

Curriculum Vitae

MIHAI R. GHERASE

Assistant Professor of Biomedical Physics
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EDUCATION

2001-2006	Ph.D. in Physics, Medical Physics program (CAMPEP in 2010), Carleton University, Ottawa, ON, Canada.
1999-2001	M.Sc. in Medical Physics, University of Bucharest, Romania.
1995-1999	B.Sc. in Physics, University of Bucharest, Romania.

CITIZENSHIP Canadian and Romanian

AWARDS

1995-1999	Undergraduate scholarships, University of Bucharest
2001-2006	Graduate scholarships, Carleton University

PROFESSIONAL SOCIETIES

- Canadian Association of Physicists (CAP)
- American Association of Physicists in Medicine (AAPM)
- Canadian Organization of Medical Physicists (COMP)
- American Physical Society (APS)

RESEARCH

2014-2015 **Assistant Professor of Biomedical Physics** within the Department of Physics at the California State University, Fresno.

- Established a microbeam x-ray fluorescence laboratory (XRF)
- Measurements of the x-ray beam size as a function of the photon energy were performed using two methods: (i) scanning x-ray fluorescence, and (ii) knife-edge. The results and comparison were summarized and discussed in a manuscript submitted to the journal *Nuclear Instruments and Methods in Physics Research B* (NIMB-S-15-00663)
- Two additional x-ray beam energy-dependent measurements: angular divergence and focal distance were included in a poster presentation at the 2015 Annual Meeting of the Far West Section of the American Physical Society, Oct. 29-31, 2015, Long Beach, CA

2006-2013 **Postdoctoral Fellow** in the XRF lab. Work involved three experimental setups: Si(Li) detector with a Cd-109 radioactive source as the excitation beam, a commercial XRF system which is based on a miniature field-emission tungsten x-ray tube and a silicon PiN diode detector, and a TLD reader Harshaw 3500 with dosimeter chips. Research work was mainly focused on *in vivo* detection of arsenic and selenium in the human body using XRF methods. Main research accomplishments include:

- Work at the Canadian Light Source in Saskatoon, Canada, October 5-10, 2012. The study focused on determining the chemical speciation of arsenic in human nails. The XANES (X-ray Absorption Near-Edge Spectroscopy) capabilities of the Hard X-ray Micro Analysis (HXMA) beamline was used.
- Research at the Canadian Light Source in Saskatoon, Canada, June 5-8, 2012. The study involved the measurements of the microscopic distribution of arsenic in human nails. The microbeam capabilities of the HXMA beamline were used. The manuscript was published in the journal *Physiological Measurement* **34**:1163-1177 (2013).
- Study of x-ray fluorescence detection of arsenic and selenium in 300 human nail samples. The samples were collected from households in rural areas with known high concentration of arsenic in the consumed well-water. The calibration work was presented at the 8th International Topical Meeting

on Industrial Radiation and Radioisotope Measurement Applications (IRRMA-8) which was held from 26 June-1 July 2011 in Kansas City, MO, US

- Development of a calibration method for depth-dependent elemental concentration samples using layered calibration method. Publication: *Nuclear Instruments and Methods In Physics Research Section B* **269**:1150-1156 (2011)
- Work towards developing an XRF system based on a commercial miniature x-ray tube for *in vivo* measurements of arsenic in skin. Publications: (1) *Physics in Medicine and Biology* **52**: N459-465 (2007), (2) *Applied Radiation and Isotopes* **68**: 743-745 (2010)
- Dosimetry study of our portable x-ray spectrometer using thermoluminescent dosimeters (TLDs). Publication: *Physics in Medicine and Biology* **55**:5499-5514 (2010)
- Development of a human nail phantom designed to estimate detectability of arsenic and selenium using a portable x-ray spectrometer. Publication: *Physics in Medicine and Biology* **55**:N151-159 (2010)
- Derivation of an analytical model that can be used for the analysis of XRF spectra for samples presenting depth-dependent concentration. Publication: *Applied Radiation and Isotopes* **67**:50-54 (2009)
- Modelling work towards an optimal K_{α} XRF detection geometry of arsenic in skin using an extended Fundamental Parameter Method. Publication: *X-ray Spectrometry* **38**:513-518 (2009)
- Fundamental Parameter Method model to estimate arsenic concentration in skin phantoms from the experimental x-ray spectra. Publication: *X-ray spectrometry* **37**:482-489 (2008)
- Synchrotron work at the Canadian Light Source in November 2008. The project involved experiments towards validating a technique to measure arsenic concentrations for homogeneous and depth-dependent skin phantoms using synchrotron radiation. Publication: *The Activity Report of Canadian Light Source 2008*
- Synchrotron Summer School at the Canadian Light Source facility. Visits of the facilities and lectures on various synchrotron research topics, Saskatoon, August 20-24, 2007

