

University of Alberta
 Department of Science
 Augustana Campus
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[Professional web profile](#), [Personal web profile](#)
 Nationalities: Canadian, German
 Languages: English, German, Norwegian

Degrees

- 1998-2001 **Ph.D. Mathematics**, University of Bristol, U.K., December 2001
 Thesis title: “*Optimal-velocity models of motorway traffic*”
 Supervisor: Prof. Andy Woods, University of Cambridge, UK
- 1992-1998 **Physik Diplom** (grade: A), University of Muenster (WWU), Germany, May 1998
 Thesis title: “*Stationäre, periodische Oberflächenwellen auf Wasser beliebiger Tiefe*”
 Supervisor: Prof. Roland Wehner

Awards

- 2020 **RWTH-University of Alberta Senior Research Fellowship**
 Fellowship at RWTH Aachen, Germany, February 2020
- 1998-2001 **Fellow, Alfred Krupp von Bohlen und Halbach-Foundation**
 First A. Krupp v.B.u.H PhD scholarship to study abroad, \$50,000
- 1998 **Travel Grant, Wilhelm und Else Heraeus-Foundation**
 Financial support to present *Diplom* research at the 1998 DPG Spring Meeting
- 1996 **ERASMUS Fellow**
 Scholarship for undergraduate studies in physics at the University of Bergen, fall 1996

Employment History

- 08/2015- **Professor of Mathematics and Physics, Department Chair**
 Department of Science, University of Alberta, Augustana Campus, Canada
- 10/2015- **Member, Theoretical Physics Institute**, University of Alberta (since 11/2018)
 Adjunct Professor, Department of Chemistry, Simon Fraser University, Canada
- 09/2014-07/2015 Professor of Physics, NTNU, Norway
- 08/2012-09/2014 Associate Professor of Physics, NTNU, Norway
- 07/2009-07/2012 Associate Professor of Physics (tenured), University of Ontario Institute of
 Technology (UOIT; now Ontario Tech University), Canada
- 09/2004-08/2008 Adjunct Professor, Dept. of Mech. Engineering, University of Waterloo, Canada
- 07/2004-06/2009 Assistant Professor of Physics, UOIT, Canada
- 08/2001-06/2004 Ballard-MITACS Industrial Postdoctoral Fellow,
 Department of Mathematics, Simon Fraser University, Canada
- 07-09/1995 Co-op student, Fluid Mechanics Division, Airbus, Bremen, Germany

At a Glance

Administration

- Chair, Department of Science, University of Alberta, Augustana Campus (since 2015)
- Head of programs, BSc and MSc Physics, Department of Physics, NTNU (2013-2015)

Leadership philosophy and style:

Creative, transparent and fair, respectful and open to different opinions, organized, strong communicator who empowers colleagues and values a highly professional work environment

Research

- Computational physics, applied mathematics, nanofluidics, computational materials science
- Electro-kinetic fluid flows: flow in soft, charged nanodomains; electro-chemical device modelling

Teaching

- Focus on computational physics and applied mathematics; use of computational methods in- and outside the classroom, supported by various pedagogical initiatives and levels of funding
- Pedagogical certificate (“*PEDup*”), NTNU (2013-2014)

Service & Administrative Experience

Summary of Key Accomplishments of the Current Role

- Led the departmental faculty to identify inter-disciplinary opportunities for research and teaching within a Department of Science
- Supported colleagues in raising their scholarly productivity, their level of Tri-Council research funding and other funding for scientific research
- In a joint effort with a physics colleague and the Development office, spearheaded the successful fundraising of \$500,000 for the construction of the Hesje Observatory
- Worked collaboratively with Science faculty and staff members on the successful introduction of a unique and innovative academic calendar (“3-11”)
- Initiated the redesign of degree programs in Science and the launch of the first-year Science Foundations, a core component common to all Science majors (on-going)
- Encouraged colleagues to develop open textbooks for Science courses and ensured that these accomplishments were acknowledged in merit decisions
- Collaborated with the other department chairs and the Dean’s office to reduce the sessional budget by 40% over three years while maintaining pedagogical integrity of programs
- On a personal level, gained experience with all fields of science and mathematics, how they function in an academic context, and how different academics view their discipline

Leadership Training and Experience

- **Certificate, Building Capacity for Reconciliation (2018-19)**
University of Alberta, Augustana Campus
 - Professional development opportunity for faculty and staff members, students, and members of the public to engage in the Calls to Action of the Truth and Reconciliation Commission; organized by Indigenous Student Services
 - Augustana Campus is the first campus and faculty of the University of Alberta to offer such a certificate, partnering regionally with Maskwacis, home to four First Nations
 - Topics included residential schools, health, education, government relations, the arts
- **Chair, Department of Science, University of Alberta, Augustana Campus (2015-)**
 - Augustana (Camrose) Campus is one of five campuses of the University of Alberta and the university’s liberal arts & science campus
 - Multi-disciplinary department with an inter-disciplinary focus
 - Approx. 400 undergraduate students (science majors)
 - Disciplines (majors): Mathematics & Physics (combined degree), Computing Science, Biology, Chemistry, Environmental Science
 - 17 professors, 2 lecturers, 1 adjunct professor
 - Supervisor for 2 lab coordinators, 4 lab technicians, and 5-10 contract instructors each term
 - Direct report & performance reviews for 24 staff & faculty members (excl. contract instructors)
 - 5 full-time academic recruitments since 2015, placing all departmental programs on solid footing and providing better gender balance and diversity
 - Successful, complete renovation of 5 lab spaces, including teaching labs in Biology and Chemistry, and a research lab in Chemistry; construction period: 5 months; overall length of project: 12 months; on time, on budget (\$2.3m)
 - Complete renovation of Senior Computing Science Lab (\$20k)
 - Renovation of 4 biology spaces (labs, office space, prep rooms) (approx. \$250k)
 - Planning for renovation of large Science lecture hall and Physics labs (approx. \$2.0m)
 - Duties include leading strategically, budget management, annual performance evaluations of all department members, hiring of new employees, overseeing lab operations, grant-writing assistance, preparation of funding applications (internal & external) for facility upgrades, leading curriculum change, fundraising

- **Gold College - University of Alberta Leadership Program (2015-2016)**
Training of the next generation of senior leadership candidates for the University of Alberta, utilizing internal and external resources; developing leadership skills required in complex, modern organizations; participant during second year of program
- **Leadership Program (“lederutviklingsprogram”), NTNU (2014-2015)**
Professional development for heads of programs (BSc, BA, MSc, MA, PhD) across all university departments; focus on leadership skills and leadership knowledge but also on NTNU’s overall strategy
- **Head of programs, BSc and MSc Physics, Department of Physics, NTNU (2013-2015)**
Tracking enrollment, retention, course offerings and program structure; responding to needs of international students; introduction of academic mentorship program for 1st-year physics students, matching groups of 3-5 students with a professor so as to increase student retention, sense of belonging and feedback, and to address student concerns

Committee Memberships

- PHRT Sub-Committee on Academic Issues (2020)
University-wide committee for the planning of online course delivery for the fall 2020 semester
- Elected member, Chairs’ Council Executive (2018-2020)
Working group of 15 Department Chairs representing about 75 Department Chairs in total; duty includes membership (*ex officio*) on the Provost’s Advisory Committee of Chairs
- Research Committee, Augustana Faculty, University of Alberta (2016)
- Academic Council, University of Alberta (2015-)
Academic leadership team of the Faculty, consisting of Dean, Vice Dean, Associate Deans and Department Chairs
- Executive Council, University of Alberta (2015-)
Faculty leadership team, consisting of members of Academic Council and heads of all operational units on campus
- Faculty Council, University of Alberta (2015-)
- Faculty Evaluation Committee, Augustana Faculty, University of Alberta (2015-)
Committee consists of the Dean, the Department Chairs, three faculty representatives (tenured professors) and one faculty member (tenured professor) external to the Faculty; main duties include annual performance assessment of all faculty members, tenure and promotion cases, and adjudication of sabbatical applications
- Chairs’ Councils, University of Alberta (2015-)
Council of all department chairs, chaired by the University President and hosted by the Provost
- Elected member, Department Council, Department of Physics, NTNU (2014-2015)
- Head of programs, BSc and MSc Physics, Department of Physics, NTNU (2013-2015)
- Outreach Committee, Department of Physics, NTNU (2013-2015)
- Undergraduate program director, Physics, UOIT (2011-2012)
- UOIT Faculty Association Executive – Grievance Officer (2011-2012)
- Program coordinator, Energy and the Environment specialisation in physics, UOIT (2009-2012)
- Science Faculty Council, UOIT (2004-2012)
- Faculty search committees: Faculty of Science and Faculty of Business & IT, UOIT (2006-2011)
- Elected member, UOIT Board of Governors (2006-2009),
Member, UOIT Finance & Audit Committee (2006-2009)

Fundraising and Donations

- Preparation of “*one-page donor pitches*” for new scientific equipment and instruments (2016-)
- Regular meetings with potential donors regarding major naming opportunities and new scientific instruments for renovated labs (2016-)
- Main achievement to-date:
 - **Hesje Observatory (17”)** at Augustana Miquelon Lake Research Station, a departmental facility in Miquelon Lake Provincial Park (part of Beaver Hills Dark Sky Preserve and UNESCO World Biosphere Reserve); on-going construction includes an affiliated 40-seater lecture hall; initiator of idea and project by consulting with provincial stakeholders, telescope facilities and the TELUS World of Science in Edmonton; the Lieutenant Governor of Alberta, the Honourable Lois Mitchell, has accepted my personal invitation to attend the ribbon cutting
- Current project: Fundraising for a **Makerspace (“KReATE ZONE”)** on campus, located inside a new, dedicated *Zero-Net-Energy* facility with highly innovative architecture; vision of year-round use by members of the campus and the public; features will include 3D printing, laser cutting, wood working, metal working and a sound studio; approx. costs: \$1.5m
Initiator of idea and project by consulting with university colleagues at the makerspace (“*The Shack*”) on the main campus and the Economic Development Department of the City of Camrose
- Donations to-date (amounts in \$ CAD):

2020	Wireless Sensors for Science Labs	\$5,000
2019	Analytical Balance	
2018-2019	Hesje Observatory, largest observatory and telescope (17”) of the University of Alberta, located in the Beaver Hills Dark Sky Preserve und UNESCO World Biosphere Reserve	\$5,000 \$500,000
2017-2018	3D Printer	\$5,000

Service to the Community

- Ongoing: Host and co-organizer with CMASTE (Centre for Mathematics, Science and Technology Education, University of Alberta); five one-day professional development workshops for pre-service and in-service teachers from across Alberta, “*Incorporating Indigenous perspectives into science and mathematics K-12 classrooms*”; Augustana Miquelon Lake Research Station and Hesje Observatory, 2020-21
- Ongoing: Host and organizer, ‘*Susan Rogers at the UofA: Engineering a Legacy*’
Dr. Rogers is Professor of Music at the Berklee College of Music in Boston, USA, and was the (music) engineer for Prince during the 1980s; event moved from April to September 2020 due to COVID-19
- Host and co-organizer, “Pipelines and protests in the USA”, public talk by Dr. Jessica Shoemaker (University of Nebraska, USA), 2018-19 Fulbright Fellow at the University of Alberta, Lunch & Learn event, April 2019, University of Alberta, Augustana Campus
- Board member, ALL (Association for Life-wide Learning) of Alberta, Camrose community organization (2017-2018)
- Rural Transportation Information Day II
Host and co-organizer; funded by Government of Alberta through grant for ALL (\$18,000); University of Alberta – Augustana Campus, September 2017
- Campus Car-sharing Initiative
Initiator of the idea; member of implementation team (2016-);
vehicles are used by faculty, staff and students; first car-sharing program in rural Canada
- Canadian Council of Deans of Science (CCDS) – Attendance at annual meetings:
 - University of Calgary, May 2018
 - Concordia University, June 2017
 Main topics: EDI, sexual harassment, donor and alumni relations, NSERC funding, international students, the landscape of science funding, indigenizing science, innovation in academia

Research

Fields of Interest and Main Activities

- Computational methods in materials science; fluid dynamics; applied mathematics; nanofluidics
- Thermodynamically consistent models for electro-kinetic flows and charged fluids
- Modelling of flow through viscoelastic, charged nanofluidic pores
- Theory of polymer electrolyte membranes
- Simulation of multi-phase and/or reactive flows in porous media
- Analysis of the dynamics of surface nanobubbles in water electrolysis
- Past interests: traffic flow theory; agent-based models; energy-economic models
- Industrial collaboration to-date: Toyota Motor Corporation (Japan & USA), Ballard Power Systems and Enbridge Inc. (both Canada)

Publications

Summary:

- 45 journal papers
- 15 papers in conference proceedings (10 peer-reviewed, 9 in Springer books)
- 2 books
- 2 patents
- 13 industrial research reports (Ballard Power Systems, Toyota Motor Corporation)
- Numerous media and outreach contributions
- [Google Scholar profile](#)

Journal papers:

(supervised HQP marked in bold)

- **Nadon, P.**, and Berg, P., *Random pore network model for polymer electrolyte membranes*, in preparation (2020)
- 1. **Mpumelelo, M.**, Berg, P., and Eikerling, M., *Asymmetric double-layer charging in a cylindrical nanopore under closed confinement*. *J. Chem. Phys.* **152**: 084103 (2020); <https://doi.org/10.1063/1.5139541>
- 2. **Mpumelelo, M.**, Berg, P., and Eikerling, M., *Electrokinetic Onsager coefficients and energy conversion in deformable nanofluidic channels*. Special Topics Issue “Dynamical aspects using mean field methods for electrolytes and applications”, *Eur. Phys. J.* **227**: pp. 2559-2573 (2019)
- 3. **Mpumelelo, M.**, Berg, P., and Eikerling, M., *Counter-ion flow through a deformable and charged nanochannel*, *Phys. Rev. E* 98: 053101, 2018.
- 4. **Sverdrup, K.**, Kimmerle, S.J., and Berg, P., *Computational investigation of the stability and dissolution of nanobubbles*, *Appl. Math. Mod.* 49: pp. 199-219, 2017.
- 5. Berg, P., and **Stornes, M.**, *Towards a consistent interpretation of electro-osmotic drag in polymer electrolyte membranes*, *Fuel Cells* 16: pp. 715-724, 2016.
- 6. Berg, P., and Staley, S., *Capital substitution in an industrial revolution*, *Can. J. Econ.* 48: pp. 1975-2004, 2015.
- 7. Berg, P., and Kulikovskiy, A.A., *A model for a crack or a delaminated region in a PEM fuel cell anode: analytical solutions*. *Electrochim. Acta* 174: pp. 424-429, 2015.
- 8. Kulikovskiy, A.A., and Berg, P., *The positioning of a reference electrode in a PEM fuel cell*, *J. Electrochem. Soc.* 8: F843-F848, 2015.
- 9. Safiollah, M., Melchy, A., Berg, P., and Eikerling, M., *Model of water sorption and swelling in polymer electrolyte membranes: Diagnostic applications*, *J. Phys. Chem.* 119: pp. 8165-8175, 2015.
- 10. **Hugdahl, H.**, and Berg, P., *Numerical determination of the eigenenergies of the Schrodinger equation in one dimension*, *Eur. J. Phys.* 36: 045013, pp. 1-12, 2015.
- 11. Schmuck, M., and Berg, P., *Effective macroscopic equations for species transport and reactions in porous catalyst layers*, *J. Electrochem. Soc.* 161: pp. E3323-E3327, 2014.

