CURRICULUM VITAE

Eugene Fourkal, Ph.D, DABR

Personal

Business Address:

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Citizenship Status: USA, Canada, Ukraine

Education and Training

Doctor of Philosophy University of Saskatchewan, Canada
- Physics Department 05/1999

M. Sc. (Supreme Laude) University of Chernivtsi, Ukraine
- Physics Department 05/1993

Work Experience

Chief Medical Physicist, Department of Radiation Oncology
UPMC Pinnacle 1/2016-present

Associate Professor Department of Radiation Oncology
Fox Chase Cancer Center 2/2010 – 12/2015

Assistant Professor Department of Radiation Oncology Fox
Chase Cancer Center 2/2003 – 1/2010

Postdoctoral Fellowship Experience

10/2001 – 1/2003 Fox Chase Cancer Center Philadelphia, PA

Department of Radiation Oncology

3/2001 – 9/2001 Stanford University Stanford, CA

- Department of Radiation Physics

7/2000 – 2/2001 University of Alberta Edmonton, AB

- Department of Medical Physics, Cross Cancer Institute

3/1999 – 6/2000 University of Alberta Edmonton, AB

- Theoretical Physics Institute

Professional Activities:

Educational

- Medical Physics Residence Training course, 10 hrs/year 2003-2014
- Annual short course on Monte Carlo dose calculations, 2 hrs/year 2002-2014
- Instructor in electrodynamics and classical mechanics courses at the University of Alberta and University of Saskatchewan 1998-2000
- Examinee for the ABR 2020-present

Grant Support

- "PIC simulation of laser-proton acceleration", PI, Varian, 2002-2007 50,000 $
- "Electromagnetic properties of Plasmonic materials", Co-PI with A. Smolyakov CBP NATO Grant, 2008, 30,000 US $

Patents Issued

- "Method of modulating laser-accelerated protons for radiation therapy", United States Patent 7268358
- "Methods and systems for increasing the energy of positive ions accelerated by high-power lasers", International application number PCT/US2005/046838
- "Laser-accelerated proton therapy units and superconducting electromagnet systems for same", International application number PCT/US2005/046834

Professional Organizations

- American Association of Physicists in Medicine (AAPM)
- American Physical Society (APS)
- American Society for Therapeutic Radiology and Oncology (ASTRO)

Committees

- ASTRO Emerging Technology Committee (2007)
- Task Group leader for ASTRO Emerging Technology Committee (2010)
- Faculty promotion committee at Fox Chase Cancer Center

Awards

- 1995-1999: University of Saskatchewan Graduate Scholarship
- 1996: Gerhard Herzberg National Fellowship
- 1997:Kavadas Memorial Scholarship

Clinical Experience

- Manage all aspects of clinical medical physics operations within the network of 4 hospitals in Central PA, treating 130-150 patients per day.
- Maintain clinical physics policies and procedures according to the AAPM, ACRO, ASTRO guidelines
- Ensure that all DEP regulations are accomplished and satisfied
- Manage the implementation of new programs/technology within the central PA UPMC Pinnacle network
- High dose rate brachytherapy for all treatment sites.
- All aspects of SRS/SBRT treatments from planning to QA and treatments.
- All aspects of monthly and annual machine calibration and dosimetry
- Radiation protection and shielding calculations.
- 3D dosimetry with Y90 microspheres
- Established Gated therapy treatment modality (phase based and DIBH)
- Experienced with working/commissioning various treatment planning systems.

