Aram H. Markosyan

Contact Information

Department of Electrical Engineering and Computer Science
University of Michigan
1301 Beal Ave, Ann Arbor
MI 48109-2122, USA

Phone: +1 (734) 647-4840
Email: armarkos@umich.edu
Web: www.markosyanaram.com

Research Interests

My research interests lie at the confluence of applied mathematics, high performance computing, plasma physics and computer science. Two current efforts are modeling of plasmas formed during operation of a diode pumped alkali laser and modeling capacitively-coupled RF plasma for the synthesis of silicon nano-crystals. In general, I am interested in numerical methods for high performance computing (HPC), conservation laws, computational fluid dynamics, computational plasma physics, adaptive mesh refinement, code verification and validation, uncertainty quantification.

Employment

2014 - Present, Postdoctoral Research Fellow, EECS, Computational Plasma Science and Engineering Group of Prof. Mark J. Kushner, University of Michigan, USA
2010 - 2014, PhD Candidate and Researcher, CWI (National Research Institute for Mathematics and Computer Science), Amsterdam, The Netherlands
2009 (9 months), Intern, Zeliade Systems, Paris, France

Education

2010 - 2014, PhD, Applied Physics, Eindhoven University of Technology, The Netherlands
PhD thesis title: *Modeling of multiple time scales in streamer discharges*
Supervised by Prof. Ute Ebert and Prof. Saša Dujko
2008 - 2009, MSci, Mathematics and Applications, Numerical Analysis and Partial Differential Equations, University Pierre and Marie Curie (Paris 6), France
2002 - 2008, MSci, Mathematics (Honors), Yerevan State University, Armenia

Research Grants

2013, European Science Foundation (ESF): No. 5697 (€3000), No. 5698 (€3000), No. 5297 (€3000) within the activity entitled "Thunderstorm effects on the atmosphere-ionosphere system". Collaborating research with F. J. Gordillo-Vázquez and A. Luque

Publication Overview

- Author or co-author of 7 published, refereed journal articles. 7 in preparation
- 1 book
- 12 full refereed proceedings at international conferences
- 34 conference presentations (1 invited oral, 10 contributed oral, 23 posters)

Professional Activities

- Elected Vice-Chair, IEEE Southeastern Michigan Section, Chapter 15: Nuclear Plasma Sciences Society (2015)
- Judge, Michigan Institute for Plasma Science and Engineering Annual Graduate Student Symposium (2015)
- Journal referee (Computer Physics Communications, Plasma Science and Technology, IEEE Transactions on Plasma Science, Plasma Sources Science and Technology, New Journal of Physics)

Professional Associations

- Society for Industrial and Applied Mathematics (SIAM), Member (2015 - present)
- American Mathematical Society (AMS), Member (2014 - present)
- American Physical Society (APS), Member (2014 - present)
- IEEE Nuclear and Plasma Sciences Society, Member (2015 - present)
- Werkgemeenschap Scientific Computing (WSC), Member (2010 - present)
- Armenian Mathematical Union (AMU), Member (2015 - present)

Technical Skills

Languages: C/C++ (STL, Boost), Fortran, Python (numpy, scipy, matplotlib), CUDA, MPI, OpenMP, QT, MATLAB, Mathematica, LaTeX
Platforms: Linux (Arch, OpenSuse, Fedora, Ubuntu), Mac OSX, MS Windows

Current Collaborators

Steven L. Girshick (University of Minnesota, USA), Yogesh B. Gianchandani (University of Michigan, USA), Mark J. Kushner (University of Michigan, USA), E.J.M. van Heesch (Eindhoven University of Technology, The Netherlands), Ute Ebert (CWI, The Netherlands), Saša Dujko (University of Belgrade, Serbia), Ronald D. White (James Cook University, Australia)

