ROBERT A. MCLEOD

Center for Cellular Imaging and NanoAnalytics
WRO-1058
CH 4058 Basel
e-mail: robbmcleod@gmail.com
cell: +41.76.494.49.94
www: entropyproduction.blogspot.ca/p/highlights.html
www.researchgate.net/profile/Robert_Mcleod5/

Biozentrum, Universität Basel
Mattenstrasse 26

work: +41.61.387.32.25

ACADEMIC EXPERIENCE

Post-doctorate – March 2015 – present
Center for Cellular Imaging and NanoAnalytics, Biozentrum, Universität Basel
Project: Resolution limitations in single-particle reconstruction of proteins
Supervisor: Henning Stahlberg

Post-doctorate – June 2013 – February 2015
Fondation Nanosciences (NSF) and
Institute Nanosciences et Cryogènie, CEA, Grenoble France
Project: Chaire d'Excellence project: 3D coherent diffractive imaging
Supervisors: Jean-Luc Rouviere, Jian-Min Zuo

Ph.D. – Physics – Jan 2006 – May 2013
University of Alberta, Department of Physics, Canada
Thesis: Quantitative Phase Retrieval in the Transmission Electron Microscope
Supervisors: Marek Malac, Ray Egerton, Mark Freeman

M.A.Sc. – Mechanical Engineering – Jan 2004 – Dec 2005
University of Victoria, Department of Mechanical Engineering, Canada
Thesis: Development of Confocal Optical Holographic Microscopy
Supervisor: Rodney Herring

B.Sc. – Physics & Computer Science – Sept 1996 – April 2001
University of Victoria, Department of Physics, Canada

RESEARCH SUMMARY

C-CINA, Unibas Post-doctorate Research

- Project goal is to understand why single-particle or nanocrystalline reconstructions of biological molecules (i.e. proteins) tend to not exceed 3.0 Å resolution, and push resolution down to 2.0 Å. Working on image artifacts from ice crystallites, instrument automation to collect 10^5 particle sets, possible limitations from the weak phase object approximation / central projection theorem.
- Collaboration with Jan Pieter Abrahams MeV coherent electron diffraction project at the Paul Scherrer Institute free electron laser facility.

CEA Post-doctorate Research

- Main project was a chaire d'excellence project for Fondation Nanosciences (NSF) held by Jian-Min Zuo (Illinois at Champaign) to compare electron and x-ray based coherent diffractive imaging (CDI) methods. In collaboration with researchers at European Synchrotron Radiation Facility (ESRF).
- Collaboration on David Cooper's single atom dopant detection project (ERC). Project aims to characterize nanoscale-effects of single dopants in semiconductors, by STEM and electron holography. Reached phase error of $2\pi/3000$ on MoS_2 at atomic resolution, which is better than the expected phase shift from a dopant's ion core. Correction of first order aberration drift during series.
- Collaboration with Marco Beleggia at Denmark Technical University to understand mechanics of charging dynamics by secondary electron emission. Project utilizes time-series electron holograms to measure the dynamic evolution of electric charge with time on (semi-)insulating specimens. Potential applications are mitigation of charging for phase imaging and with Zernike phase plates.
- Collaboration with M. ven Hertog on correlated microscopy (cathodoluminescence and in-situ biasing of ZnO nanowire characterized with electron holography). Currently working on modeling to determine whether ZnO nanowire acts as a bulk, surface, or facet edge conductor.
- Experience on double corrected, monochromated FEI Titan Ultimate TEM (~ 900 hours) and Python scripting language for instrument automation. Developed software such as control over ptychography and precession diffraction, and automatic determination of crystal axis orientation. Wrote STEM series software that greatly ameliorates scan error problems.

Ph.D. Research

- Thesis on quantitative phase retrieval (i.e. characterization of electric and magnetic fields) in the transmission electron microscope. Primary work on developing instrumentation: hardware, software, and techniques to make a better microscope. Often consulted by electron microscopy group staff to help solve problems.
- Summation of hologram series at high-resolution. Improves phase error by an order of magnitude (0.006 rad or $2\pi/1050$) with no loss of spatial resolution. Measurement of object phase error shows quantitative agreement with prediction.
- Quantitative metric to measure contrast in electron holograms. Provides third component signal for electron holography. Demonstrated utility of local visibility for image processing.
- Method of characterizing detector MTF by holographic fringes. Characterization of incomplete read-out of CCD and resulting low-frequency bias. Means to collect low-noise dark reference and advice for gain references to avoid correlated artifacts.
- Scripted remote control of TEM and Gatan peripherals via TCP/IP from a Matlab interface. Scripted interface became a successful commercial product for Hitachi (Maestro).
- Side-projects: measurement of how quiescence of laboratory space affects the TEM, assisted in design, fabrication, and conducted testing of high-speed mechanical shutter. Skilled in specimen preparation, including cross-sections, use of ion mills, evaporators, and sputtering systems. Knowledge of vacuum systems and good practical habits for maintaining instruments.
- Trained on Hitachi HF-3300 TEM (~3000 hours), JEOL 2200FS TEM, and Hitachi S-5500 and S-4800 SEM.

M.A.Sc. Research

- Designed for a large optical tabletop prototype of a confocal scanning holographic microscope. Utilized Zemax and Pro/Engineer CAD for design and optimization of optical and opto-mechanical components. Procured over 500 optical components (table, optics, opto-mechanical parts, lasers, cameras) from vendors.

PROFESSIONAL WORK EXPERIENCE

General Manager – PTD Technologies Inc. – Jan - Nov 2002

- Researched potential of electrical analog for human muscular tissue electrophysiology. Developed software package that conducted analog input/output functions through a data acquisition card. Investigated new modality for counterpulsation, a non-invasive agina therapy. Supervised co-op student. Assisted with grant applications. Reference available upon request.
  Supervisors: Prof. (emeriti) Geoffrey Voss, and Prof. George Beer

Contractor – Tactex Controls Inc. – Jan - Mar 2003

- Hired to research potential of proprietary Kinotex pressure sensor for a biomedical application. Developed theoretical model for Kinotex operation and analyzed potential for stochastic simulation. Developed new modality of sensor.

TEACHING EXPERIENCE

- Physics 126 – Introduction to Physics II, Teaching Assistant, Winter 2008
- Physics 124 – Introduction to Physics I, Teaching Assistant, Fall 2007
- Mechanical Engineering 240 – Thermodynamics, Teaching Assistant, Winter 2005
- Mechanical Engineering 285–Properties of Materials, Teaching Assistant, Summer 2005
- Mechanical Engineering 240 – Thermodynamics, Teaching Assistant, Winter 2004
- Mechanical Engineering 420 – Instrumentation, Teaching Assistant, Summer 2004

VOLUNTEER EXPERIENCE

Extreme Science Outreach – Faculty of Graduate Studies and Research – 2012

- Outreach presentation on 'Extreme Nanotechnology' to high-schools in Canada and USA over webcast.

Trip Leader – University of Alberta Outdoors Club – 2011-2013

- Organized and lead numerous backcountry skiing and hiking trips.
- Certified in Avalanche Safety Training, Wilderness First Aid, and Alpine Club of Canada Ski Touring Leadership.
- Assisted negotiations with Campus Recreation and Office of Risk Management. Wrote official communications.

Coach, Equipment Manager – United Alberta Paddling Society – 2009-2012

- Certified NCCP level 1 kayak instructor. Lead instructor Beginner Kayaking and Roll Clinic courses. Lead on-the-river beginner groups, advanced river runs, and organized numerous events.

Vice President – Graduate Physics Student Association – 2011

- Assisted president in organization of graduate student symposium, including inviting a guest seminar speaker (Prof. David Griffiths).

PEER REVIEWED PUBLICATIONS

[1] R.F. Egerton, R.A. McLeod, M. Malac, Validity of the dipole approximation in TEM-EELS studies, Microscopy Research and Technique, 77 (2014) 773-778.

[2] R.A. McLeod, M. Bergen, M. Malac, Phase Measurement Error in Summation of Electron Holography Series, Ultramicroscopy 141 (2014) 38-50.

[3] R.A. McLeod, M. Kupsta, M. Malac, Determination of Localized Visibility in Off-axis Electron Holography, Ultramicroscopy, 138 (2014) 4-12.

[4] R.A. McLeod, M. Malac, Characterization of Detector Modulation-transfer Function via Noise, Edge, and Holographic Methods, Ultramicroscopy 129 (2013) 42-52.

[5] R.F. Egerton, R. McLeod, F. Wang, M. Malac, Basic questions related to electron-induced sputtering in the TEM, Ultramicroscopy, 110 (2010) 991-997.

[6] F. Wang, R.F. Egerton, M. Malac, R.A. Mcleod, M.S. Moreno, The spatial resolution of electron energy loss and x-ray absorption fine structure, Journal of Applied Physics, 104 (2008) 034906.

[7] S. Lai, R.A. McLeod, D. Laurin, S. Atalick, R.A. Herring, An algorithm for 3-D refractive index measurement in holographic confocal microscopy, Ultramicroscopy, 107 (2007) 196-201.

[8] P. Jacquemin, D. Laurin, S. Atalick, R. McLeod, S. Lai, R.A. Herring, Non-intrusive, Three-Dimensional Temperature and Composition Measurements inside Fluid-Cells in Microgravity using a Confocal Holography Microscope, Acta Astronautica, 60 (2007) 723-727.

