Mineral Resources, 2002.
- Guidelines for Building Passive Solar Homes in Northern New Mexico, Available from the New Mexico Solar Energy Association (1-888-88NMSOL) or from the NMSEA website (www.nmsea.org), 2000.
- NMSEA Solar Energy Curriculum, B. P. Luce, Available from the New Mexico Solar Energy Association (1-888-88NMSOL), 2000/2007.
- Twenty-four “Flair from the Chair” articles, for the NMSEA SunPaper, December 1999 – December 2004 issues.
- “Modeling and Analysis of the Chaco Canyon Sun Dagger Site”, B. P. Luce, Archaeoastronomy . 2010, Vol. 23, p115-137. 17p.
- Five “how-to” guides for consumers on small-scale renewable energy systems, created for the State of Vermont through the Northeastern Vermont Development Association, available at <http://www.nvda.net/publications-maps.php>.
- Farm Renewable Energy Research Reports, covering assessments for photovoltaic, solar hot water, biodiesel, and micro-hydro development, produced for the Vermont Agency of Agriculture in collaboration with Lyndon State Students, 2010-2011, Available upon request.

- "Strategic Analysis of Farm-based Renewable Energy Opportunities in Vermont", B. P. Luce, Prepared for the Vermont Agency of Agriculture under VTREAP/AIC Grant number 02200-12001, 2012. Available upon request.

Scientific Presentations

- "Dynamics of the Periodic Complex Ginzburg-Landau Equation," Arizona Days Conference at the CNLS, LANL, February 5, 1994.
- "On the Derivation of an Amplitude Equation for Optical Pulses in an Actively Doped Optical Fiber," CNLS, LANL, February 25, 1994.
- "Nonlinear Schroedinger Equation Under Perturbation Towards the Complex Ginzburg-Landau Equation," Department of Mathematics, University of Arizona at Tuscon, March 3, 1994.
- "Nonlinear Schroedinger Equation Under Perturbation Towards the Complex Ginzburg-Landau Equation," Rensselaer Polytechnic Institute (RPI), April 6, 1994.
- "Homoclinic Structure of Chaotic Dynamics in the Complex Ginzburg-Landau Equation," Department of Mathematics, Boston University, April 15, 1994.
- "Homoclinic Structure of Chaotic Dynamics in the Complex Ginzburg-Landau Equation," SIAM Conference, San Diego, July 26, 1994.
- "Homoclinic Structure of the Complex Ginzburg-Landau Equation," Einstein Chair Seminar Series, City College of New York (CUNY), September 19, 1994.
- "Nonlinear amplification of Solitons in Highly Dispersive Fiber Transmission Systems," Dept. of Mathematics, University of New Mexico, Albuquerque, NM, February 7, 1995.
- "Homoclinic Bifurcations in the Ginzburg-Landau Equation," Colorado Days Meeting, Boulder, CO, March 28, 1995.
- "Nonlinear amplification of Solitons in Highly Dispersive Fiber Transmission Systems," SIAM Dynamical Systems Meeting, Snowbird, UT, May 24, 1995.
- "Stable soliton transmission using loop mirrors", Poster session at the fall 1995 AFOSR meeting at the University of Arizona at Tuscon.
- "Chaos Theory and Large Programming Projects", Thoughtworks Inc. (a Chicago based software firm), April 8, 1996.
- "The Persistence of Autosolitons in Optical Fiber Amplifiers", University of Notre Dame Symposium on Current and Future Directions in Applied Mathematics, April 18-21, 1996.
- "The Persistence of Autosolitons in Optical Fiber Amplifiers", at the weekly seminar of the Applied Mathematics Department at Northwestern University, hosted by William Kath, on April 23rd, 1996.
- "The Persistence of NLS Traveling Waves under Perturbations Describing Optical Amplification", CNLS, LANL, June 3, 1996.

- "A Power Spectral Test for the Breakdown of Deterministic Dynamics in the Presence of Low-frequency Noise", Poster given at Colorado Days Meeting, Boulder, CO, April 30 - May 2, 1998.
- "Nonlinear Fiber Optical Pulse Propagation", Universidad de Zacatecas, Mexico, August, 1999.
- "Homoclinic Chaos in a Double-Gyre Ocean Model", Arizona/Los Alamos Days Conference, University of Arizona, Tucson AZ, February 2, 2001.
- "Artificial Photosynthesis? Synthesizing Carbon-based Fuels with Carbon-free Energy Sources and Atmospherically Derived Carbon Dioxide as a Possible Alternative to a Pure Hydrogen Economy", CNLS, August 21, 2001
- "What is Time?", Lyndon State College, December 1st, 2008.
- "A Quantitative Look at Prospects for Renewable Energy Generation in the Northeast", University of Vermont, February 20th, 2013.
- "Comparing Renewable Energy Options for Vermont and the Northeast: The real potentials of, cost trends, and impact issues of different resources," Johnson State College, November 13, 2013.

Scientific Workshops Organized

- "Arizona Days", Center for Nonlinear Studies (CNLS), LANL, February 4-5, 1994.
- "Colorado Days", LANL, May 4-5, 1994.
- Wrote successful proposal leading to the co-sponsorship by the LANL (CNLS) of "The University of Notre Dame Symposium on Current and Future Directions in Applied Mathematics," April 18-21, 1996.

Patents Awarded

- "Nonlinear Pulse Reshaping for Optical Fiber Transmission Systems", U.S. Patent No. 6,157,762, issued December 5, 2000.

Successful Laboratory Directed Research and Development Proposals (LDRD)

- "Fiber Optic Communications Using Solitons (FOCUS)" (Fiscal Year 96).
- "Soliton Optical Communications" (Fiscal Year 97).

Renewable Energy Experience

Summary

Since arriving at Lyndon State College in 2008, I have been directly involved in developing a number of PV system projects in Vermont, acquired a certificate in PV System installation, produced energy guides for consumers for the Northeast Vermont Development Association on multiple renewable energy sources, collaborated with students in assessments for renewable energy projects at area farms, have researched and provided advocacy to New England communities on energy development, and have conducted extensive research on innovative greenhouse heating strategies. I also have given many public presentations on various aspects of renewable energy development in the region.

Prior to relocating to Vermont, I worked to advance renewable energy policy in New Mexico with the New Mexico Coalition for Clean Affordable Energy (CCAEE), an organization I helped found and then direct, and worked to increase public awareness of renewable energy and energy efficiency issues through public education efforts with the New Mexico Solar Energy Association (NMSEA), for which I served as president and vice-president for many years. I also participated actively in proceedings of the New Mexico Public Regulation Commission, negotiated numerous agreements among energy policy stakeholders, and lobbied and/or testified at the New Mexico State Legislature and the United States Congress. I also served on many energy related task forces and working groups. I created NMSEA's renewable energy curriculum and passive solar guidelines, and maintained both NMSEA's and CCAEE's websites. I demonstrated renewable energy technology at over sixty New Mexico schools, organized eight energy fairs, exhibited and gave presentations at hundreds of events statewide, published numerous articles on renewable energy, and worked closely with the media to promote renewable energy. Via these various activities I was involved in planning and overseeing the development of a variety of renewable energy projects, ranging from homeowner scale installations up through utility-scale projects. I also served as the Renewable Energy Program Manager at Los Alamos National Laboratory for two years, which included work on advancing research on photovoltaics, carbon sequestration, fuel synthesis, and biomass energy development.

Renewable Energy Technology Experience:

- Hands-on experience with installation and interconnection of photovoltaic systems in conjunction with local installers in New Mexico (1997-1998, 2005).
- Extensive independent study of wind power, concentrating solar, and photovoltaic technologies, including interactions with National Laboratory scientists, company scientists and technicians, and investors (1996-2007).
- Participated in PV installation workshop at Northwoods Stewardship Center, East Charleston VT, Spring 2008.
- Acquired grant funding for, and oversaw the design and installation of a 5.6 kilowatt PV system at Lyndon State College (2009-2012).
- Provided educational presentations, technical support, and publicity assistance for the installation of the community owned PV system, of which I am presently a co-owner of, at the First Universalist Parish in Derby Line, VT.
- Conducted assessments of ground source (geothermal) heat pumps at home installations and in the lab at Lyndon State College.
- Collaborating presently in a research project involving the use of air source heat pumps in greenhouses, and am presently conducting active modeling research of this system.

Passive Solar Design Experience:

- Developed NMSEA's Passive Solar Design Guidelines, working with architects and national laboratory scientists.
- Experience with operating Energy-10 passive solar design software.
- Experience with assisting New Mexico residents in the design of their solar homes.
- Taught passive solar design course at EcoVersity, Santa Fe, NM.

Energy Policy Advocacy Experience:

- Advocated and provided official testimony for the New Mexico Renewable Energy Standard at the Public Regulation Commission and New Mexico Legislature. This included extensive negotiations with utilities, coops, renewable energy developers, and other stakeholders.
- Performed cost and projected growth analysis of the New Mexico Renewable Energy Standard for Public Regulation cases on setting reasonable cost thresholds for implementation of the Standard. (2004-2005).
- Advocated for the New Mexico Renewable Energy Production Tax Credit (2002, 2004-2006).