Spoken Languages

Armenian (native), English, Russian, French

Citizenship

Citizen of the Republic of Armenia

References

Prof. Mark J. Kushner
Director of Department of Energy Plasma Science Center, University of Michigan
George I. Haddad Professor of Engineering EECS, University of Michigan
University of Michigan, EECS,
1301 Beal Ave, Ann Arbor, MI 48109, USA
Phone: +1 (734) 647-8148
Email: mjkush@umich.edu

Prof. Ronald D. White
Node Director and Chief Investigator in the ARC Centre of Excellence for Antimatter-Matter Studies, Australia
James Cook University, 1 James Cook Drive,
Townsville, Australia, QLD 4811
Phone: +1 202 1234 5678
Email: ronald.white@jcu.edu.au

Prof. Hae June Lee
Electrical Engineering and Computer Science Department, Pusan National University
Visiting Prof. University of Michigan
University of Michigan, EECS,
1301 Beal Ave, Ann Arbor, MI 48109, USA
Phone: +1 (734) 647-4840
Email: haejune@umich.edu

Dr. Francisco J. Gordillo Vázquez
Tenured Scientist at Solar System Department
Instituto de Astrofísica de Andalucía-CSIC
Glorieta de la Astronomia, Spain
IAA-CSIC, P.O. Box 3004,
Granada, Spain, 18080
Phone: +34 958 814 530
Email: vazquez@iaa.es

Books

- **A.H. Markosyan**, *Modeling multiple time scales in streamer discharges*, Eindhoven: Eindhoven University of Technology (171 p.), (2014), ISBN 978-94-6259-167-7, doi: 10.6100/IR774469

Refereed Journal Articles

[7] **Aram H. Markosyan**, Jannis Teunissen, Sasha Dujko and Ute Ebert, *Comparing fluid models for streamer discharges*, Plasma Sources Sci. Technol. **24** 065002 (2015)

[6] J. Zhang, E.J.M. van Heesch, F.J.C.M. Beckers, A.J.M. Pemen, R.P.P. Smeets, T. Namihira and **A.H. Markosyan**, *Breakdown Streangth and Dielectric Recovery in a High Pressure Supercritical Nitrogen Switch*, IEEE Trans. Diel. and El. Insul. Vol. **22**, Issue 4, pp. 1823-1832, (2015)

[5] J. Zhang, **A.H. Markosyan**, M. Seeger, E.M. van Veldhuizen, E.J.M. van Heesch and U. Ebert, *Numerical and experimental investigation of recovery in super-critical N_2*, Plasma Sources Sci. Technol. **24** 025008 (2015)

[4] **A.H. Markosyan**, A. Luque, F. J. Gordillo-Vázquez, U. Ebert, PumpKin: *A tool to find principal pathways in plasma chemical models*, Computer Physics Communications **185**, pp. 2697- 2702, (2014)

[3] S. Nijdam, E. Takahashi, **A.H. Markosyan** and U. Ebert, *Investigation of positive streamers by double pulse experiments, effects of repetition rate and gas mixture,* Plasma Sources Sci. Technol. **23** 025008 (2014)

[2] S. Dujko, **A.H. Markosyan**, R.D. White, U. Ebert, *High order fluid model for streamer discharges: I. Derivation of model and transport data*, J. Phys. D: Appl. Phys. **46** 475202 (2013)

[1] **A.H. Markosyan**, S. Dujko, U. Ebert, *High order fluid model for streamer discharges: II. Numerical solution and investigation of planar fronts*, J. Phys. D: Appl. Phys. **46** 475203 (2013)

Conference Contributions

Full Refereed Proceedings

[12] **A.H. Markosyan** and M.J. Kushner, *Plasma formation during operation of a diode pumped alkali laser*, proceedings of the 22^{nd} International Symposium on Plasma Chemistry, ISPC22, July 5 - 10, 2015, Antwerp, Belgium [3 pages]

[11] R. Le Picard, **A.H. Markosyan**, D.H. Porter, M.J. Kushner and S.L. Girshick, *Numerical simulation of capacitively-coupled RF plasma flowing through a tube for the synthesis of silicon nanocrystals*, proceedings of the 22^{nd} International Symposium on Plasma Chemistry, ISPC22, July 5 - 10, 2015, Antwerp, Belgium [3 pages]

[10] S. Dujko, **A.H. Markosyan**, U. Ebert, *Propagation of negative planar streamer fronts in noble gases*, proceedings of the 27^{th} Summer School and Int. Symposium on the Physics of Ionized Gases, SPIG 2014, August 26 - 29, 2014, Belgrade, Serbia [4 pages]

[9] E.J.M. van Heesch, J. Zhang, **A.H. Markosyan**, Takao Namihira, F.J.C.M. Beckers, T. Huiskamp, W.F.L.M. Hoeben, A.J.M. Pemen, U. Ebert, *Supercritical Fluids for High-power Switching; proceedings of IEEE International Power Modulator and High Voltage Conference*, IPMHVC 2014, June 1 - 5, 2014, Santa Fe, NM, USA [4 pages]

[8] S. Dujko, **A. Markosyan**, U. Ebert, *High order fluid model for negative planar streamer fronts in rare gases*, Proceedings of the 9^{th} EU-Japan Joint Symposium on Plasma Processing, JSPP2014, January 19-23, 2014, Bohinjska Bistrica, Slovenia [4 pages]

[7] S. Dujko, D. Bošnjaković, J. Mirić, I. Simonović, Z.M. Raspopović, R.D. White, **A.H. Markosyan**, U. Ebert, Z.Lj. Petrović, *Recent results from studies of non-equilibrium electron transport in modeling of low-temperature plasmas and particle detectors*, Proceedings of the 9^{th} EU-Japan Joint Symposium on Plasma Processing, JSPP2014, January 19-23, 2014, Bohinjska Bistrica, Slovenia [4 pages]

[6] **A.H. Markosyan**, A. Luque, F. J. Gordillo-Vázquez, U. Ebert, *Analyzing atmospheric kinetic pathways using PumpKin*, Proceedings of the European Planetary Science Congress 2013, EPSC2013, September 08-13, 2013, London, United Kingdom; Vol. 8, EPSC2013-655 [2 pages]

[5] **A.H. Markosyan**, J. Zhang, B. van Heesch, U. Ebert, *Streamer to spark transition in supercritical N_2*, Proceedings of the XX^{th} Symposium on Physics of Switching Arc, FSO 2013, September 2-6, 2013, Nove Mesto na Morave, Czech Republic [4 pages]

[4] **A.H. Markosyan**, A. Luque, F. J. Gordillo-Vázquez, U. Ebert, *PumpKin: A tool to find principal pathways in plasma chemical models*, Proceedings of the XXXI International Conference on Phenomena in Ionized Gases, ICPIG 2013, July 14-19, 2013, Granada, Spain [2 pages]

[3] **A. Markosyan**, S. Dujko, U. Ebert, *Derivation and test of high order fluid model for streamer discharges*, Proceedings of the Scientific Computing in Electrical Engineering,SCEE2012, September 11-14, 2012, ETH Zurich, Switzerland; pp. 107-108 [2 pages]

[2] S. Dujko, **A. Markosyan**, R.D. White, U. Ebert, *High order fluid model for streamer discharges*, Proceedings of the 26^{th} Summer School and International Symposium on the Physics of Ionized Gases, SPIG 2012, August 27-31, 2012, Zrenjanin, Serbia; ISBN: 978-86-7031-244-9, pp. 345-348 [4 pages]

[1] **A. Markosyan**, S. Dujko, U. Ebert, *High order fluid model for ionization fronts in streamer discharges*, Proceedings of the XXI Europhysics Conference on Atomic and Molecular Physics of Ionized Gases, XXI ESCAMPIG, July 10-14, 2012, Viana do Castelo, Portugal [2 pages]