[9] R.A. McLeod, Development of Confocal Optical Holographic Microscopy, in: Department of Mechanical Engineering, University of Victoria, Victoria, 2005.

[10] P. Jacquemin, R. McLeod, D. Laurin, S. Lai, R.A. Herring, Design of a Confocal Holography Microscope for Three-dimensional Temperature and Compositional Measurements of Fluids in Microgravity, Journal of Microgravity Sciences & Technology, 17 (2005) 36-40.

CONFERENCE PROCEEDINGS

[1] R.A. McLeod, M. Beleggia, M. Malac, Specimen charging measured by off-axis electron holography, International Microscopy Conference 2014, Prague. IT-11-P-1954: 1042.

[2] R.A. McLeod, J-L. Rouviere, J-M. Zuo, Illumination wavefront determination by image and diffraction focal series, International Microscopy Conference 2014, Prague. IT-9-P-2743: 876.

[3] B. Mayall, R.A. McLeod, D. Cooper, Optimisation of spatial and phase resolution of off-axis electron holography for detection of single dopant atoms, International Microscopy Conference 2014, Prague. IT-11-P-2111: 1046.

[4] D. Cooper, B. Mayall, R.A. McLeod, R. Dunin-Borkowski, The detection of single dopant atoms by off-axis electron holography, International Microscopy Conference 2014, Prague. IT-2-O-2611: 232.

[5] M. Bergen, R.A. McLeod, M. Malac, D. Hoyle, Y. Taniguchi, T. Yaguchi, J. Chen, T. Yotsuji, Centralized Instrument Control for a TEM Laboratory, Microscopy and Microanalysis, 19 (2013) 1394-1395.

[6] M. Malac, R.A. McLeod, Y. Taniguchi, M. Bergen, D. Hoyle, Evaluating long-term stability and transient disturbances of a TEM, Microscopy and Microanalysis, 19 (2013), 1202-1203.
[7] R.A. McLeod, M. Malac, Two-step Deconvolution in Electron Energy-loss Spectroscopy on hBN K-edge, Microscopy and Microanalysis, 18 (2012) 1034-1035.
[8] R.A. McLeod, M. Bergen, M. Malac, Technique for Complex Averaging of Electron Holograms, Microscopy and Microanalysis, 17 (2011) 918-919.
[9] R.A. McLeod, M. Malac, Determination of Camera Modulation-Transfer Function by Electron Holography, Microscopy and Microanalysis, 16 (2010) 140-141.
[10] M. Malac, R.A. McLeod, P. Li, W.C. Bigelow, J.Y. Howe, L.F. Allard, Y. Taniguchi, M.S. Moreno, Fast mechanical shutter in Hitachi HF 3300, a 60 kV to 300 kV TEM, Microscopy and Microanalysis, 16 (2010) 338-339.
[11] R. McLeod, M. Malac, Technique for Fitting Complex Probes in Nano-Beam Diffraction, Microscopy and Microanalysis, 15 (2009) 768-769.
[12] R. Egerton, F. Wang, R. McLeod, M. Malac, Basic Questions Related to Electron-Induced Sputtering, Microscopy and Microanalysis, 15 (2009) 1356-1357.
[13] R.A. McLeod, M. Malac, Evaluating Visibility and Spatial Resolution in Electron Holography, Microscopy and Microanalysis, 14 (2008) 854-855.
[14] R.A. McLeod, M. Malac, Towards quantitative electron holography: precision in specimen thickness dependence removal. in: Microscopical Society of Canada 34th Annual Meeting, Edmonton, AB, 2007.
[15] R.A. McLeod, P. Jacquemin, S. Lai, R.A. Herring, Confocal Holography: Improved Resolution Through Object Scanning, Microscopy and Microanalysis, 11 (2005) 784-785.
[16] R. McLeod, P. Jacquemin, D. Laurin, R.A. Herring, A Viable Confocal Holography Microscope and Method for High-Level Research Measurements, Microscopy and Microanalysis, 10 (2004) 1246-1247.

NON-REFEREED PUBLICATIONS

[1] R.A. McLeod, M. Malac, Electron Holography, History and Practice, The Bulletin of the Microscopical Society of Canada, 38 (2010) 7-9.
[2] R.A. McLeod, DM3 Import for Gatan Digital Micrograph, in, 2010: www.mathworks.com/matlabcentral/fileexchange/29351-dm3-import-for-gatan-digital-micrograph
[3] R.A. McLeod, P. Jacquemin, S. Lai, R.A. Herring, Confocal Holography: A Tool for Non-invasive Internal Measurement, Microscopy Today, 13 (2005) 30-31.