- Negotiated green power program design with PNM for their Sky Blue Program (2003).
- Obtained extensive experience and developed a strong positive relationship with the New Mexico media on renewable energy issues.
- Served on Governor Richardson's Concentrating Solar Power Task Force.
- Worked with concentrating solar power companies to explore and promote CSP development in New Mexico.
- Chaired Governor Richardson's Distributed Solar Task Force, and advocated the resulting policies to the Legislature and Public Regulation Commission: Solar Tax Credits, increasing the net-metering threshold.
- Proposed and negotiated PNM's Photovoltaic Incentive Program and I-25 Solar Demonstration Station.
- Served on Governor Richardson's Rural Cooperative Issues Task Force.
- Served on Governor Richardson's Climate Change Advisory Group.
- Served on the Western Governor's Solar Power and Advanced Coal Task Forces.
- Advocacy of other clean energy policies in New Mexico: Solar sales tax exemption, solar-ready roofs, clean energy revenue bonds, green build tax credits, biodiesel tax credits, low-income energy policies, solar rights policies, carbon emission registry, mercury reduction policies, opposed conventional coal plant subsidies, and advanced energy manufacturing tax incentives.
- Testified on several occasions to the energy committees of the Vermont and New Hampshire Legislatures, 2012-2013.
- Contributed extensively to the advocacy efforts of Energize Vermont, a nonprofit advocacy group in Vermont that advocates for renewable energy development that is in keeping with Vermont's natural beauty and fragile environment.

Public Education Experience:

- Organized the Taos "Solar Village" event (1998, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007).
- Organized four tours of solar homes in Los Alamos and Santa Fe, New Mexico.
- Provided extensive hands-on solar and wind energy exhibits at hundreds of events throughout New Mexico (1997-2007).
- Provided hundreds of public presentations on renewable energy development to groups throughout New Mexico (1997-2007).
- Provided hundreds of email alerts to the New Mexico public and news media.
- Created NMSEA's Educational Primer for Teachers, and NMSEA's "Energy Pathways" presentation approach.
- Presentations on renewable energy at over sixty New Mexico schools (1998-2007).

- Authored five “how-to” guides for consumers on small-scale renewable energy systems for the State of Vermont through the Northeastern Vermont Development Association, available at <http://www.nvda.net/publications-maps.php>.
- Gave numerous presentations on energy to communities in Vermont, New Hampshire, and Massachusetts, 2008-2014. Locations in Vermont include the towns/cities of Middlebury, Montpelier, Burlington, Northfield, Grafton, St. Johnsbury, Waitsfield, Waterbury, Rutland, Barton, Lyndon, Newark, Island Pond, United Towns & Gores. Towns in Massachusetts include Lenox and surrounding communities. Towns in New Hampshire include Alexandria and surrounding communities.

Administrative and Grant-writing Experience:

- Ten years experience with administering nonprofit organizations related to renewable energy, including more than five years serving as board chairman.
- Author of successful grant applications to the Energy Foundation, McCune Foundation, and others in New Mexico.
- Helped establish and inform the Renewable Energy Industries Association of NM.
- Extensive experience with maintaining renewable energy orientated websites (1999-2007).
- Authored two successful grant applications to the Vermont Agency of Agriculture for student renewable energy project assessments at local farms in 2010 and 2011.
- Authored a successful grant for the installation of PV System at Lyndon State College from the Department of Energy.
- Authored a proposal for and won a competitive RFP to conduct research and write a “Strategic Analysis of Farm-based Renewable Energy Opportunities in Vermont” for the Vermont Agency of Ag in 2012.
- Co-authored a successful proposal in 2012 to conduct heat pump experiment at the University of New Hampshire Horticultural Research Center.

Electric Transmission & Interconnection Related Experience:

- Participated in Governor Bill Richardson’s Electric Transmission Task Force, and in subsequent efforts to develop/advocate for the RE Transmission Authority.
- Participated in the “Project Power” working group, which addressed upgrades of transmission lines into the Santa Fe/Las Vegas area. Experience included:
 - Transmission system stability and capacity considerations;
 - Evaluation of visual impacts;
 - Calculation and measurement of electromagnetic field impacts: Provided independent calculation and measurement of field impacts to verify PNM claims;
 - Work with community groups concerned with impacts;
 - Evaluation of alternatives.
- Participated in Public Regulation Commission workshops on system interconnection and net-metering: Provided information and testimony to the Commission about technical

screens for interconnecting renewable energy sources and model interconnection and net-metering rules.

- Academic coursework in electrical systems, including DC and AC electrical systems, electronics (1982-1984).
- Independent study of transmission system theory, including stability theory (2005-2006).
- Participated in numerous regional forums and conferences on transmission and renewable energy development in New Mexico, and several in Vermont.
- Negotiated net-metering legislative proposals on net-metering with New Mexico rural electric coops, and advocated this legislation to the New Mexico Legislature.