Talks

[11] **A.H. Markosyan**, R. Le Picard, D.H. Porter, M.J. Kushner and S.L. Girshick, *Capacitively Coupled RF Plasmas for the Synthethesis of Silicon Nanocrystals: Scaling and Mechanisms*, proceedings of the 68^{th} Annual Gaseous Electronics Conference and 9^{th} International Conference on Reactive Plasmas, GEC68/ICRP9, October 12 - 16, 2015, Honolulu, HI, USA

[10] **A.H. Markosyan** and M.J. Kushner, *Effects of Plasma Formation on Cesium Diode (DPAL) and Excimer (XPAL) Pumped Alkali Lasers*, proceedings of the 68^{th} Annual Gaseous Electronics Conference and 9^{th} International Conference on Reactive Plasmas, GEC68/ICRP9, October 12 - 16, 2015, Honolulu, HI, USA

[9] N.Y. Babaeva, **A.H. Markosyan**, O. Zatsarinny, K. Bartschat, M.J. Kushner, *Plasma formation during operation of adiode pumped alkali laser*, proceedings of the 67^{th} Annual Gaseous Electronics Conference, GEC 2014, November 3 - 7, 2014, Raleigh, North Carolina, USA

[8] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Testing fluid models of different order on streamer discharges*, proceedings of the 67^{th} Annual Gaseous Electronics Conference, GEC 2014, November 3 - 7, 2014, Raleigh, North Carolina, USA

[7] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Comparison of various fluid models for streamer discharge*, proceedings of the Plasma Processing Science Gordon Research Seminar, GRS 2014, July 26 - 27, 2014, Bryant University, Smithfield, RI, USA

[6] **A.H. Markosyan**, A. Luque, F. J. Gordillo-Vázquez, U. Ebert, *PumpKin: A tool to find principal pathways in plasma chemical models*, Proceedings of the Physics@FOM, January 21 - 22, 2014, Veldhoven, Netherlands

[5] **A.H. Markosyan**, A. Luque, F. J. Gordillo-Vázquez, U. Ebert, *PumpKin: A tool to find principal pathways in plasma chemical models*, Bulletin of the American Physical Society, 66^{th} Annual Gaseous Electronics Conference, GEC 2013, September 30 - October 4, 2013, Princeton, New Jersey, USA; vol. 58, No. 8, p. 72

[4] **A.H. Markosyan**, J. Zhang, B. van Heesch, U. Ebert, *Numerical investigation of voltage recovery after breakdown supercritical nitrogen*, Proceedings of the XX^{th} Symposium on Physics of Switching Arc, FSO 2013, September 2-6, 2013, Nove Mesto na Morave, Czech Republic

[3] *invited talk* **A.H. Markosyan**, S. Dujko, U. Ebert, *Challenges in fluid modeling of streamer discharges*, Proceedings of the Werkgemeenschap Scientific Computing spring meeting 2013, WSC Spring Meeting 2013, May 17, 2013, Amsterdam, Netherlands

[2] **A. Markosyan**, S. Dujko, U. Ebert, *Numerical study of high order fluid model for streamer discharges*, Proceedings of the 25^{th} Symposium Plasma Physics and Radiation Technology, March 5 - 6, 2013, Lunteren, Netherlands

[1] **A. Markosyan**, S. Dujko, R. White, J. Teunissen, U. Ebert, *High order fluid model for streamer discharges*, Bulletin of the American Physical Society, 65^{th} Annual Gaseous Electronics Conference, GEC 2012, October 22-26, 2012, Austin, Texas, USA; vol.57, No.8, p.53

Posters

[23] S. Dujko, Z.Lj. Petrović, R.D. White, G. Boyle, A. Banković, I. Simonović, D. Bošnjaković, J. Mirić, **A.H. Markosyan** and S. Marjanović, *Transport processes for electrons and positrons in gases and soft-condensed matter: Basic phenomenology and applications*, proceedings of the 29^{th} International Conference on Photonic, Electronic and Atomic Collisions, ICPEAC 2015, July 22 - 28, 2015, Toledo, Spain