12. **Kimmerle, S.-J., Ladipo, K.,** Novruzi, A., and Berg, P., *Contact resistance at PEM-PEM interfaces: charged-fluid flow between nanochannels*, ECS Transactions 59: pp. 145-159, 2014.
13. **Ramandi, M.,** Dincer, I., and Berg, P., *Transient modeling of three-dimensional heat and mass transfer in a molten carbonate fuel cell [...]*, Int. J. Hydrogen Energy 39: pp. 8034-8047, 2014.
14. Berg, P., and **Benjaminsen, B.E.,** *Effects of finite-size ions and relative permittivity in a nanopore model of a polymer electrolyte membrane*, Electrochim. Acta 120: pp. 429-438, 2014.
15. Berg, P., **Kimmerle, S.-J.,** and Novruzi, A., *Modeling, shape analysis and computation of the equil. pore shape near a PEM-PEM intersection*, J. Math. Anal. Appl. 410: pp.241-256, 2014.
16. Berg, P., and **Boland, A.,** *Analysis of ultimate fossil fuel reserves and associated CO₂ emissions in IPCC scenarios*, Nat. Resour. Res. 23: pp. 141-158, 2014.
17. Kulikovskiy, A., and Berg, P., *Analytical description of a dead spot in a PEM fuel cell anode*, ECS Electrochemistry Letters 2: pp. F64-F67, 2013.
18. **Ramandi, M.,** Berg, P., and Dincer, I., *Numerical analysis of transient processes in molten carbonate fuel cells via impedance perturbations*, J. Power Sources 231: pp. 134-145, 2013.
19. Schmuck, M., and Berg, P., *Homogenization of a catalyst layer model for periodically distributed pore geometries in PEM fuel cells*, Appl. Math. Res. Express (AMRX) 2013: pp. 57-78, 2013.
20. **Ramandi, M.,** Berg, P., and Dincer, I., *Three dimensional modeling of polarization characteristics in MCFCs [...]*, J. Power Sources 218: pp. 192-203, 2012.
21. Berg, P., and **Findlay, J.,** *Analytical solution of the Poisson-Nernst-Planck-Stokes equations in a cylindrical channel*, Proc. Roy. Soc. A 467: pp. 3157-3169, 2011.
22. Eikerling, M., and Berg, P., *Poroelectroelastic theory of water sorption and swelling in polymer electrolyte membranes*, Soft Matter 7: pp. 5976-5990, 2011.
23. **Ladipo, K.,** Berg, P., **Kimmerle, S.J.,** Novruzi, A., *Effects of radially-dependent parameters on proton transport in PEM nanopores*, J. Phys. Chem. 134: 074103, pp. 1-12, 2011.
24. Berg, P., **Hanz, P.,** and **Milton, I.** *An energy-economic oil production model*, IMA J. Appl. Math., doi: 10.1093/imamat/hxr049, pp. 1-26, 2011.
25. **Wu, H.,** Berg, P., and Li X. *Modelling of PEMFC transients with finite-rate phase-transfer processes*, J. Electrochem. Soc. 157: pp. B1-12, 2010.
26. Berg, P., and **Findlay, J.,** *Comment on: Analysis of molten carbonate fuel cell performance using a three-phase homogeneous model*, J. Electrochem. Soc. 157: p. S13, 2010.
27. **Wu, H.,** Berg, P., and Li, X., *Steady and unsteady 3-D non-isothermal modeling of PEM fuel cells [...]*, Appl. Energy 87: pp. 2778-2784, 2010.
28. **Wu, H.,** Li, X., and Berg, P., *On the modeling of water transport in polymer electrolyte membrane fuel cells*, Electrochim. Acta 54: pp. 6913-6927, 2009.
29. Berg, P., and **Ladipo, K.,** *Exact solution of an electro-osmotic flow problem in a cylindrical channel of polymer electrolyte membranes*, Proc. Roy. Soc. A 465: pp. 2663-2679, 2009.
30. **Rashidi, R.,** Berg, P., and Dincer, I., *Performance investigation of a combined MCFC system*, Int. J. Hydrogen Energy 34: pp. 4395-4405, 2009.
31. **Rashidi, R.,** Dincer, I., Naterer, G., and Berg, P., *Performance evaluation of direct methanol fuel cells for portable applications*, J. Power Sources 187: pp. 509–516, 2009.
32. **Rashidi, R.,** Dincer, I., and Berg, P., *Energy and exergy analyses of a MCFC hybrid system*, J. Power Sources 185: pp. 1107-1114, 2008.
33. Berg, P., and **Korte, S.,** *Higher-order Hubbert models for the world oil production*, J. Pet. Sci. Technol. 26: pp. 217-230, 2008.
34. Berg, P., Novruzi, A., and **Volkov, O.,** *Reaction kinetics at the triple-phase boundary in PEM fuel cells*, J. Fuel Cell Sci. Technol. 5: 021007, pp. 1-10, 2008.
35. Ward, J., Wilson, R.E., and Berg, P., *Multiscale analysis of a spatially heterogeneous microscopic traffic model*, Physica D 236: pp. 1-12, 2007.
36. **Wu, H.,** Li, X., and Berg, P., *Numerical analysis of dynamic processes in fully humidified PEM fuel cells*, Int. J. Hydrogen Energy 32: pp. 2022-2031, 2007.
37. **Wu, H.,** Berg, P., and Li, X., *Non-isothermal transient modeling of water transport in PEM fuel cells*, J. Power Sources 165: pp. 232-243, 2007.

38. Berg, P., Novruzi, A., and Promislow, K., *Analysis of a cathode catalyst layer model for a polymer electrolyte fuel cell*, Chem. Eng. Sci. 61: pp. 4316-4331, 2006.
39. Berg, P., Caglar, A., Promislow, K., and Wetton, B., *Electrical coupling in PEM fuel cell stacks: mathematical and computational modelling*, IMA J. Appl. Math. 71: pp. 241-261, 2006.
40. Berg, P., Promislow, K., Stumper, J., and Wetton, B., *Discharge of a segmented PEM fuel cell*, J. Fuel Cell Sci. Technol. 2: pp. 111-120, 2005.
41. Wilson, R.E., Berg, P., Hooper, S., and Lunt, G., *Many-neighbour interaction and non-locality in traffic models*, Eur. Phys. J. B 39: pp. 397-408, 2004.
42. Berg, P., Promislow, K., St-Pierre, J., Stumper, J., and Wetton, B., *Water management in PEM fuel cells*, J. Electrochem. Soc. 151: pp. A341-353, 2004.
43. Berg, P., and Woods, A.W., *On-ramp simulations and solitary waves of a car-following model*, Phys. Rev. E 64: 035602, pp. 1-4, 2001.
44. Berg, P., and Woods, A.W., *Travelling waves in an optimal-velocity model of freeway traffic*, Phys. Rev. E 63: 036107, pp. 1-11, 2001.
45. Berg, P., Mason, A., and Woods, A.W., *Continuum approach to car-following models*, Phys. Rev. E 61: pp. 1056-1066, 2000.

Conference proceedings:

1. Kimmerle, S.J., **Sverdrup, K.**, and Berg, P., *Dynamic equilibrium of a coupled ODE-PDE problem for surface nanobubbles*, Proc. Appl. Math. Mech. 17: pp. 843-844, 2017.
2. **Kimmerle, S.J.**, Berg, P., and Novruzi, A., *An electrohydrodynamic equilibrium shape problem for polymer electrolyte membranes in fuel cells*, System Modeling and Optimization: 25th IFIP TC 7 Conference, CSMO 2011, Eds.: Hoernberg and Troeltzsch; pp. 387-396, Springer, 2013.
3. Berg, P., and **Benjaminsen, B.E.**, *Mean-field models in PEM nanopores*, Proceedings of 4th European PEFC & H2 Forum 2013, Eds.: Jones *et al.*, 2013.
4. Berg, P., *Mathematical modelling of fuel cells*, Progress in Industrial Math. at ECMI 2008, Eds.: Fitt, Norbury, Ockendon and Wilson; Springer, pp. 715-720, 2010.
5. **Wu, H.**, Berg, P., and Li, X., *Steady and unsteady 3D, two-phase, non-isothermal modeling of PEM fuel cells [...]*, Proceedings of IGEC-IV, Eds.: Li, Wang, Hao and Zhu, DVD, 2008.
6. Berg, P., and **Findlay, J.**, *Linking cellular automata and optimal-velocity models through wave selections at bottlenecks*, Traffic and Granular Flow '05, Eds.: Schadschneider, Poeschel, Kuehne, Schreckenberg and Wolf; pp.515-520, Springer, 2007.
7. Ward, J., Wilson, R.E., and Berg, P., *Wave selection problems in the presence of a bottleneck*, Traffic and Granular Flow '05, Eds.: Schadschneider, Poeschel, Kuehne, Schreckenberg and Wolf; pp.565-576, Springer, 2007.
8. **Wu, H.**, Li, X., and Berg, P., *Transient analysis of fully humidified PEM fuel cells*, Proceedings of the 2nd International Energy Conference, Eds.: Dincer and Li, ISBN: 0-9781236-0-3, 2006.
9. Berg, P., and Wilson, R.E., *Bifurcation analysis of metastability and waves in the OV model*, Traffic and Granular Flow '03, Eds.: Hoogendoorn, Luding, Bovy, Schreckenberg and Wolf; pp. 247-252, Springer, 2005.
10. Berg, P., and Promislow, K., *Modelling water uptake of proton exchange membranes*, Techn. Proc. of the 2003 Nanotechn. Conf. pp. 493-496, Computational Publications, NY, 2003.
11. Berg, P., Promislow, K., Stockie, J., and Wetton, B., *Mathematical modelling of water management in PEM fuel cells*, Techn. Proc. of the 2003 Nanotechn. Conf., pp. 459-462, Computational Publications, NY, 2003.
12. Berg, P., and Wilson, R.E., *Microscopic parameters and macroscopic features of traffic flow*, Proceedings of Computational Physics of Transport and Interface Dynamics, Eds.: Emmerich, Nestler and Schreckenberg; pp. 329-342, Springer, 2003.
13. Wilson, R.E., and Berg, P., *Existence and classification of travelling wave solutions to second-order highway traffic models*, Traffic and Granular Flow '01, Eds.: Fukui, Sugiyama, Schreckenberg and Wolf; pp. 85-90, Springer, 2003.

14. Berg, P., and Woods A.W., *Travelling waves in a linearly stable, optimal-velocity model of road traffic*, Progress in Industrial Mathematics at ECMI 2000, Eds.: Anile, Capasso and Greco; pp. 281-285, Springer, 2002.
15. Berg, P., and Woods, A.W., *Relating car-following and continuum models of road traffic*, Traffic and Granular Flow '99: Social, Traffic and Granular Dynamics, Eds.: Helbing, Herrmann, Schreckenberg and Wolf; pp. 389-394, Springer, 2000.

Magazine articles (editor reviewed):

1. Berg, P., *Electric cars helpful, but not the sole advance in mobility*, The CCPA Monitor, March 2010 Issue, Canadian Centre for Policy Alternatives (CCPA)
2. Berg, P., *Debunking the green myth*, The CCPA Monitor, November 2009 Issue, Canadian Centre for Policy Alternatives (CCPA)

Industrial research reports:

1. Berg, P., **Kimmerle, S.-J., Ladipo, K.**, and Novruzzi, A., Toyota (TEMA) research collaboration: Final report, February 2011.
- 2.-13. Berg, P., Caglar, A., Chang, P., Promislow, K., Stockie, J., and Wetton, B., Ballard-MMSC project reports (quarterly and annually), 2002-2004.

Books:

1. *Endliche Welt, unendliches Geld – Das wahre Dilemma der Nachhaltigkeit*, (German; *Finite World, Infinite Money – Sustainability's Real Dilemma*), oekom verlag, 2016, paperback, 188 pages, ISBN: 978-3-86581-803-4
2. *The Finite Planet – How Resource Scarcity Will Affect Our Environment, Economy and Energy Supply*, CreateSpace, 2011, ebook & paperback, 173 pages, ISBN: 1466320435

Funding for Research, Science Infrastructure and Scholarly Work

(amounts in \$ CAD)

2020	RWTH-University of Alberta Senior Research Fellowship <u>principal investigator</u> , Program administered by RWTH Aachen, Germany	\$2,000
2018-2023	NSERC Discovery Grant , <u>principal investigator</u> <i>Electrokinetic Flow through Charged, Soft Porous Media</i>	\$120,000
2017	Beakerhead , <u>principal investigator</u> Beakerhead 2017, <i>Up Against All Odds</i> Design and creation of interactive arts & science installation based on Gambler's Ruin Problem/asymmetric diffusion; approx. 1,200 participants (gamblers) over four days	\$18,000
2016-2018	Strategic Investment Funds (SIF) , <u>co-applicant</u> Government of Canada, Government of Alberta principal applicant: Hugh Warren, University of Alberta <i>Augustana Science Renewal</i> (Laboratories); on time (4 months construction window), on budget	2,300,000
2015-2016	Norgesuniversitetet , <u>principal investigator</u> <i>Creating a Computational-physics Online Platform with IPython Notebook</i> , educational project, total budget: \$135,000	\$49,000
2014-2015	IS-DAAD , <u>principal investigator</u> <i>Physical Models and Numerical Schemes for Nanofluidic Diodes and Transistors</i> ; researcher exchange with WIAS, Berlin, Germany	\$9,000
2013-2014	PNA 2012-2013 - Project funds for North America <u>principal investigator</u> , <i>Morphology and Physical Properties of Polymer Electrolyte Membranes</i> ; NTNU workshop and researcher exchange with Simon Fraser University, Canada	\$27,000

2011-2016	NSERC Discovery Grant, <u>principal investigator</u> <i>Physical Theory of Pore Formation, Water Transport and Proton Flow in Polymer Electrolyte Membranes</i> (discontinued in 2012 due to move to NTNU)	\$100,000
2008-2011	Toyota Motor Corporation, <u>principal investigator</u> <i>Modelling Ionomer-Ionomer and Ionomer-Catalyst Layer Interfaces</i> ; industrial research contract with Toyota (Japan & USA); collaboration with University of Ottawa	\$380,000
2007-2012	The Ontario Fuel Cell Research and Innovation Network Ontario Research Fund; principal applicant: Brant Peppley (Queen's Univ.); 17 investigators, total budget: \$16,500,000; PI for project "Modelling and simulation of molten carbonate fuel cells" (MCFCs), a collaboration with Enbridge Inc., Ontario	\$284,000
2007-2011	Thermo-mechanical Design of Nuclear Hydrogen Production , Ontario Research Fund, principal applicant: Greg Naterer (UOIT); 21 investigators, total budget: \$5,500,000; participation as co-applicant and research collaborator only	
2005-2009	NSERC Discovery Grant, <u>principal investigator</u> <i>Reaction Kinetics and Transport Processes of Catalyst Layers in PEM Fuel Cells</i>	\$76,000
2005	CFI New Opportunities, Computational Science and Visualization Laboratory (CSVL) , principal applicant: Greg Lewis (UOIT), 8 investigators (group grant)	\$112,000
2004-2006	Ballard-MITACS: Mathematical Modelling and Computational Science project, individual operating grant; industrial collaboration with Ballard Power Systems, BC	\$15,000
1998-2001	Fellow, Alfried Krupp von Bohlen und Halbach-Foundation First PhD scholarship recipient to study outside Germany	\$50,000
1998-2001	EPSRC , Tuition waiver for PhD studies	\$12,500
1998	Travel Grant, Wilhelm und Else Heraeus-Foundation Presenting <i>Diplom</i> research at the 1998 DPG Spring Meeting	\$500
1996	ERASMUS Fellow Scholarship for undergraduate studies in physics at the University of Bergen, Fall 1996	\$750
Internal funds:		
2018	University of Alberta: FT-IR spectrometer Matching funds provided by the Provost's Office	\$11,000
2015-2018	University of Alberta start-up grant	\$30,000
2014	NTNU: IT Project (<i>IKTiSU</i>), <u>principal investigator</u> , <i>IPython Notebook as a Computational-physics Teaching Tool in QUM</i> ; Funded as part of NTNU's strategic focus on the development of technology in teaching	\$15,000
2013-2015	NTNU PhD Grant, <u>principal investigator</u> Funding of one PhD student	\$125,000
2012-2015	NTNU start-up grant	\$18,000
2004-2006	UOIT start-up grant	\$60,000