2001-2006 Research Assistant in the hyperpolarized xenon (H-Xe) Magnetic Resonance Imaging (MRI) laboratory from Carleton University (now at Imaging Research Laboratories from the Robarts Research Institute in London, Ontario). The research project involved work with a custom-built hyperpolarized ^{129}Xe (H-Xe) system. Research accomplishments include:

- Experimental work towards the development of H-Xe dissolved in a perfluorooctyl bromide (PFOB) emulsion as a Magnetic Resonance contrast agent for cancer detection. Using a radial diffusive exchange model and dynamic acquisition of NMR spectra flow measurements were demonstrated in a phantom-type experiment
- Experimental work comparing the NMR properties of H-Xe dissolved in PFOB and in alternative solvents (highly fluorinated sucrose polyesters) for potential applications. Publication: *Journal of Fluorine Chemistry* **125**:1457 (2004)
- Development of a radial two-compartment diffusive theoretical model which was used to analyze the diffusive exchange spectra of H-Xe dissolved in PFOB emulsion. Publication: *Journal of Chemical Physics* **125**:044906 (2006)

TEACHING

- 2014-2015** *Diagnostic X-ray Imaging Physics* (upper-division Medical Physics course)
Responsibilities: 3h lecture and 3h labs, preparation and marking of: (1) 6-7 assignments, (2) preparation of two midterm and one final exams, (3) lab manual and reports.
Topics: Fourier transforms, convolution, tomographic reconstruction principles, statistical distributions, x-ray production, x-ray imaging modalities.
Textbook: *The Essential Physics of Medical Imaging* J.T. Bushberg et al., Lippincott Williams & Wilkins, 3-rd ed., 2012
- 2014** *Mechanics and Wave Motion* (introductory classical mechanics course)

- Responsibilities: 3h lecture and 1h labs, preparation of three midterm and final exams, marking lab reports and lab quizzes.
 Topics: kinematics, dynamics, conservation of energy and momentum, collisions, rotational dynamics and kinematics, simple harmonic oscillations.
 Textbook: *Physics for Scientists and Engineers* by R.D. Knight, Pearson, 3-rd ed., 2013
- 2014** *General Physics II* (1-st year calculus-based undergraduate)
 Responsibilities: 6h lecture & supervising in-class activities, preparation of assignments using *Mastering Physics* software, preparing assignments' solutions, preparing and marking two midterm and final exams.
 Topics: Newtonian gravitation, rotational motion, static equilibrium, simple harmonic motion, electric and magnetic fields, special relativity, and cosmology.
- 2013** *Statistical Mechanics* (3-rd year undergraduate)
 Responsibilities: 3h lecture, preparation and marking of assignments, midterm and final exams.
 Topics: statistical definition of the entropy and temperature, Boltzmann distribution, thermal radiation and Planck distribution, chemical potential and Gibbs distribution, ideal gas, Fermi and Bose gases, Maxwell distribution.
 Textbook: *Thermal physics* by C. Kittel & H. Kroemer, Freeman, 2nd ed., NY, 2003.
- 2009-2012** *Data Acquisition and Analysis* (2-nd year undergraduate)
 Responsibilities: lab manual preparation, 3h lecture, 3h lab, preparation and marking of assignments, midterm and final exams.
 Topics: random and systematic uncertainties, Gauss and Poisson distributions, correlation coefficients, fitting methods, chi-squared test, Monte Carlo methods.
 Textbook: *An introduction to error analysis* by J.R. Taylor, University Science Books, 2nd ed., Sausalito, 1997.
- 2009-2012** *Methods of Mathematical Physics* (3-rd year undergraduate)
 Responsibilities: 3h lecture, 3h lab, preparation of assignments, midterm and final exams.
 Topics: linear algebra, vector calculus, Fourier transforms.
 Textbooks:
- *Essential Mathematical Methods for the Physical Sciences* by K.F. Riley & M.P. Hobson, Cambridge University Press, 1-st ed., Cambridge, 2011.
 - *Mathematical Methods for Physicists* by G.B. Arfken & H.J. Weber, 6-th ed., Academic Press, San Diego, 2005.
 - *Mathematical Methods for Physicists* by H.J. Weber & G.B. Arfken, 5-th ed., Academic Press, San Diego, 2004.
- 2008** *Statistical Mechanics* (3-rd year undergraduate)
 Responsibilities: 3h lecture, preparation and marking of assignments, midterm and final exams.
 Topics: thermodynamics review, entropy, canonical ensemble, identical particles, Maxwell distribution of molecular speeds, Planck's distribution, systems with variable number of particles, Fermi and Bose particles.
 Textbook: *Introductory statistical mechanics* by R. Bowley & M. Sanchez, Clarendon Press, 2-nd ed., Oxford, 1999.
- 2007** *Medical Physics* (4-th year undergraduate)
 Responsibilities: Guest lecturer for the Magnetic Resonance Imaging
- 2006** *Physics of the Living Body* (3-rd year undergraduate)
 Responsibilities: lab preparation, supervision and marking assignments
- 2001-2006** Teaching Assistant at Carleton University physics courses (10 semesters)
 Responsibilities: lab supervision, board problem solving, marking assignments, lab reports, lab exams, and written tests.

RESEARCH SUPERVISION

Co-supervision of the following students in their undergraduate research projects:

- Marc Vallee (2007-2008) M.Sc. degree in Medical Physics, McMaster University
- Isadel Eddy (2007-2008) High-school teacher, Massachusetts.
- Chris Roy (2009-2010) Ph.D. student in Medical Biophysics, University of Toronto.
- Joanna Mader (2009-2010) Ph.D. student in Medical Physics, University of Victoria.
- Kevin Alexander (2009-2011) M.Sc. student in Medical Physics, Queen's University
- Sarah Thomas (2011-2012) M.Sc. student in Community and Regional Planning, UBC
- John Groves (2012-2013) M.Sc. student in Mechanical Engineering, University of Guelph.

COMPUTATIONAL SKILLS

- C++ programming language: numerical algorithms and codes for research projects.
- *Origin* data analysis software: nonlinear curve fitting, data analysis, and plotting.
- *Microsoft Office* package: text editing, data analysis, and presentation.
- Operating systems: *Microsoft Windows* and *UNIX*.

PROFESSIONAL INVOLVEMENT

- Judge at the Canada-Wide Science Fair, May 17, 2012, held in Charlottetown, Prince Edward Island, Canada.
- Co-author of the textbook *Physics for Scientists and Engineers: An Interactive Approach Solutions* which accompanies the textbook published by Nelson Education Ltd. in 2013.
- External reviewer for the journal *Applied Radiation and Isotopes*.