[22] E.J.M. van Heesch, J. Zhang, F.J.C.M. Beckers, T. Huiskamp, W.F.L.M. Hoeben, E.M. van Veldhuizen, A.J.M. Pemen, **A.H. Markosyan** and U. Ebert, *Super-critical and high-pressure media for high-repetition rate plasma switch*, proceedings of the 20^{th} IEEE Pulsed Power Conference (PPC) and the 26th IEEE Symposium on Fusion Engineering (SOFE), PPC 2015 SOFE, May 31 - June 4, 2015, Austin, Texas, USA

[21] **A.H. Markosyan**, S. Dujko, U. Ebert, *2D streamer simulations using the high order fluid model*, proceedings of the 67^{th} Annual Gaseous Electronics Conference, GEC 2014, November 3 - 7, 2014, Raleigh, North Carolina, USA

[20] R. Le Picard, **A.H. Markosyan**, D. Porter, M.J. Kushner, S.L. Girshick, *Numerical simulation of 2D capacitively-coupled RF plasma for the synthesis of silicon nanocrystals*, proceedings of the 67^{th} Annual Gaseous Electronics Conference, GEC 2014, November 3 - 7, 2014, Raleigh, North Carolina, USA

[19] **A.H. Markosyan**, A. Luque, F. J. Gordillo-Vázquez, U. Ebert, *PumpKin: A tool to find principal pathways in plasma chemical models*, proceedings of the 5^{th} Annual MIPSE Graduate Student Symposium, October 8, 2014, Ann Arbor, USA; p15

[18] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Comparison of various fluid models for streamer discharge*, proceedings of the Plasma Processing Science Gordon Research Conference, GRC 2014, July 27 - August 1, 2014, Bryant University, Smithfield, RI, USA

[17] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Comparison of various fluid models for streamer discharge*, Proceedings of the Plasma Processing Science Gordon Research Conference (GRC 2014), July 27 - August 1, 2014, Bryant University, Smithfield, RI, USA

[16] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Comparison of various fluid models for streamer discharge*, Proceedings of the Plasma Processing Science Gordon Research Seminar (GRS 2014), July 26 - 27, 2014, Bryant University, Smithfield, RI, USA

[15] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Fluid models and the reality*, Proceedings of the 26^{th} Symposium Plasma Physics and Radiation Technology, March 11 - 12, 2014, Lunteren, Netherlands; A19

[14] **A.H. Markosyan**, J. Teunissen, S. Dujko, U. Ebert, *Comparing fluid model for streamer discharges*, Bulletin of the American Physical Society, 66^{th} Annual Gaseous Electronics Conference, GEC 2013, September 30 - October 4, 2013, Princeton, New Jersey, USA; vol. 58, No. 8, p. 20

[13] **A.H. Markosyan**, J. Zhang, B. van Heesch, U. Ebert, *Investigating streamer to spark transition in supercritical N_2*, Bulletin of the American Physical Society, 66^{th} Annual Gaseous Electronics Conference, GEC 2013, September 30 - October 4, 2013, Princeton, New Jersey, USA; vol. 58, No. 8, p. 25

[12] S. Dujko, Z.Lj. Petrović, R.D. White, D. Bošnjaković, J. Mirić, **A.H. Markosyan**, U. Ebert, *Non-conservative electron transport in gases and its application in modelling of non-equilibrium plasmas and particle detectors*, Proceedings of the XVII International Workshop on Low-Energy Positron and Positronium Physics and the XVIII International Symposium on Electron-Molecule Collisions and Swarms, POSMOL 2013, July 19-21, 2013, Kanazawa, Japan