Supervision

The vast majority of the following HQP has moved on to first-choice careers, including graduate studies, teaching positions in academia, research opportunities in companies and academia, software and hardware development, the financial service sector, and positions in government.

• 3 postdoctoral fellows:

- Sven-Joachim Kimmerle (2010, University of Ottawa, co-supervisor): "*Ionomer-ionomer interface resistance*", funded by Toyota Motor Corporation, Japan & USA
- Kehinde Ladipo (2008-2010, UOIT, main supervisor): "*Ionomer-ionomer interface resistance*", funded by Toyota Motor Corporation, Japan & USA
- Oleg Volkov (2005-2007, University of Ottawa, co-supervisor): "*PEM cathode catalyst layer: reaction kinetics at the mesoscopic pore level*", funded by MITACS and NSERC

• 4 PhD students:

- Matse Mpumelelo (2016-2020, Simon Fraser University, co-supervisor & main sponsor): "*Electro-kinetic flow through visco-elastic, charged pores*", funded by University of Alberta start-up funds and NSERC
- Morten Stornes (2013-2015, NTNU, main supervisor): "*Electro-kinetic flow phenomena at the nanoscale*", funded by NTNU
- Masoud Ramandi (2009-2012, UOIT, main supervisor): "*Multi-dimensional modelling of transient transport phenomena in molten carbonate fuel cells*", funded by Ontario Research Fund (ORF) and Enbridge
- Hao Wu (2005-2009, University of Waterloo, main supervisor): "*Mathematical modelling of transient transport phenomena in PEM fuel cells*", funded by NSERC

• 11 MSc students:

- Jack Edwards (2019-, University of Alberta, co-supervisor & main sponsor): "*Random pore network models for polymer electrolyte membranes*"
- Magnus Dahle (MSc project only, 2014-2015, NTNU, main supervisor): "*Soft PEM pores*"
- Knut Sverdrup (2014-2015, NTNU, main supervisor): "*Nanobubble stability in water electrolysis*"
- Kjersti Krakhella (2014-2015, NTNU, co-supervisor): "*New materials for bipolar plates*"
- Endre Skeie (2014-2015, NTNU, main supervisor): "*Lattice-gas models for ionic liquids*"
- Asbjørn Sperre (2014-2015, NTNU, main supervisor): "*Surface nanobubbles in electrolysis*"
- Bjoern Eirik Benjaminsen (2012-2013, NTNU, main supervisor): "*Nanoflows of protons and water in polymer electrolyte membranes*"
- John Mizanki (2010-2013, full-time/part-time, UOIT, main supervisor): "*Energy-economic model for transition to renewables*", supported by NSERC
- Ian Milton (2007-2010, part-time, UOIT, main supervisor): "*Applications and numerical investigations of differential-algebraic equations*"
- Justin Findlay (2007-2009, UOIT, main supervisor): "*Mass transport in the cathode electrode of a molten carbonate fuel cell*", funded by ORF and Enbridge
- Ramin Rashidi (2007-2008, UOIT, co-supervisor): "*Thermodynamic analysis of hybrid MCFC systems*", funded by ORF and Enbridge

• 4 undergraduate thesis students:

- Anthony Boland (2011-2012, UOIT, main supervisor): "*Analysis of fossil fuel ultimates based on IPCC data and their relation to CO₂ emissions*"
- Paul Prior (2011-2012, UOIT, main supervisor): "*Modeling energy production and population characteristics of a world powered only by oil*"
- Paul Hanz (2008-2009, UOIT, main supervisor): "*Energy-economic models*"
- Justin Findlay (2006-2007, UOIT, main supervisor): "*Flow patterns in cellular automata and optimal-velocity traffic models at highway bottlenecks*"

- **4 undergraduate summer research students:**

- *Rae Metrunec (2019-, University of Alberta; secured funding to hire Ms. Metrunec to work on new Hesje Observatory; main supervisors: Glynnis Hood, Gerhard Lotz)
- Philippe Nadon (2019-2020, University of Alberta, main supervisor, supported by NSERC Discovery Grant)
- Paul Hanz (2007, UOIT, main supervisor, supported by Faculty of Science grant)
- Justin Findlay (2005, UOIT, main supervisor, supported by Faculty of Science grant)
- Stephen Korte (2005, UOIT, main supervisor, supported by NSERC USRA grant)

Presentations and Organization of Workshops/Mini-symposia/Sessions

- 05/2021 *Nanoscale Physics of Electrochemical and Biological Media*, WE-Heraeus Seminar, Physikzentrum Bad Honnef, Germany; currently in application stage; Co-applicants: Prof. Barbara Wagner, WIAS, Prof. Michael Eikerling, FZ Jülich, Germany
- 02/2020 Seminar Speaker, IEK-13: Modelling and Simulation of Materials in Energy Technology, FZ Jülich, Germany
- 08/2019 **Invited speaker**, International Workshop *Ion Transport and Nanofluidics: Modeling, Analysis and Numerics*, The Fields Institute, Toronto, Canada
- 06/2019 Conference presentation, E.L.K.I.N. 2019, MIT, USA
- 06/2019 Conference talk, CAP 2019 - Annual Congress, Simon Fraser University, Canada
- 05/2019 Seminar talk, Weierstrass Institute (WIAS), Berlin, Germany
- 05/2019 Seminar talk (invited), FZ Juelich, Juelich, Germany
- 05/2019 Co-host and speaker, Alberta Math Dialogue 2019, University of Alberta, Canada
- 02/2019 Seminar talk, TPI Seminar Series, Department of Physics, University of Alberta
- 02/2019 Conference talk, International Workshop *Dead Sea Water 2019: Nanomaterials at the Water-Energy Nexus*, Ein-Gedi, Israel
- 11/2018 Colloquium talk, Department of Physics, University of Alberta
- 06/2018 **Keynote speaker**, International Workshop *Complex Heterogeneous Systems*, Heriot-Watt University, Scotland
- 03/2018 Seminar talk, Enersense, NTNU, Norway
- 12/2017 Lunch & Learn presentation, "Gravitational waves - The 2017 Physics Nobel Prize", University of Alberta – Augustana Campus, Canada
- 08/2016 Conference presentation, Fuel Cells Gordon Research Conference, Stone Hill College, USA
- 05/2016 **Invited speaker**, *Ion Transport: Electrodifusion, Electrohydrodynamics and Homogenization*, BIRS, Banff, Canada
- 07/2015 Conference talk, ECS Conf. on Electrochem. Energy Conversion & Storage, Glasgow, UK
- 02/2015 **Invited speaker**, *Advances in Polymers for Fuel Cells & Energy Devices*, Asilomar, USA
- 01/2015 Colloquium talk, Department of Physics, NTNU, Norway
- 10/2014 Conference talk, ECI2014 - *Electrochemical Interfaces: Recent Topics and Open Questions*, WIAS, Berlin, Germany
- 07/2014 Seminar talk, Structure et Proprietes d'Architectures Moleculaires, Groupe Polymeres Conducteurs Ioniques, CEA, Grenoble, France
- 06/2014 **Invited speaker**, International Symposium *Modeling and diagnostics of polymer electrolyte fuel cells*, 97th Canadian Chemistry Conference 2014, Vancouver, Canada
- 05/2014 **Mini-lectures**, "The Poisson-Nernst-Planck equation: theory, applications and shortcomings", Department of Chemistry, Simon Fraser University, Canada
- 11/2013 Conference talk, *Hydrogen and Fuel Cells in the Nordic Countries 2013*, Oslo, Norway
- 10/2013 **Organizer and chair**, *PEM 2013*, international workshop, NTNU, Norway
- 08/2013 Seminar talk, Department of Chemistry, Simon Fraser University, Canada
- 07/2013 Conference talk, European Fuel Cell Forum 2013, Lucerne, Switzerland
- 04/2013 Seminar talk (Seminar Series "Current problems in theoretical physics"), Department of Physics, University of Duisburg-Essen, Germany
- 03/2013 Conference talk, ModVal 10, Bad Boll, Germany

