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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

2007 – present Associate Professor, SUNY at Stony Brook
2005 – present Scientist, Computational Science Center (CSC), Brookhaven National Laboratory (BNL), Upton, NY
2003 – 2005 Associate Scientist, CSC, BNL
2001 – 2003 Assistant Scientist, CSC, BNL
1999 – 2001 Postdoctoral Research Associate, CSC, 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

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, mathematical physics.

Main Research Grants :

Project Title: Study of Plasma Liner Driven Magnetized Target Fusion via Advanced Simulations

Role in the Project: Principal Investigator

Source of Support: DOE OFES

Project Duration: 12/25/2009 – 12/26/2012

Project Title: Deployment of a Suite of High Performance Computational Tools for Multiscale Multiphysics Simulation of Generation-IV Reactors

Role in the Project: Co-PI

Source of Support: DOE NE

Project Duration: 09/30/2007 – present

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

Role in the Project: Institutional PI

Source of Support: DOE OASCR

Project Duration: 10/01/2006 – present

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

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 – 30/09/2007

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

Publications

1. S. Wang, R. Samulyak, T. Guo, An embedded boundary method for parabolic problems with interfaces and application to multi-material systems with phase transitions, *Acta Mathematica Scientia*, 30 B (2010).
2. R. Samulyak, P. Parks, L. Wu, Spherically symmetric study of plasma liner implosion for magnetized target fusion, *Physics of Plasmas*, 2010. Submitted
3. P. Parks, T. Lu, R. Samulyak, Charging and $E \times B$ rotation of ablation clouds surrounding refueling pellets in hot fusion plasmas, *Physics of Plasmas*, 16, 060705 (2009).
4. H.G. Kirk, R. Samulyak, N. Simos, T. Tsang, I. Efthymiopoulos, A. Fabich, H. Haseroth, F. Haug, J. Lettry, V.B. Graves, P.T. Spampinato, K.T. McDonald, J.R.J. Bennett and T.R. Edgecock, A proof-of-principal experiment for a high-power target system, BNL report BNL-82153-2009-CP, 2009.
5. Z. L. Xu, T. Lu, R. Samulyak, J. Glimm, X. M. Ji, Dynamic phase boundaries for compressible fluids, *SIAM J. Sci. Computing*, 30 (2008), No. 2, 895 - 915.
6. J. Du, T. Lu, R. Samulyak, Algorithms for magnetohydrodynamics of ablated materials, *Journal of Nanoscience and Nanotechnology*, 8 (2008), 3674 - 3685.
7. R. Samulyak, T. Lu, P. Parks, J. Glimm, X. Li, Simulation of pellet ablation for tokamak fuelling with ITAPS front tracking, *Journal of Physics: Conf. Series*, 125 (2008) 012081.
8. R. Samulyak, T. Lu, P. Parks, A magnetohydrodynamic simulation of pellet ablation in the electrostatic approximation, *Nuclear Fusion*, 47 (2007), 103-118.
9. 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.*, 226 (2007), 1532 - 1549.
10. T. Lu, R. Samulyak, J. Glimm, Direct numerical simulation of bubbly flows and its application, *J. Fluid Eng.*, 129 (2007), 595 - 604.
11. 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.
12. Wurigen Bo, Brian Fix, James Glimm, Xiaolin Li, , Xingtao Liu, R. Samulyak, and Lingling Wu *Frontier and Applications to Scientific and Engineering Problems*, *Proceedings in Applied Mathematics and Mechanics*, (2007).

13. R. Ryne et al., Recent progress on the MaryLie/IMPACT beam dynamics code, DOE report, 2007. Available at DOE Information Bridge:
www.osti.gov/servlets/purl/902811-NxUXr2/
14. 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.
15. