

Roman V. Samulyak

Scientist
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Education

New Jersey Institute of Technology/Rutgers University (joint program), Applied Mathematics, Ph.D., 1999
L'viv University, Ukraine, Mathematical Physics, Candidate of Science (Ph.D.), 1995
L'viv University, Ukraine, Physics, M.S., 1992
L'viv University, Ukraine, Physics, B.S., 1989

Appointments

10/2005 – present Scientist, Computational Science Center, Brookhaven National Laboratory, Upton, NY
10/2003 – 10/2005 Associate Scientist, Computational Science Center
10/2001 – 10/2003 Assistant Scientist, Center for Data Intensive Computing, BNL
08/1999 – 09/2001 Postdoctoral Research Associate, Center for Data Intensive Computing, BNL
09/1996 – 05/1999 Graduate Research and Teaching Assistant, Department of Mathematical Sciences and Particle Technology Center, New Jersey Institute of Technology, Newark, NJ
10/1995 – 08/1996 Research Associate, Department of Nonlinear Mathematical Analysis, Institute for Applied Problems of Mechanics and Mathematics, L'viv, Ukraine

Prizes and Honors

Outstanding Graduate Alumnus Award, College of Science and Liberal Arts, New Jersey Institute of Technology, 2004
George Soros Graduate Fellowship Award, 1995 - 1996, L'viv University

Fields of Expertise:

Mathematical modeling, numerical methods and large scale computing, fluid dynamics and magnetohydrodynamics, computational accelerator physics

Research Grants :

Project Title: Numerical Algorithms for the Magnetohydrodynamics of Multifluid Systems

Role in the Project: Principal Investigator

Source of Support: DOE OASCR

Project Duration: 03/21/2001 – present

Award Amount: \$270,000 / year

Project Title: Interoperable Technologies for Advanced Petascale Simulations (within SciDAC program)

Role in the Project: Co-Investigator

Source of Support: DOE OASCR

Project Duration: 10/01/2006 – present

Award Amount: \$200,000 / year

Project Title: Neutrino Factory/Muon Collider Collaboration (Target simulations)

Role in the Project: Co-PI for Target Simulations

Source of Support: DOE HENP / NSF

Project Duration: 10/01/2000 – present

Award Amount: Average \$50,000 / year (for simulation activities)

Project Title: Advanced Computing for 21st Century Accelerator Science and Technology (SciDAC)

Role in the Project: Institutional PI

Source of Support: DOE HENP

Project Duration: 10/01/2001 – 06/30/2006

Award Amount: \$110,000/year

Publications

1. R. Samulyak, T. Lu, P. Parks, A magnetohydrodynamic simulation of pellet ablation in the electrostatic approximation, Nucl. Fusion, 47 (2007), 103-118. Available at http://pubweb.bnl.gov/users/rosamu/www/Papers/Pellet/pellet_MHD_NuclFusion_06.pdf
2. J. Glimm, B. Fix, X. Li, J. Liu, X. Liu, T. Lu, R. Samulyak, Z. Xu, Front Tracking under TSTT, Astronomical Society of the Pacific, 359 (2007), p. 15.
3. R. Samulyak, J. Du, J. Glimm, Z. Xu, A numerical algorithm for MHD of free surface flows at low magnetic Reynolds numbers, J. Comp. Phys., (2007). *Submitted*. Available at <http://pubweb.bnl.gov/users/rosamu/www/Papers/MHD/mhd-embedbdry06.pdf>
4. T. Lu, R. Samulyak, J. Glimm, Direct numerical simulation of bubbly flows and its application, J. Fluid Eng., 129 (2007). *To appear in May issue*. Available at <http://pubweb.bnl.gov/users/rosamu/www/Papers/Multiphase/JFE07.pdf>
5. R. Samulyak, T. Lu, Y. Prykarpatsky, J. Glimm, Z. Xu, M.N. Kim, Comparison of heterogeneous and homogenized numerical models of cavitation, Int. J. Multiscale Comp. Eng., 4 (2006), No 3, 377 - 389. Available at <http://pubweb.bnl.gov/users/rosamu/www/Papers/Multiphase/IJMCE06.pdf>
6. Z. Xu, M.N. Kim, W. Oh, J. Glimm, R. Samulyak, X.L. Li, and C. Tzanos, Atomization of a high speed jet, Int. J. Multiscale Comp. Eng., 4 (2006), 601 - 616. Available at http://pubweb.bnl.gov/users/rosamu/www/Papers/Multiphase/jet_atomization.pdf
7. Z. L. Xu, T. Lu, R. Samulyak, J. Glimm, X. M. Ji, Dynamic phase boundaries for compressible fluids, SIAM J. Computing, 2006. *Submitted*. Available at http://pubweb.bnl.gov/users/rosamu/www/Papers/Multiphase/phase_transition_alg.pdf
8. J. Du, T. Lu, R. Samulyak, Algorithms for magnetohydrodynamics of ablated materials, Journal of Nanoscience and Nanotechnology, 2006. Submitted
9. N.V. Mokhov, P.C. Czarapata, A.I. Drozhdin, D.A. Still, R.V. Samulyak, Beam-induced damage to the Tevatron Components and what has been done about it. Fermilab Preprint: FERMILAB-Conf-06/415-AD, November 2006.
10. B. Fix, J. Glimm, X. Li, Y. Li, X. Liu, R. Samulyak, Z. Xu, A TSTT integrated FrontTier code and its applications in computational fluid physics, Journal of Physics: Conf. Series, 16 (2005), 471 - 475.