- 01/2013 Colloquium talk, Department of Chemistry, NTNU, Norway
- 11/2012 Seminar talk, WIAS, Berlin, Germany
- 09/2012 Colloquium talk, Department of Physics, NTNU, Norway
- 10/2011 Seminar talk, Department of Mathematics, Michigan State University, Lansing, USA
- 06/2011 **Session co-organizer and speaker**, "*Challenges of the renewable energy transition*", Energy Technology Session, CAP 2011 Congress, St. John's, Canada
- 05/2011 **Invited speaker**, Comp. Electrochem. Session, 219th ECS Meeting, Montreal, Canada
- 10/2010 **Invited speaker**, Canada-Taiwan Symp. on Renewable Energy Techn., Ottawa, Canada
- 09/2010 **Mini-symposium organizer, chair and speaker**, "*Sustainable energy*", Dynamics Days Europe 2010, University of Bristol, UK
- 07/2010 Conference talk, CAIMS 2010, St. John's, Canada
- 06/2010 Seminar talk, Department of Chemical Engineering, MIT, USA
- 06/2010 Conference talk, CAP 2010 Congress, Toronto, Canada
- 06/2010 Conference talk, ASME 2010 8th Int. Fuel Cell Sci., Eng. & Tech. Conf., Brooklyn, USA
- 01/2010 Seminar talk, Applied Mathematics Seminar, University of Waterloo, Canada
- 12/2009 **Invited speaker**, FCRC-NRC 4th Annual Colloquium on Fuel Cell & Hydrogen Technology, University of Waterloo, Canada
- 11/2009 **Invited lecture**, Canada-US MEA Fuel Cell Modelling and Characterization Workshop, NRC Institute for Fuel Cell Innovation, Vancouver, Canada
- 09/2009 Seminar talk, PDE/Analysis Seminar Series, McMaster University, Canada
- 06/2009 **Invited speaker**, CAIMS 2009, Western University, Canada
- 05/2009 **Invited talk**, ICH2P, UOIT, Canada
- 03/2009 **Keynote speaker**, FC-Cubic Mass Transfer Workshop, AIST Polymer Electrolyte Fuel Cell Cutting-Edge Research Center, Tokyo, Japan
- 07/2008 **Invited speaker**, ISTCP VI, University of British Columbia, Canada
- 07/2008 **Mini-symposium organizer and chair**, "*Mathematical modelling of fuel cells*", ECMI 2008, University College London, UK
- 03/2008 **Keynote speaker**, The 3rd FC-Cubic Workshop, AIST Polymer Electrolyte Fuel Cell Cutting-Edge Research Center, Tokyo, Japan
- 07/2007 Seminar talk, SHARNET Seminar Series, UOIT, Canada
- 09/2006 **Invited speaker**, Workshop on *Modelling & Simulation of PEMFCs*, WIAS, Germany
- 11/2005 Seminar talk, NRC Institute for Fuel Cell Innovation, UBC, Canada
- 11/2005 Seminar talk, IAM Seminar Series, UBC, Canada
- 10/2005 Conference presentation, Traffic and Granular Flow '05, Humboldt University, Germany
- 10/2005 Seminar talk, Department of Engineering Mathematics, University of Bristol, UK
- 06/2005 Conference presentation, 1st International Green Energy Conference, University of Waterloo, Canada
- 03/2005 **Invited speaker**, Computational Fuel Cell Dynamics III, BIRS, Banff, Canada
- 06/2004 **Invited speaker**, Symposium on Advanced Energy Systems, CSME Forum 2004, Western University, Canada
- 10/2003 Conference presentation, Traffic and Granular Flow '03, TU Delft, Netherlands
- 06/2003 **Invited speaker**, BP Institute Seminar Series, University of Cambridge, UK
- 04/2003 **Technical organization**, Computational Fuel Cell Dynamics II, BIRS, Banff, Canada
- 02/2003 Conference presentation, Int. Conf. on Computational Nanotechnology, San Francisco, USA
- 02/2003 **Project organizer**, IAM-CSC-PIMS Senior Undergraduate Math Modelling Workshop, University of British Columbia and Simon Fraser University, Canada
- 05/2002 Conference presentation, 8th Int. Symp. on Polymer Electrolytes, Santa Fe, USA
- 02/2002 **Invited lecture**, Computational Physics of Transport and Interface Dynamics, Max-Planck-Institute for the Physics of Complex Systems, Dresden, Germany
- 09/2000 **Invited speaker**, ECMI 2000, Palermo, Italy
- 09/1999 Conference presentation, Traffic and Granular Flow '99, University of Stuttgart, Germany
- 03/1998 Conference presentation, DPG Fruehjahrstagung, University of Regensburg, Germany

Miscellaneous

- Patents: (Inventors: Kulikovskiy, A.A., Berg, P.)
Verfahren zur Ermittlung von Ueberspannungen in Brennstoffzellen
(Method for the determination of overpotentials in fuel cells)
 - i. European Patent Office. EP 3 057 168. Granted/Issued: 2016
 - ii. German Patent Office. DE 10 2015 001 572. Granted/Issued: 2016
- On-going collaborations:
 - M. Secanell, University of Alberta, Canada
 - M. Eikerling, FZ Jülich & RWTH Aachen, Germany
 - J. Fuhrmann, Weierstrass Institute for Applied Analysis and Stochastics (WIAS), Germany
- Journal referee:

<ul style="list-style-type: none"> ○ Applied Physics Letters ○ Electrocatalysis ○ Electrochemical Solid State Letters ○ Europhysics Letters ○ Fuel Cells ○ International Journal of Hydrogen Energy ○ Journal of Chemical Physics 	<ul style="list-style-type: none"> ○ Journal of the Electrochemical Society ○ Journal of Power Sources ○ Journal of Fuel Cell Science and Technology ○ Physical Review E ○ Physica A ○ Physica D
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- Grant proposal reviewer:
 - NSERC (*Natural Sciences and Engineering Research Council of Canada*):
 Discovery Grant, University Faculty Award, Collaborative Research Grant, Applied Research and Development Grant, College and Community Innovation programs
 - NRC (*National Research Council Canada*): International programs
 - MITACS: Elevate
 - Israel Ministry of Science & Technology: Taiwan-Israel Joint Research Cooperation
- External examiner:
 - 08/2017 PhD defense of David Benjamin Paul Harvey, Queen's University, Canada
 - 04/2015 PhD defense of Bolaji James Adesokan, DTU, Denmark
 - 08/2013 PhD defense of Karen Chan, Simon Fraser University, Canada
- Chair (administrator) of PhD defence:
 - 10/2013 PhD defense of Arne Stormo, Department of Physics, NTNU
 - 02/2013 PhD defense of Knut Gjerden, Department of Physics, NTNU
- Visiting fellow:
 - 02/2020 RWTH Aachen, Germany
 - 07-08/2011 Department of Energy, Transportation and Environment, DIW, Berlin, Germany
 - 05-06/2003 Department of Engineering Mathematics, University of Bristol, UK
- Memberships:
 - American Physical Society (life-time member, 2010-)
 - Canadian Applied and Industrial Mathematics Society (2005-2011, 2016-2018)
 - Canadian Association of Physicists (2005-2012, 2016-2019)
 - The Electrochemical Society (2008-2017)
 - German Physical Society (DPG) (1998-)
 - Society for Industrial and Applied Mathematics (2019-)
 - Theoretical Physics Institute (TPI), University of Alberta (2018-)

Teaching

My Teaching Philosophy – In a Nutshell

Teaching and learning are processes that take place in a social context. It is the responsibility of the teacher to create a productive learning environment and it is the duty of the students to commit to their studies. The ideal outcome of attending university is for students to become responsible, critical and engaged citizens who have acquired the skills and knowledge to lead a successful and productive life that enhances their well-being and those of their fellow citizens. Nothing can replace a knowledgeable, inspiring and organized teacher, equipped with a great sense of humour, not even a computer.

Professional Development

- **Pedagogical certificate – Pedagogical development program (“PEDup”), NTNU (2013-2014)**
This two-semester intensive course covered modern pedagogical theory and teaching methodologies. It also included peer review and class visits, as well as professional coaching for public speaking.

Pedagogical Initiatives & Program Development

- **Department lead for redesign of the science curriculum, Department of Science, University of Alberta (2018-):**
 - Introduction of a common first-year *Science Foundations* core for all students in science and mathematics
 - Movement towards more resilient and more viable, interdisciplinary programs of high pedagogical value
 - Balancing a main objective of a liberal arts & science education, namely the graduation of well-rounded citizens, against students’ attainment of key disciplinary knowledge
- **Department lead for implementation of innovative “3-11” Calendar (*Augustana Calendar*), unique in Canada, Department of Science, University of Alberta (2016-2018):**
Each of the two 14-week semesters is divided into two sections:
 - 3-week block (students take only 1 course; ‘S’ (September) and ‘J’ (January) blocks)
 - 11-week term (students take 4 courses)
 The 3-week blocks facilitate field trips, field courses, trips abroad, internships, *First-year Seminar*, lab-based science courses for non-science majors, and other modern forms of pedagogy and instruction; the *First-year Seminar* helps students transition from high-school to university, while forming cohorts, and assessing and building their academic skills.
- **Introduction of academic mentorship program for 1st-year physics students, NTNU (2014-2015)** (see “Leadership Training and Experience” above for details)
- **Program development at UOIT (2004-2007):**
 - BSc Medical Physics
Developed solely by myself, including program map and all courses
 - MSc and PhD Modelling and Computational Science
Developed jointly with fellow faculty members; highly successful, interdisciplinary graduate program, spanning applied mathematics, computing science, computational chemistry and computational physics
 - MSc and PhD Materials Science
Developed jointly with fellow faculty members at UOIT and Trent University; joint program offered by UOIT and Trent University, facilitated by high-performance computing facilities, including top-notch teleconference facilities for remote teaching
 All programs required approval by Ontario’s Postsecondary Education Quality Assessment Board.

IT and Teaching

- Member, PHRT Sub-Committee on Academic Issues (**planning committee for online course delivery for the fall 2020 semester**), university-wide committee (2020)
- Presenter, *Transitioning to Online Delivery at the University of Alberta: Main Challenges and Opportunities*, Int. Online Discussion: New Opportunities in Digital Teaching, RWTH Aachen, attendees from RWTH Aachen, University of Alberta, Tsinghua University, IIT Madras (July 2020)
- **Principal investigator of the nationally-funded project** *Creating a computational-physics online platform with IPython Notebook*, Norway (2015-2016)
 - Main outcome: **creation of computational-physics web site** www.numfys.net
The web site was created by undergraduate student assistants, funded externally. It is used, and built further, by NTNU faculty members and students for courses in physics, mathematics and engineering, and it has become a major cross-departmental and cross-faculty educational initiative at NTNU. It employs the unique features of IPython/Jupyter Notebook, and combines LaTeX and executable Python code into a single web site for learning purposes (open source).
- **IT in Education (IKTiSU) projects at NTNU** (2012, 2014), involving Matlab and IPython Notebook
- Introduction of computational physics and numerical methods into most of my courses, including homework problems, projects, and final exam questions
- Extensive experience with online learning platforms (WebCT, It's Learning, Moodle), web-based tools (online lecture notes, PhET, videos) and tablet computer use in the classroom
- Joined **UOIT** in 2004, **Canada's first university with a full-fledged laptop program for both faculty and students**, in its second year of operation; active engagement in developing new pedagogical approaches to teaching by use of technology and discussing the limitations of such technologies; gained valuable experience with the establishing of a new academic institution

Classroom Experience

- Significant teaching experience at the undergraduate and graduate level, covering small (< 20 students), medium-sized (20-50 students) and large courses (50-250 students)
- Use of tablet PC as teaching tool and online lecture notes ("skeleton" versions posted before class, completed notes posted immediately after class) since 2004
- Student evaluations typically very good/excellent
- Courses taught:
 - Calculus II
 - Calculus III
 - Ordinary Differential Equations
 - Mathematical Ecology and Dynamical Systems
 - Numerical Methods
 - Mathematical Modelling
 - Physics I
 - Physics II
 - Mechanics I
 - Mechanics II (Lagrangian and Hamiltonian Mechanics)
 - Quantum Mechanics I
 - Quantum Mechanics II
 - Fluid Mechanics
 - Physics and Geophysics
 - Introductory Environment Science
 - Introductory Energy Science
 - Emerging Energy Technologies
 - Hydrogen-based Energy Systems and Fuel Cells
 - Science in Context
 - History of Mathematics and Physics

- Guest lectures:
 - *Mapping the World*, AIDS 101 – First-year Seminar, University of Alberta, Fall 2018
 - *The Nature of Fundamental Laws of Nature: Minimization, Symmetry, Covariance*, AUPHI 365 – Aesthetics, University of Alberta, Winter 2019

Favourite Teacher at Present

Professor Leonard Susskind

Stanford University

Online Lecture Series *“The Theoretical Minimum”*

<http://theoreticalminimum.com>

Public Engagement in Science, Citizen Science

- ***Beyond the Imitation Game***

From Alan Turing & Bletchley Park to James Bond & Quantum Encryption

“Discover the remarkable story of the Enigma machine, a device invented in 1918 that would encrypt the most secret communications in Hitler’s Germany. Learn about the machine’s inner workings, the code-breaking efforts of Alan Turing, the crucial role of pinch raids, the ties to modern encryption technology, and what Canada and James Bond have to do with it all. Witness an on-stage Enigma machine and demonstration, and engage in an in-depth question and answer period.”