[11] **A.H. Markosyan**, S. Dujko, R. U. Ebert, *High order fluid model for streamer discharges in rare gases*, Proceedings of the XVII International Workshop on Low-Energy Positron and Positronium Physics and the XVIII International Symposium on Electron-Molecule Collisions and Swarms, POSMOL 2013, July 19-21, 2013, Kanazawa, Japan

[10] **A. Markosyan**, J. Zhang, B. van Heesch, U. Ebert, *Investigating heating dynamics in sparks*, Proceedings of the European Geoscience Union General Assembly 2013, EGU2013, April 07-12, 2013, Vienna, Austria

[9] **A. Markosyan**, J. Zhang, B. van Heesch, U. Ebert, *On the heating dynamics in sparks*, Proceedings of the Physics@FOM, January 22 - 23, 2013, Veldhoven, Netherlands; p.41

[8] **A. Markosyan**, J. Zhang, B. van Heesch, U. Ebert, *Investigating voltage recovery after breakdown supercritical nitrogen*, Bulletin of the American Physical Society, 65^{th} Annual Gaseous Electronics Conference, GEC 2012, October 22-26, 2012, Austin, Texas, USA; vol.57, No.8, p.84

[7] **A. Markosyan**, S. Dujko, R. White, J. Teunissen, U. Ebert, *High order fluid model for streamer discharges*, Bulletin of the American Physical Society, 65^{th} Annual Gaseous Electronics Conference, GEC 2012, October 22-26, 2012, Austin, Texas, USA; vol.57, No.8, p.53

[6] *poster award* **A. Markosyan**, S. Dujko, U. Ebert, *Why do we need high order fluid model for streamer discharges?* Proceedings of the 37^{th} Woudschoten conference, WSC Conference 2012, October 3-5, 2012, Zeist, Netherlands

[5] **A. Markosyan**, S. Dujko, U. Ebert, *High order fluid model for simulations of streamer and sprites*, Proceedings of the 1^{st} Thunderstorm Effects on the Atmosphere-Ionosphere System Summer School, TEA-IS, June 17-22, 2012, Los Alamos, Torremolinos (Malaga), Spain

[4] S. Dujko, **A. Markosyan**, R.D. White, Z.Lj. Petrović, U. Ebert, *High-order fluid model of streamer discharges in molecular nitrogen*, Bulletin of the American Physical Society, 43^{rd} Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics, DAMOP 2012, June 4-8, 2012, Anaheim, California; vol.57, No.5, p.118

[3] **A. Markosyan**, S. Dujko, U. Ebert, *High order fluid model for ionization fronts in streamer discharges*, Proceedings of the 24^{th} Symposium Plasma Physics & Radiation Technology, March 6 - 7, 2012, Lunteren, Netherlands; p. B7

[2] **A. Markosyan**, S. Dujko, W. Hundsdorfer, U. Ebert, *A high order density model for streamer discharges*, Proceedings of the Physics@FOM, January 17 - 18 2012, Veldhoven, Netherlands; p. 250

[1] **A. Markosyan**, S. Dujko, W. Hundsdorfer, U. Ebert, *A high order density model for streamer discharges*, Proceedings of the 14^{th} Euregional WELTPP Workshop on the Exploration of Low Temperature Plasma Physics, December 1 - 2, 2011, "Rolduc" Kerkrade, Netherlands; P42

THESES

- **A.H. Markosyan** Advised by Prof. Ute Ebert and Prof. Saša Dujko "Modeling multiple time scales in streamer discharges". Eindhoven University of Technology, The Netherlands. May 2014.
- **A.H. Markosyan** Advised by Dr. Claude Martini and Prof. Olivier Pironneau. "SVI implied variance parameterization". University Pierre and Marie Curie (Paris 6), France. December 2009.
- **A.H. Markosyan** Advised by Prof.. Michael Poghosyan. "Existence of the minimal element of the class of super-solutions in the one-phase parabolic free boundary problem in convex domain". Yerevan State University, Armenia. May 2008.