PRESENTATIONS

- (1) E. Da Silva, B. Kirkham, J.W. Groves, **M.R. Gherase**, D.E.B. Fleming, A. Pejović-Milić, "In vivo quantification of strontium in bone using handheld X-ray fluorescence spectrometers", International Society for Trace Element Research in Humans, Tokyo, Japan, November 18-22, 2013. *Winner of "Young Investigator Award"* for Eric Da Silva.
- (2) D.E.B. Fleming, **M.R. Gherase**, M. Anthonisen. "Calibrations for measurement of manganese and zinc in nail clippings using portable XRF", European Conference on X-ray Spectrometry, Vienna, Austria, June 18-22, 2012.
- (3) D.E.B. Fleming and **M.R. Gherase**. "A method for detecting trace concentrations of arsenic and selenium in nail clippings using a portable x-ray fluorescence device", 8th International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications, hosted by Kansas State University, conference in Kansas City, MO, June 26 – July 1, 2011.
- (4) **M.R. Gherase** and D.E.B. Fleming. "Calculation of depth-dependent elemental concentration with x-ray fluorescence using a layered calibration method". Canadian Association of Physicists Congress, St. John's, NL, June 13-17, 2011.
- (5) D.E.B. Fleming, **M.R. Gherase**, K.M. Alexander. "A miniature x-ray tube approach to measuring lead in bone using L-XRF". European X-ray Spectrometry Conference, Figueira da Foz, Portugal, June 20-25, 2010.
- (6) **M.R. Gherase**, J.E. Mader, D.E.B. Fleming. "Radiation dose from a proposed measurement of arsenic and selenium in human skin", Canadian Organization of Medical Physicists, Ottawa, Ontario, June 16-19, 2010.
- (7) **M.R. Gherase**, D.E.B. Fleming, C.-Y. Kim. "Detecting arsenic and defining its micro-distribution in skin phantoms". Canadian Association of Physicists Congress, Moncton, New Brunswick, Canada, June 7-10, 2009.
- (8) **M.R. Gherase**, M.E. Vallee, D.E.B. Fleming, "Simultaneous detection of arsenic and selenium in polyester resin skin phantoms", 7th International Topical Meeting on Industrial Radiation and

- Radioisotope Measurement Applications, Czech Technical University, Prague, Czech Republic, June 22-27, 2008.
- (9) D.E.B. Fleming, I.S. Eddy, **M.R. Gherase**, M.K. Gibbons, G.A. Gagnon, “Real-time monitoring of arsenic filtration by granular ferric hydroxide”, 7th International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications, Czech Technical University, Prague, Czech Republic, June 22-27, 2008.
 - (10) **M.R. Gherase**, M. Vallee, D.E.B. Fleming, “K-shell x-ray fluorescence measurements using the fundamental parameter method”, Canadian Association of Physicists Congress, Quebec, QC, June 8-11, 2008.
 - (11) D.E.B. Fleming and **Mihai Gherase**, “Arsenic distribution in human skin”, Canadian Light Source, Saskatoon Synchrotron Summer School, Saskatoon, SK, August 20-24, 2007.
 - (12) D.E.B. Fleming, G. Brown, R. Dauphinee, **M.R. Gherase**, “Advances in Arsenic and Lead Measurement”, CIHR RURAL Centre Annual Summit, Saint Mary’s University, Halifax, Nova Scotia, September 28-29, 2006.
 - (13) **M.R. Gherase**, “Characterization of hyperpolarized ^{129}Xe dissolved in perfluorooctyl bromide emulsions as a novel magnetic resonance contrast agent, XEMAT III: The Third International Symposium on Xenon Nuclear Magnetic Resonance of Materials, Ottawa, Ontario, Canada, June 1-3, 2006
 - (14) **M.R. Gherase**, J.C. Wallace, G.E. Santyr, “Flow measurements using hyperpolarized ^{129}Xe dissolved in a perfluorocarbon emulsion carrier”, the 4-th Annual Symposium of the Imaging Network Ontario, Toronto, Ontario, Canada, March 1-3, 2005
 - (15) **M.R. Gherase**, J.C. Wallace, G.O. Cron, G.E. Santyr, “Theoretical analysis and measurement of the time course of hyperpolarized ^{129}Xe dissolved in a large diameter ($>3\ \mu\text{m}$) perfluorocarbon emulsion carrier”, the 3-rd Annual Symposium of the Imaging Network Ontario, Toronto, Ontario, Canada, March 3-5, 2004
 - (16) **M.R. Gherase**, J.C. Wallace, L. Bernas, M. Nezamadeh, I. Cameron, G.E. Santyr, “Multi-exponential analysis of CPMG T_2 decay curves for ^{129}Xe dissolved in PFOB emulsions: implications for hyperpolarized xenon agent development”, the 11-th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine, Toronto, Ontario, Canada, July 10-16, 2003
 - (17) J.C. Wallace, **M.R. Gherase**, L. Bernas, A. Cross, G.O. Cron, G.E. Santyr, “Magnetic resonance imaging flow measurement using hyperpolarized ^{129}Xe in a perfluorocarbon carrier injected in a hollow-fiber capillary model of a breast tumor”, the 3-rd Scientific Conference of the Canadian Breast Cancer Research Alliance, Ottawa, Ontario, Canada, October 25-27, 2003

PUBLISHED ABSTRACTS

- (1) **M.R. Gherase**, J.E. Mader and D.E.B. Fleming. “Radiation dose from a proposed measurement of arsenic and selenium in human skin”, *Medical Physics* **37**: 3892-3893 (2010)
- (2) **M.R. Gherase**, D.E.B. Fleming, C.-Y. Kim. “Detecting arsenic and defining its micro-distribution in skin phantoms”, *Physics in Canada* **65**: 106-107 (2009)
- (3) **M.R. Gherase**, M. Vallee, D.E.B. Fleming. “K-shell X-ray fluorescence measurements using the fundamental parameter method”, *Physics in Canada* **64**: 123 (2008)

PEER-REVIEWED PUBLICATIONS

- (1) D. McIver, J. VanLeeuwen, A. Knafla, J. Campbell, K. Alexander, **M.R. Gherase**, J. Guernsey, D.E.B. Fleming, Evaluation of a novel portable x-ray fluorescence screening tool for detection of arsenic exposure, accepted for publication in *Physiological Measurement* (2015)
- (2) D.E.B. Fleming, J.W. Groves, **M.R. Gherase**, G.N. George, I.J. Pickering, O. Ponomarenko, G. Langan, J.E. Spallholz, M. Alauddin, H. Ahsan, S. Ahmed, P.F. La Porte, Soft tissue measurement of arsenic and selenium in an animal model using portable X-ray fluorescence, *Radiation Physics and Chemistry*, **116**: 241-247 (2015)

- (3) O. Ponomarenko, **M.R. Gherase**, M.S. LeBlanc, C.-Y. Kim, E.D. Desouza, M.J. Farquharson, F.E. McNeill, S. Nehzati, I.J. Pickering, G.N. George, D.E.B. Fleming, Synchrotron XAS analysis of arsenic chemical speciation in human nail clippings, *Environmental Chemistry* **11**(6): 632-643 (2014)
- (4) **M.R. Gherase**, E.D. Desouza, M.J. Farquharson, F.E. McNeill, C.-Y. Kim, D.E.B. Fleming, X-ray fluorescence measurements of arsenic micro-distribution in human nail clippings using synchrotron radiation, *Physiological Measurement*, **34**(9):1163-1177 (2013)
- (5) D.E.B. Fleming, **M.R. Gherase**, M. Anthonisen, Calibrations for measurement of manganese and zinc in nail clippings using portable XRF, *X-ray Spectrometry* **42**(4):299-302 (2013)
- (6) D.E.B. Fleming, **M.R. Gherase**, K.M. Alexander, A miniature X-ray tube approach to measuring lead in bone using L-XRF, *X-ray Spectrometry* **40**(5):343-347 (2011)
- (7) **M.R. Gherase** and D.E.B. Fleming, A calibration method for proposed XRF measurements of arsenic and selenium in nail clippings, *Physics in Medicine and Biology* **56**(20):N215-N225 (2011)
- (8) **M.R. Gherase** and D.E.B. Fleming, Calculation of depth-dependent elemental concentration with x-ray fluorescence using a layered calibration method, *Nuclear Instruments and Methods in Physics Research Section B* **269**(10):1150-1156 (2011)
- (9) H.C. MacDonald, C.P. Laroque, D.E.B. Fleming, **M.R. Gherase**, Dendroanalysis of metal pollution from the Sydney Steel Plant in Sydney, Nova Scotia, *Dendrochronologia* **29**(1):9-15 (2011)
- (10) **M.R. Gherase**, J.E. Mader, D.E.B. Fleming, Radiation dose from a proposed measurement of arsenic and selenium in human skin, *Physics in Medicine and Biology* **55**(18):5499-5514 (2010)
- (11) C.W. Roy, **M.R. Gherase**, and D.E.B. Fleming, Simultaneous assessment of arsenic and selenium in human nail phantoms using a portable x-ray tube and detector, *Physics in Medicine and Biology* **55**(6):N151-159 (2010)
- (12) D.E.B. Fleming, I.S. Eddy, **M.R. Gherase**, M.K. Gibbons, and G.A. Gagnon, Real-time monitoring of arsenic filtration by granular ferric hydroxide, *Applied Radiation and Isotopes* **68**(5):821-824 (2010)
- (13) **M.R. Gherase**, M.E. Valee, and D.E.B. Fleming, Simultaneous detection of arsenic and selenium in polyester resin skin samples, *Applied Radiation and Isotopes* **68**(5):743-745 (2010)
- (14) **M.R. Gherase** and D.E.B. Fleming, Optimal K_{α} XRF detection geometry of arsenic in skin using an extended fundamental parameter method, *X-ray Spectrometry* **38**(6):513-518 (2009)
- (15) **M.R. Gherase** and D.E.B. Fleming, K-shell X-ray fluorescence measurements of arsenic depth-dependent concentration in polyester resin discs using the fundamental parameter method, *Applied Radiation and Isotopes* **67**(1):50-54 (2009)
- (16) D.E.B. Fleming, **M.R. Gherase**, C.-Y. Kim, Detecting arsenic and defining its micro-distribution in skin phantoms, *The Activity Report of Canadian Light Source 2008*, 121-122
- (17) **M.R. Gherase** and D.E.B. Fleming, Fundamental parameter approach to XRF spectroscopy measurements of arsenic in polyester resin skin phantoms, *X-ray Spectrometry* **37**(4):482-489 (2008)
- (18) D.E.B. Fleming and **M.R. Gherase**, A rapid, high sensitive technique for measuring arsenic in skin phantoms using a portable x-ray tube and detector, *Physics in Medicine and Biology* **52**(19):N459-465 (2007)
- (19) **M.R. Gherase**, J.C. Wallace, A.R. Cross, G.E. Santyr, Two-compartment radial diffusive exchange analysis of the NMR lineshape of Xe dissolved in a perfluorooctyl bromide emulsion, *Journal of Chemical Physics* **125**(4):044906 (2006)
- (20) G.W. Buchanan, R. Smits, E. Munteanu, G.E. Santyr, J.C. Wallace, **M.R. Gherase**, Synthesis and dissolved hyperpolarized xenon NMR studies of sucrose octaoleate- F_{104} , *Journal of Fluorine Chemistry* **125**(10):1457-1460 (2004)

NON PEER-REVIEWED PUBLICATIONS

- (1) **M.R. Gherase**, Analysis of theoretical NMR spectra generated by exact solutions of the Bloch-McConnell and the Bloch-Torrey equations for a two-compartment radial diffusive exchange model, arXiv:1204.6678v1 [physics.med-ph] (2012)
- (2) **M.R. Gherase**, Characterization of hyperpolarized Xe-129 NMR spectra, PhD Thesis, VDM Verlag Dr. Muller, Saarbrucken (2009)