11. R. Ryne et. al., SciDAC advances and applications in computational beam dynamics, *Journal of Physics: Conf. Series*, 16 (2005), 210 - 214.
12. R. Samulyak, Y. Prykarpatsky, Richtmyer-Meshkov instability in liquid metal flows: influence of cavitation and magnetic fields, *Mathematics and Computers in Simulations*, 65 (2004), 431 - 446. Available at <http://pubweb.bnl.gov/users/rosamu/www/Papers/MHD/MCS04.pdf>
13. R. Samulyak, T. Lu, Y. Prykarpatsky, Direct and homogeneous numerical approaches to multiphase flows, *Lecture Notes in Comp. Sci.*, 3039 (2004), 653 - 660.
14. A.I. Drozhdin, N.V. Mokhov, D.A. Still, R. Samulyak Beam-induced damage to the tevatron collimators: analysis and dynamic modeling of beam loss, energy deposition and ablation, Fermilab report No. FERMILAB-FN-751, 2004.
15. M. Alsharoá, et al., Recent progress in neutrino factory and muon collider research within the Muon Collaboration, *Phys. Rev. Special Topics - Accelerators and Beams*, 6 (2003), Issue 8, 081001-1 – 52.
16. R. Samulyak, J. Glimm, W. Oh, H Kirk, K. McDonald, Numerical simulation of free surface MHD flows: Richtmyer - Meshkov instability and applications, *Lecture Notes in Comp. Sci.*, 2667 (2003), 558 - 567.
17. J. Glimm, X. L. Li, W. Oh, M.-N. Kim, A. Marchese, R. Samulyak, C. Tzanos, Jet breakup and spray formation in a diesel engine. Second MIT Conf. on Comp. Fluid and Solid Mechanics, June 27-30, 2003.
18. J. R. J. Bennett, et. al, Studies of a Target System for a 4-MW, 24-GeV Proton Beam, CERN Tech. Report CERN-INTC-2003-033 INTC-I-049, 2003.
19. Davenport, J.W., Deng, Y., Glimm, J., and Samulyak, R. Computational science at Brookhaven National Laboratory: Three selected topics. Proc. 6th International Seminar on Science and Computing, Moscow, September 15-17, 2003.
20. R. Ryne, A. Adelman, P. Colella, V. Decyk, A. Dragt, S. Habib, T. Mottershead, F. Neri, J. Qiang, R. Samulyak, D. Serafini, P. Walstrom, MaryLie/IMPACT: a parallel beam dynamics code with space charge. In *Particles and Accelerators*, 2003, May 12-16, Portland, OR.
21. R. Samulyak, Numerical simulation of hydro- and magnetohydrodynamic processes in the Muon Collider target, *Lecture Notes in Comp. Sci.*, 2331 (2002), 391 - 400.