Series of public presentations in Norway (Trondheim, Oslo), Canada (Edmonton, Calgary, Camrose, Kingston, Waterloo, Oshawa, Vancouver) and Germany (Versmold, Bielefeld), displaying an original German Enigma machine from WWII (2015-); on-campus and off-campus events; solo and joint (with intelligence expert and historians) performances; over 2700 attendees to-date

2015-2017:

- February 2015, Dokkhuset, Trondheim, Norway (\approx 250 attendees)
- March 2015, Statoil R&D Centre - Rotvoll, Trondheim, Norway
- March 2015, Delta Jubileum, NTNU, Norway
- March 2015, Gloeshaugen Akademiske Klubb, NTNU, Norway
- April 2015, Microsoft, Trondheim, Norway
- May 2015, Deichmanske Bibliotek (public library - main branch), Oslo, Norway
- March 2016, High-school Event, Loughheed Performing Arts Centre, Camrose, Canada
- March 2016, Loughheed Performing Arts Centre, Camrose, Canada
- March 2016, The Military Museums of Calgary, Canada
- August 2016, Telus World of Science - Edmonton, Canada
- December 2016, “For Our Soldiers”, Military Comm. & Electronics Museum, Kingston, Canada
- December 2016, Military Comm. & Electronics Museum, Kingston, Canada
- September 2017, CJD Gymnasium, Versmold, Germany
- November 2017, The Military Museums of Calgary, Canada

2018 (Enigma Centennial):

- February 2018 (Enigma Centennial), Bridges Series, St. Jerome's University, Waterloo, Canada; with [David O’Keefe](#) and Richard Brisson
- March 2018, UOIT, Oshawa, Canada
- March 2018, Regent Theater, Oshawa, Canada
- May 2018, Calgary Knights of the Round Table, Calgary, Canada
- June 2018, Simon Fraser University, Burnaby, Canada
- October 2018, The Military Museums of Calgary, Canada (with David O’Keefe)
- October 2018, University of Alberta, Edmonton, Canada (with David O’Keefe) (500 attendees, sold out; plus over 3,000 live streams across Canada and internationally)

2019:

- April 2019, Keynote Speaker, Student Science Conference, Red Deer College, Canada
- May 2019, Keynote Speaker, International Week, FH Bielefeld, Germany

2020:

- July 2020 (invited), The Military Museums of Calgary, Canada (with David O'Keefe), postponed due to COVID-19
- July 2020 (invited), Michael J Fox Theatre, Burnaby, Canada; with David O'Keefe and [Ted Barris](#), postponed due to COVID-19

- **Crypto Challenge** (2019-2020), co-initiator, <https://ualberta-crypto.netlify.com>
Cryptography challenge between two undergraduate student teams, one located at the Augustana Campus and one located at the Edmonton (North) Campus of the University of Alberta; rules and challenge entirely determined and agreed upon by students
- **"Human Physics"** experiment at 2018 Grade 7 Augustana Science Fair, involving all participants simultaneously; simulating visually the Gambler's Ruin problem or, equivalently, asymmetric diffusion by use of overhead camera (≈ 200 attendees)
(for details, see [personal web site](#))
- **Beakerhead 2017**
 - "Up Against All Odds" (Gambler's Ruin Problem): design and creation of interactive, outdoor arts & science installation in downtown Calgary, involving about 1,200 players over four days, September 2017
 - "[7 Wonderers](#)" at the National Music Centre - Studio Bell, Calgary: seven scientists perform on stage for seven minutes each, each finishing with a musical performance (my part: "Major Tom" by Peter Schilling), two-hour event, September 2017
 - Invited participant, "Beakerhead SciComm" workshop hosted by Jay Ingram (host of "Daily Planet", Discovery Channel), Banff Science Communications Program, Banff Center, Canada, June 2017
- **Science Fair**, University of Alberta, Augustana Campus (2016-)
Science fair for approx. 200 grade 7 students in Camrose and surroundings; participants are mentored by Augustana science students through regular school visits (≈ 200 participants)
- **Books**
 1. *Endliche Welt, unendliches Geld – Das wahre Dilemma der Nachhaltigkeit*, (German; *Finite World, Infinite Money – Sustainability's Real Dilemma*), oekom verlag, 2016, paperback, 188 pages, ISBN: 978-3-86581-803-4
 2. *The Finite Planet – How Resource Scarcity Will Affect Our Environment, Economy and Energy Supply*, CreateSpace, 2011, ebook & paperback, 173 pages, ISBN: 1466320435
- Online **"Thought Experiment: Falling Objects"**
Creative combination of 'common sense' and sketching of physical circumstances to argue why all objects accelerate equally fast within a uniform gravitational field; collaborative project with a computer scientist and an artist
(for details, see [personal web site](#))
- **"The 2015 Nobel Prizes - explained in 15 minute bites"** (now an annual event)
Lunch & Learn Series (organizer), University of Alberta – Augustana Campus
 - Physics and Chemistry, October 2015
 - Peace and Physiology/Medicine, November 2015
 - Economic Sciences (Riksbank Prize) and Literature, December 2015

- Two **TEDx** talks (TEDxUOIT and TEDxTrondheim)
 - *"Probing the universe"*, The Unseen, 3rd Annual TEDxTrondheim Conference, October 2014, Trondheim, Norway
 - *"Resource scarcity: Sustainability by default?"*, TEDxUOIT, January 2011, Oshawa, Canada
- **Director, Durham Regional Science Fair**, April 2006, UOIT, Canada
- **Over 40 media contributions** in local, provincial and national print media, and on radio and television, involving energy and science policy issues, and the Enigma story
 - Print: NextWave - Science Magazine, Toronto Star, Council of Ontario Universities, Durham Trade and Commerce, Oshawa This Week, Artsforum, Adressavisen, Camrose Booster, Camrose Canadian, Metro News
 - Radio: CBC, KX96, AM 980, CHED
 - Television: CBC, Global TV, Rogers TV, CHEX TV, I-Channel, VG TV

Selection:

 - CBC Radio Active (radio): "Beyond the Imitation Game", October 22nd, 2018
 - Camrose Booster & University of Alberta's *Folio* Newsletter: "Stephen Hawking: 1942-2018", April 10th, 2018
 - Camrose Booster: "Nobel prizes are a bridge between science and society" [The 2017 Nobel prizes in science] (with Sheryl Gares - main author), February 13th, 2018
 - Camrose Booster: "Making waves - A hundred years later" (Physics Nobel Prize: Gravitational Waves), March 15th, 2016
 - Global TV Edmonton - Morning Show: "The Enigma story", March 10th, 2016
 - VG TV: "Enigma maskinen", May 1st, 2015
 - Oshawa This Week: "Toyota helps university's research efforts", March 18th, 2009
 - Council of Ontario Universities: "A sampling of 2005-2006 success stories of federal and provincial investment in university research", p.112, May 2nd, 2006
 - NextWave - Science Magazine: "Modeling a Career: Industrial Internships for Mathematicians", September 22nd, 2005
- Speaker at several academic, public and corporate events on energy and science policy issues

Selection:

 - Presentation: "Scientific challenges of the renewable energy transition", Brown Bag Seminar, July 2011, German Institute of Economic Research, Berlin, Germany
 - Panelist: "The future of the car", Cleantech Breakfast Series, Ogilvy Renault, May 2009, MaRS Centre, Toronto, Canada
 - Panelist: "Hydrogen infrastructure: Production, distribution and usage in a hydrogen-fuelled world", Critical Energy Choices Conference 2007, September 2007, MaRS Centre, Toronto
 - Presentation: "Faculty of Science, UOIT: Energy research and initiatives", presented to Stephen Harper (MP) and Jim Flaherty (MPP), August 25th, 2005, UOIT, Canada

Personal Interests

- History of physics and mathematics
- World history of the 20th century
- Languages
- Classical music
- Road biking, football (soccer), skiing (downhill, Telemark, cross country), hiking

August 26th, 2020