Refereeing

- Medical Physics (2001-present)
- Physics in Medicine and Biology (2002-present)
- Physical Review E, B (1998-present)
- Physics of Plasmas (1999-present)
- Radiation Oncology (2014-present)
- Grant Reviewer for American Association for the Advancement of Science (2008)

Editorial Responsibilities

- Editorial Board member: Austin Journal of Radiation Oncology and Cancer (2014-2019)
- Guest Associate Editor for Medical Physics (2006)

Board Certification

- American Board of Radiology-Therapeutic Radiologic Physics (2005)

Peer Reviewed Articles

- E. Fourkal, Marta Guerra, et al, “Cellular automaton model of radiation damage to the tumor” DOI:10.13140/RG.2.2.30940.62084, 2020
- **E. Fourkal**, A. Nahum, et al, “Average energy required to produce an ion pair, revisted”. arXiv:1703.10032 **[physics.plasm-ph],** 2017
- T. Carlier, K. Willowson, **E. Fourkal**, D. Bailey, et al, “90Y-PET imaging: exploring limitations and accuracy under conditions of low counts and high random fractions”. Med. Physics, Vol. 42, p. 4295-4309, 2015
- K. Willowson, M. Tapner, D. Bailey, *et al* “A multicentre comparison of quantitative (90)Y PET/CT for dosimetric purposes after radioembolization with resin microspheres : The QUEST Phantom Study.” Eur. J. Nucl. Med. Mol. Imag. Vol. 42, p.1202-1222, 2015
- **E. Fourkal**, I. Veltchev, M. Lin *et al*, “3D in-patient dose reconstruction from the PET-CT imaging of Y-90 microspheres for metastatic cancer to the liver: Feasibility study”. Med. Physics, Vol. 40, p. 081702, 2013.
- A. Smolyakov, **E. Fourkal,** “Negative permeability and negative refraction in composite systems with finite size inclusions”. Phys. Rev. A, Vol. 78, p. 013817, 2013
- Mu-Han Lin, Jinsheng Li, Lu Wang, Sion Koren, Jiajing Fan, **Eugene Fourkal**, and C.-M. Ma, “4D dose reconstruction using online measured EPID cine images for lung SBRT treatment validation”. Medical Physics, Vol. 39, p. 5949-5958, 2012
- A. Allen, T. Pawlicki, L. Dong, **E. Fourkal**, *et al* , “An evidence based review of proton beam therapy: The report of ASTRO’s emerging technology committee”. Radiotherapy and Oncology, doi:10.1016/j.radonc.2012.02.001, 2012
- **E. Fourkal**, I. Veltchev, C-M. Ma, J. Fan, “Linear energy transfer of proton clusters”. Featured article in Physics in Medicine and Biology, Vol. 56, p. 3123-3136, 2011
- A. Smolyakov, **E. Fourkal**, S. Krasheninnikov, N. Sternberg, “Resonant modes and transmission in multi-layer structures”. Progress in Electromagnetics Research, Vol. 107, p. 293-314, 2010
- **E. Fourkal**, I. Veltchev, A. Taffo, C. Ma, V. Khazak, N. Skobeleva, “Photo-Thermal Cancer Therapy using Gold Nanorods”, IFMBE Proceedings, Vol. 25/7, 761-763, 2009
- **E. Fourkal**, I. Veltchev, A. Smolyakov, “Energy and information flow in superlensing”. Phys. Rev. A, Vol. 79, p. 033846, 2009
- **E. Fourkal**, J. Fan, I. Veltchev, “Absolute dose reconstruction in proton therapy using PET imaging modality: Feasibility study”. Phys. in Med. and Biol., Vol. 54, p. N217-N228, 2009
- **E. Fourkal**, I. Veltchev, C-M. Ma, “Laser-to-proton energy transfer efficiency in laser-plasma interactions”. Journal of Plasma Physics, Vol. 75, p. 235-250, 2009
- W. Luo, J. Li, **E. Fourkal**, et al, “Dosimetric advantages of IMPT over IMRT for laser accelerated proton beams”. Phys. in Med. and Biol. Vol. 53, p. 7151-7166, 2008.
- J. Fan, W. Luo, **E. Fourkal**, *et al*, “Shielding design for a laser-

accelerated proton therapy system". Physics in Medicine and Biology, Vol. 52, p. 3913-3930, 2007.

- I. Veltchev, **E. Fourkal**, C-M. Ma, "Laser induced Coulomb mirror effect: applications for proton acceleration". Physics of Plasmas, Vol. 14, p. 033106, 2007.
- **E. Fourkal**, I. Veltchev, J. Fan, W. Luo, C. Ma, "Energy optimization procedure for treatment planning with laser-accelerated protons". Med. Phys., Vol. 34, p. 577-584, 2007.
- **E. Fourkal**, I. Veltchev, C-M. Ma, A. Smolyakov, "Resonant transparency of materials with negative permittivity". Physics Letters A, Vol. 361, p. 277-282, 2007.
- **E. Fourkal**, I. Veltchev, C-M. Ma, A. Smolyakov, "Evanescent wave interference and the total transparency of a warm high-density plasma slab". Physics of Plasmas, Vol 13, p. 092113, 2006.
- C. Ma, I. Veltchev, **E. Fourkal,** et al, "Development of a laser-driven proton accelerator for cancer therapy". Laser Physics, Vol. 16, p. 639-646, 2006.
- **E. Fourkal,** I. Veltchev, C. Ma, "Coulomb explosion effect and the maximum energy of protons accelerated by high-power lasers". Phys. Rev. E. Vol. 71, p. 036412, 2005.
- W. Luo, **E. Fourkal**, J. Li, C. Ma, "A particle selection and beam collimation system for laser-accelerated proton beam therapy". Med. Phys. Vol. 32, p. 794-806, 2005.
- J. S. Li, B. Shahine, **E. Fourkal** and C.M. Ma, "A Particle Track Repeating Algorithm for Proton Beam Dosimetry", Phys. Med. Biol. Vol. 50, p. 1001-1010, 2005.
- L. Wang, B. Movsas, R. Jacob, **E. Fourkal**, L. Chen, R. Price, S. Feigenberg, A. Konski, A. Pollack and C.M. Ma, "Stereotactic IMRT for prostate cancer: Dosimetric impact of multileaf collimator leaf width in the treatment of prostate cancer with IMRT", J. Applied Clinical Med. Phys. Vol. 5, p. 29-41, 2004.
- Ma, R. A. Price, J. S. Li, L. Cheng, L. Wang, **E. Fourkal**, L. Qin, J. Yang, "Monitor unit calculation for Monte Carlo treatment planning". Phys. Med. Biol. Vol. 49, p. 1671-1688, 2004
- **E. Fourkal,** *et al*, **"**Intensity modulated radiation therapy using laser-accelerated protons: A Monte Carlo dosimetric study**"**. Physics in Medicine and Biology Vol. 48, p. 3977, 2003
- **E. Fourkal**, *et al*, "Particle selection for laser-accelerated proton therapy feasibility study". Med. Phys. Vol. 30, p. 1660, 2003
- C.-M. Ma, T. Pawlicki, J.S. Li, J. Deng, M. Lee, A. Kapur, R. Price, S. McNeeley, L. Chen, **E. Fourkal**, and M. Ding, "Accurate Dosimetry for Intensity Modulated Radiation Therapy" in Accurate dosimetry for radiation dosimetry, Ed. J. Seuntjens and P. Mobid (Med. Phys. Publishing, Madison, 2002) .
- M. Ding, J.S.Li, J.Deng, **E. Fourkal**, and C-M Ma, **"**Dose correlation for thoracic motion in radiation therapy of breast cancer". Med. Phys. Vol. 30, p. 2520, 2003
- **E. Fourkal**, *et al*, "Particle in cell simulation of laser accelerated proton beams for radiation therapy". Med. Phys. Vol. 29, p. 2788, 2002
- M. Lachaine, **E. Fourkal**, B. G. Fallone, "Investigation into the

physical characteristics of active matrix flat panel detectors for radiotherapy". Med. Physics Vol. 28, p. 1689, 2001