22. R. Ryne, J. Qiang, A. Dragt, S. Habib, T. Mottershead, F. Neri, R. Samulyak, P. Walstrom, MaryLie/IMPACT: a parallel beam dynamics code with space charge. In Proc. of the Computational Accelerator Physics Conference, Oct. 15-18, 2002, East Lansing, MI.
23. Feasibility Study-II of a Muon-Based Neutrino Source”, editors S. Ozaki, R. Palmer, M. Zisman, J. Gallardo, BNL Tech. Report BNL-52623, June 2001; available at <http://www.cap.bnl.gov/mumu/studyii/FS2-report.html>.
24. A. Luccio, N. D’Imperio, R. Samulyak, Solving by parallel computing the Poisson problem for high intensity beams in circular accelerators, In Particles and Accelerators 2001, June 18 - 22, Chicago, IL
25. K. T. McDonald, R. Samulyak, et al., The primary target facility for a neutrino factory based on muon beams, In Particles and Accelerators 2001, June 18-22, Chicago, IL
26. K. T. McDonald, R. Samulyak et al., The R&D program for targetry at neutrino factory, In Particles and Accelerators 2001, June 18 - 22, Chicago, IL.
27. H. Kirk, R. Samulyak et al., Target studies with BNL E951 at the AGS, In Particles and Accelerators 2001, June 18 - 22, Chicago, IL.
28. J. Glimm, H. Kirk, X. L. Li, J. Pinezich, R. Samulyak, N. Simos, Simulation of 3D fluid jets with application to the Muon Collider target design, in Advances of Fluid Mechanics III (Editors: M. Rahman, C. Brebbia), WIT Press, 2000, 191 - 200.
29. D. Blackmore, R. Samulyak, M.C. Leu, Singularity theory approach to swept volumes, International Journal of Shape Modeling, 6 (2000), No.1, 105 - 129.
30. D. Blackmore, R. Samulyak, R. Dave, A. Rosato, Dynamics of a two species oscillating particle system, IUTAM Symposium on Segregation in Granular Flows, Kluwer Academic Publishers, Netherlands, 2000, 255 - 268.
31. D. Blackmore, R. Samulyak, A. Rosato, New mathematical models for granular flow dynamics, Nonlinear Mathematical Physics, 6 (1999), No. 2, 198- 221.
32. D. Blackmore, R. Samulyak, M.C. Leu, Trimming swept volumes, Computer Aided Design, 31 (1999), 215 - 223.
33. D. Blackmore, Y. Prykarpatsky, R. Samulyak, The integrability of Lie- invariant geometric objects generated by ideals in the Grassmann algebra. Nonlinear Mathematical Physics, 5 (1998), N1, 1-14.

34. M. Kopych, Y. Prykarpatsky, R. Samulyak, Adiabatic invariants of a generalized Henon-Heiles Hamiltonian system and the structure of chaotic motion. Proc. of Ukr. Acad. of Sci., 1997, No 2, p.32-36.
35. A. Prykarpatsky, W. Strampp, D. Blackmore, Yu. Sidorenko, R. Samulyak, Some remarks on Lagrangian and Hamiltonian formalism related to infinite dimensional dynamical systems with symmetries, Condensed Matter Phys., 6 (1995), 79 - 104.
36. A. Prykarpatsky, O. Hentosh, M. Kopych, R. Samulyak, Neumann-Bogoliubov-Rosochatius oscillatory dynamical systems and their integrability via dual moment maps. Part I. Nonlinear Mathematical Physics, 2 (1995), No 2, p.98-113.
37. A. Prykarpatsky, R. Samulyak, Higgs model as an exactly integrable bi-Hamiltonian dynamical system of the classical field theory. Proc. of Ukr. Acad. of Sci., 1995, No 1, p.34-37.
38. R. Samulyak, Generalized Dicke type dynamical system as the inverse nonlinear Schrodinger equation. Ukr. Math. J., 47 (1995), No 1, 149-151.
39. R. Samulyak, Hamiltonian analysis of exact integrability of the quantum 3-level superradiance Dicke model, Ukr. Math. J., 44 (1992), No 9, 1149-1155.
40. L. Ivankiv, A. Prykarpatsky, R. Samulyak, Nonequilibrium statistical mechanics of many particle systems and adsorbtion phenomena, IAPMM Preprint, IAPMM-10-91, NAS Publisher, Lviv.

Seminars, Invited Conference Talks and Other Selected Presentations

1. Numerical Algorithms for MHD of Free Surface Flows of Ablated Materials, minisymposium talk at the SIAM Conference on Computational Science and Engineering, February 19 - 23, 2007, Costa Mesa, CA.
2. Axisymmetric MHD Simulations of Pellet Ablation, presentation at the Annual APS Meeting of the Division of Plasma Physics, October 30 - November 3, 2006, Philadelphia, PA.
3. MHD Simulation of Pellet Ablation in Tokamaks, Computational Plasma Physics Seminar, Princeton Plasma Physics Laboratory, Princeton University, July 26, 2006.
4. MHD Control of Laser Ablation Plumes: Models, Algorithms, and Simulation, minisymposium talk at 7th World Congress on Computational Mechanics, July 16-22, 2006, Los Angeles, CA.
5. Numerical Algorithms for MHD of Multiphase Systems and Applications to Fusion Science, Computational Science Center Seminar, Brookhaven National Laboratory, March 9, 2006
6. New Algorithm for Riemann Problem at the Phase Transition Boundary, presentation at the Annual SIAM Conference, July 11 - 15, 2005, New Orleans, LA.
7. Direct Numerical Simulation of Bubbly/Cavitating Flows and Applications to Cavitation Mitigation, invited talk at the Workshop on Mitigation of Cavitation Damage Erosion in Liquid Metal Spallation Targets, November 30 - December 1, 2005 ORNL/SNS.
8. Low Magnetic Reynolds Number Flows with Phase Transitions, presentation at the Second Conference on Frontiers in Applied and Computational Mathematics (FACM-05), May 13-15, 2005, New Jersey Institute of Technology, Newark, NJ.
9. Magnetohydrodynamics Simulations of Free Surface Flows. invited talk at the 2nd High-Power Targetry Workshop, October 10 - 14, 2005, Oak Ridge, TN.
10. Modeling and Simulation of Multiphase Flows and Applications to Accelerator Targets, invited talk at the Conference on Analysis, Modeling and Computation of PDE and Multiphase flow dedicated to the 70th birthday of James Glimm, August 3-5, 2004, Stony Brook University, Stony Brook, New York.

11. Direct and Homogeneous Numerical Approach to Multiphase Flows and Applications, minisymposium talk at the 4th International Conference on Computational Sciences, June 2004, Krakow, Poland.
12. Computational Models for Multiphase MHD Flows, Seminar at the Department of Mechanical Engineering, NJIT, March 25, 2004.
13. Liquid Targets for Advanced Accelerators: Modeling and Simulations, Seminar at National Superconducting Cyclotron Laboratory, Michigan State University, February 5, 2004.
14. Progress in Numerical Studies of Liquid Mercury Targets, invited talk at the Neutrino Factory/Muon Collider Collaboration Meeting, January 27-31, 2004, Mission Inn, Riverside, CA.
15. Algorithms for Multiphase MHD and Applications, minisymposium presentation at 7th US Congress on Computational Mechanics, July 28 - 30, 2003, Albuquerque, NM.
16. Numerical Simulation of Richtmyer-Meshkov Instability in Free surface MHD Flow, minisymposium talk at the 3rd International Conference on Computational Sciences, May 2003, Montreal, Canada.
17. Numerical Simulation of the Hg-Jet Target, invited talk at the Neutrino Factory/Muon Collider Collaboration Meeting, May 9 - 15, 2002, Shelter Island, NY.
18. Numerical Simulation of Hydro- and MHD Processes in Liquid Metal Targets, minisymposium talk at the 2nd International Conference on Computational Sciences, April 2002, Amsterdam, the Netherlands.
19. Computational Methods in Accelerator Physics, Center for Data Intensive Computing Seminar, Brookhaven National Laboratory, October 9, 2001, Upton, NY.
20. Computational Hydro- and Magnetohydrodynamics of 3D free surface flows of real materials. NJIT Applied Mathematics Colloquium, September 7, 2001.
21. Computational Free Surface Hydrodynamics and Magnetohydrodynamics and Applications to the Muon Collider Target Design. Seminar at Princeton Plasma Physics Laboratory, October 12, 2000, Princeton.
22. Simulation of 3D Fluid Jets with Applications to the Muon Collider Target Design, presentation at the 3rd International Conference on Advances in Fluid Mechanics, May, 2000, Montreal, Canada.
23. Front Tracking Simulations of 3D Jets and Accelerator Target Applications, Center for Data Intensive Computing Seminar, Brookhaven National Laboratory, March 24, 2000, Upton, NY.

24. Exact Finite Dimensional Reductions of Nonlinear Dynamical Systems on Functional Manifolds and Applications to Laser Physics Models. Arizona Center for Mathematical Sciences Seminar, University of Arizona, April 1999, Tucson, AZ.
25. Mathematical Models for Particle Flow Dynamics. Department of Mathematics Seminar. Duke University, April 1999, Durham, NC.
26. Dynamical Systems Associated with Particle Flow Models: Theory and Numerical Methods. Department of Applied Mathematics and Statistics Seminar, SUNY at Stony Brook, March 3, 1999, Stony Brook, NY.

Synergistic Activities

American Physical Society

Reviewer for applied and computational mathematics journals and DOE Office of Science proposals

Postdocs and graduate students supervised

Tianshi Lu, postdoctoral research associate, Computational Science Center, 2005 - present.

Yarema Prykarpatsky, postdoctoral research associate, Center for Data Intensive Computing, 2002 - 2004.

Tianshi Lu, graduate student at the Department of Applied Mathematics and Statistics, SUNY at Stony Brook, 2002 - 2005.

Jian Du, graduate student at the Department of Applied Mathematics and Statistics, SUNY at Stony Brook, 2004 - present.

Graduate and Post Doctoral Advisors

J. Glimm, Department of Applied Mathematics and Statistics, SUNY at Stony Brook, and CDIC/BNL

D. Blackmore, Department of Math. Sciences, New Jersey Institute of Technology

A. Prykarpatsky, Institute for Applied Problems of Mechanics and Mathematics, L'viv, Ukraine