THIERRY BOTTER

2121 Spaulding Avenue ● Berkeley, CA 94703 ● C : 510-684-2524 H : 510-931-6226
thierry.botter@gmail.com **Citizenship : Canada, France**

EDUCATION

Ph.D. **University of California, Berkeley**, *Physics* 2007-present

Institut d'Optique Graduate School (Palaiseau, France), *Physics* 2006-2007
Research Intern: Laser development for a cold-atom experiment

M.S. **University of Illinois at Urbana-Champaign**, *Aerospace Engineering* 2004-2006

B.Sc. **Queen's University (Kingston, ON, Canada)**, *Engineering Physics* 2000-2004
Degree included a specialization in mechanical engineering

SUMMARY

Areas of interest: Optics and photonics; atomic physics; advanced sensor technologies

Strengths

- Experience in developing and integrating advanced optical and electronic systems
- Broad experience in providing experimental solutions to complex, cutting-edge problems
- Strong background in both experimental physics and aerospace engineering
- Excellent analytical and creative-thinking skills; able to quickly learn and acquire new skills
- Strong teamwork and leadership skills; effective contributor in collaborative environments

EXPERIENCE

Doctoral Research: Optomechanics, *University of California, Berkeley* 2007-present

- Conducted world-leading experimental research on cavity-based light-matter interactions
- Engineered a high-gain low-power optical parametric amplifier (20 dB with 40 pW pump)
- Created high-resolution magnetic and mechanical resonance imaging systems for atoms
- Developed a quantum-sensitive thermometer and bolometer for mechanical oscillators
- First to observe various quantum effects, including mechanically induced optical squeezing, zero-point motion of 2000+ atoms, and quantum non-demolition MRI

Assistant Researcher: BEC and Atomic Interferometry, *Observatoire de Paris* 2006

- 12-month internship on European-funded project: quantum optics with low-power lasers
- Developed 3 extended-cavity diode laser setups and feedback-control electronics

Master's Thesis: Solar Sail Dynamics and Control, *U. of Illinois at U.-C.* 2004-2006

- Simulated pitch dynamics of a passively stabilized, space-bound solar sail design
- Project funded by the *National Aeronautics and Space Administration (NASA)*
- Participated in student-led micro-satellite project designed for space-based research

Research & Development Assistant, *Sudbury Neutrino Observatory* 2003

- 4-month internship at world-renowned neutrino observatory
- Evaluated properties of defective optical fibers to improve calibration data

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TECHNICAL SKILLS & KNOWLEDGE

Optics

- Development of stabilized diode lasers, including narrow-linewidth designs (< 100 kHz)
- Design and construction of high-precision interferometers (< 1 nm resolution)
- Fabrication of a high-finesse (> 10,000) optical cavity
- Low-power photodetection (1 pW – 1 mW): optical homodyne and heterodyne, SPCM
- Familiarity with various image sensor technologies, including CCD and CMOS cameras
- Optical spectrum analysis; beam characterization, including experience with DataRay
- Optical modulators and amplifiers, and non-linear optics (SHG and OPA)

Control Systems

- Optical feedback and feedforward schemes for amplitude, frequency and phase control
- Designing analog and digital PID loop, including high-bandwidth loops (> 1 MHz)
- Referencing and locking separate frequencies, from RF to optical frequencies

Electronics

- Development of high-speed, high-bandwidth analog controllers
- General RF components (amplifiers, switches, phase detectors, oscillators, couplers, ect.)
- Spectrum and network analyzers; signal and function generators

Mechanical

- UHV, cryogenics; mechanical design: AutoCAD, SolidWorks

Software

- Data acquisition and analysis: Maple, Mathematica, MATLAB/Simulink, Igor, LabVIEW
- Programming: Java, C

SELECTED SCHOLARSHIPS & AWARDS

Doctoral Research Scholarship, *FQRNT – Quebec Government* 2007-2010

- Competitive funding for best doctoral candidates in science and engineering ($60,000 total)

Marie Curie Research Training Network Fellowship, *European Union* 2006

- Fellowship funds selected researchers on leading European projects (€24,000 total)

NSERC Postgraduate Scholarship, *National Science & Engineering Council* 2004-2006

- Scholarship supports top-ranked Canadian graduates; less than 100 are tenable abroad ($34,600 total)

NSERC Postgraduate Scholarship Supplement, *Canadian Space Agency* 2004-2006

- Earned competitive supplement for research in aerospace engineering ($11,534 total)

JDS Uniphase Undergraduate Scholarship, *Queen's University* 2001-2004

- Scholarship awarded to top engineering physics candidate ($15,000 total)

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SCHOLARLY DEVELOPMENT

Publications

- D. W.C. Brooks, T. Botter, N. Brahms, T.P. Purdy, S. Schreppler, D.M. Stamper-Kurn, "Nonclassical light generated by quantum-noise-driven cavity optomechanics," **Nature** *Vol. 488,* 476-480 (2012)
- T. Botter, D.W.C. Brooks, N. Brahms, S. Schreppler, D.M. Stamper-Kurn, "Linear Amplifier Model for Optomechanical Systems," **Phys. Rev. A** *85*, 013812 (2012)
- N. Brahms, T. Botter, S. Schreppler, D.W.C. Brooks, D.M. Stamper-Kurn, "Optical detection of the quantization of collective atomic motion," **Phys. Rev. Lett.** *108*, 133601 (2012)
- N. Brahms, T.P. Purdy, D.W.C. Brooks, T. Botter, D.M. Stamper-Kurn, "Cavity-aided magnetic resonance microscopy of atomic transport in optical lattices," **Nature Physics** *7*, 604-607 (2011)
- T.P. Purdy, D.W.C. Brooks, T. Botter, N. Brahms, Z.-Y. Ma, D.M. Stamper-Kurn, "Tunable cavity optomechanics with ultracold atoms," **Phys. Rev. Lett.** *105*, 133602 (2010)
- T. Botter, V.L. Coverstone, R.L. Burton, "Structural dynamics of spin-stabilized solar sails with applications to ultrasail," **Journal of Guidance Control and Dynamics** *Vol 31 No. 2*, 402-413 (2008)

Talks & Presentations

- Presented graduate work at 6 different conferences, including an invitation-only talk at an international meeting (Monte Verità, Switzerland)

PH.D. THESIS DESCRIPTION

My Ph.D. thesis has focused on the strong interactions between individual photons and a cloud of ultracold atoms inside a high-finesse optical cavity. The interaction gives rise to an optomechanical coupling, where the collective, center-of-mass motion of the atoms forms the mechanical element. My experimental work has led to many key findings, such as the observation of mechanically induced optical squeezing (published in *Nature*) and of zero-point motion from an ensemble of 2000+ atoms (published in *Phys. Rev. Lett.*), and the development of a sub-micron-resolution magnetic resonance imaging technique for trapped atoms (published in *Nature Physics*).

As part of this work, I have designed and constructed a number of sophisticated experimental tools. Examples include a heterodyne detector for picowatt-level optical signals, a high-finesse optical cavity and a stabilized laser-diode system with sub-hundred-kilohertz linewidth. Many of these realizations have required careful, intricate integration of electronic controls and optical signals. Normal operating conditions required as many as 15-nested feedback loops to function simultaneously and in unison. Several additional experimental challenges characterized my research, such as fine-tuning magnetic fields and optical properties to collect, cool and prepare the atomic cloud, producing and maintaining ultra-high vacuum in our experimental chamber, and carefully selecting reliable data out of the thousands of consecutive data records to yield a single, averaged result.