- **E. Fourkal**, M. Lachaine, B. G. Fallone, "Signal formation in *a*-Se based x-ray detectors". Phys. Rev. B. Vol.63, p. 195204-1, 2001
- M. Lachaine, **E. Fourkal**, B. G. Fallone, "Detective quantum efficiency of a direct-detection active matrix flat panel imager at megavoltage energies". Med. Physics, Vol. 28, p. 1364, 2001
- **E. Fourkal**, V. Bychenkov, W. Rozmus, *et al*, "Effect of electron-electron collisions on inverse bremsstrahlung heating by a laser field". Phys. of Plasmas, Vol. 8, p. 550, 2001
- **E. Fourkal**, A. Smolyakov, "The generalized exact set of hydrodynamic equations for any collision rate in weakly ionized plasma". Phys. of Plasmas, Vol. 7, p. 122, 2000
- **E. Fourkal**, A. Smolyakov, A. Hirose, "Nonlocal ion transport in a weakly ionized nonequilibrium plasma". IEEE Transactions on Plasma Science Vol. 26, p. 198, 1998
- **E. Fourkal**, A. Smolyakov, A. Hirose, "Nonlocal electron kinetics in a weakly ionized plasma". Phys. Rev. E, Vol. 58, p. 965, 1998

Invited Talks

- **E. Fourkal "**On the increased RBE of proton clusters**",** Okinawa Institute of Science and Technology, Okinawa, Japan, 2015
- **E. Foukal** "Acceleration of protons by high power lasers for clinical applications", Princeton University Plasma Physics Lab, Princeton 2013
- **E. Fourkal** "3D in-patient dose reconstruction from the PET-CT imaging of Y-90 microspheres for metastatic cancer to the liver", Spring Symposium DVC-AAPM, "Innovations and Challenges in state-of-the-art radiation therapy", Philadelphia, 2013
- **E. Fourkal** "Clinical proton source using high-power lasers. Current challenges and future directions", Canadian Association of Physicist Congress, Toronto, Canada 2010
- **E. Fourkal "**Nanophotonics-new research possibilities for radiation oncology**",** Spring Symposium DVC-AAPM, "Innovations in Diagnostic and Therapeutic Medical Physics", Philadelphia, 2009
- **E. Fourkal** "Acceleration of protons by high-power lasers for clinical applications. Current challenges and future directions", 20th International Conference on the Application of Accelerators in Research and Industry, Fort Worth, Texas 2008
- **E. Fourkal** "Acceleration of protons by high-power lasers for clinical applications. Current challenges and future directions", Department of Radiation Oncology, Paul Scherrer Institute, Villigen, Switzerland 2007
- **E. Fourkal** "Laser-Accelerated protons for radiation therapy", 49th Annual Meeting of the American Association of Physicists in Medicine, Minneapolis MN, 2007
- **E. Fourkal** "High-power laser-proton accelerators. Current challenges and future directions" Department of Radiation Oncology, University of Pennsylvania, Philadelphia, 2006
- **E. Fourkal** "New research endeavors in proton therapy" 12th Radiation Oncology Nursing Conference, Philadelphia, 2003

National/International Conference (Oral and Poster) Presentation

- **E. Fourkal**,M. Guerra, M. Lamberto, “A cellular automaton model of radiation damage to the tumor”, 59th Annual Meeting of the American Association of Physicists in Medicine, Denver CO, 2017
- **E. Fourkal**, “Cancer Stem Cell hypothesis and radiation treatments”, 58th Annual Meeting of the American Association of Physicists in Medicine, Washington DC, 2016
- **E. Fourkal**, I. Veltchev, V. Nahirnyak, “On the ion beam range and dose verification in hadron therapy using sound waves”, 57th Annual Meeting of the American Association of Physicists in Medicine, Anaheim CA, 2015
- **E. Fourkal**, I. Veltchev, M. Hossain, A. Nahum “4D Radiobiology”, 56th Annual Meeting of the American Association of Physicists in Medicine, Auston TX, 2014
- **E. Fourkal**, I. Veltchev, M. Lin, M. Johnson, et al “A Novel Method for Dosimetry Calculation Utilizing PET-CT in Patients Treated with Radioembolization”, 55th Annual Meeting of the American Association of Physicists in Medicine, Indianapolis IN, 2013
- **E. Fourkal**, I. Veltchev, M. Lin, S. Koren, et al “3D in-patient dose reconstruction from the PET-CT imaging of ^{90}Y microspheres for metastatic cancer to the liver”, 54th Annual Meeting of the American Association of Physicists in Medicine, Charlotte NC, 2012
- **E. Fourkal**, I. Veltchev, et al, “Linear Energy transfer of proton clusters”, 52nd Annual Meeting of the American Association of Physicists in Medicine, Philadelphia PA, 2010
- **E. Fourkal** et al**, “**Photo-thermal cancer therapy using gold nano-rods”, 11th International Congress of Medical Physics and Biomedical Engineering, Munich, 2009.
- **E. Fourkal** et al**, “**Laser-to-proton energy transfer efficiency in laser-plasma interactions”, 50th Annual Meeting of the American Association of Physicists in Medicine, Houston TX, 2008.
- **E. Fourkal** et al**, “**Absolute dose reconstruction in proton therapy using PET imaging modality: Feasibility study”, 49th Annual Meeting of the American Association of Physicists in Medicine, Minneapolis MN, 2007.
- **E. Fourkal** et al, “Prepulse Effect and Maximum Energy of Protons Accelerated by High-Power Lasers”, 48th Annual Meeting of the American Association of Physicists in Medicine, Orlando FL, 2006
- **E. Fourkal** et al, “Analytical Calculation of Spread-Out-Bragg-Peak Distributions for Laser-Accelerated Proton Beams”. 47th Annual Meeting of the American Association of Physicists in Medicine, Seattle WA, 2005
- **E. Fourkal** et al, “Optimized Target Design and Generation of Quasi-Monoenergetic Proton Beams for Laser-Proton Accelerator”. 46th Annual Meeting of the American Association of Physicists in Medicine, Pittsburg PA, 2004
- **E. Fourkal** et al, “Laser-accelerated carbon ion beams for radiation therapy”. 45th Annual Meeting of the American Association of Physicists in Medicine, San Diego CA, 2003
- **E. Fourkal** et al, “Particle in cell simulation of laser accelerated proton beams for radiation therapy”. 44th Annual Meeting of the American Association of Physicists in Medicine, Montreal, PQ, 2002.
- **E. Fourkal** et al, “Mechanism for Charge Creation in A-Se Based X-Ray Detectors”. 43rd Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, Utah 2001.
- **E. Fourkal** et al, "Ion acoustic wave damping with hybrid kinetic-

hydrodynamic closure". 42nd Annual Meeting of the APS/DPP, Quebec City, Quebec, Canada, 2000.

- **E. Fourkal** et al, "Particle simulation of nonlocal transport in laser hot spot". 42nd Annual Meeting of the APS/DPP, Quebec City, Quebec, Canada, 2000.
- **E. Fourkal** et al, "Electron distribution function in laser heated plasmas". 42nd Annual Meeting of the APS/DPP, Quebec City, Quebec, Canada, 2000.
- **E. Fourkal** et al, "Electron distribution function in laser produced plasmas". 48th Annual Conference on Anomalous Absorption. Pacific Grove, CA, 1999.
- **E. Fourkal** et al, "The generalized exact set of hydrodynamic equations for any collision rate in weakly ionized plasma". 40th Annual Meeting of the APS/DPP, New Orleans, LA, 1998.
- **E. Fourkal** et al, "Nonlocal electron kinetics in a weakly ionized plasma". 50th Gaseous Electronics Conference , Madison, WI, 1997
- A. Smolyakov, **E. Fourkal** , "Fluid modeling of low pressure discharges". 50th Gaseous Electronics Conference, Madison, WI, 1997.
- **E. Fourkal** et al, "Non local ion transport in a weakly ionized non-equilibrium plasma". 49th Annual IEEE conference on plasma science. San Diego, CA, 1997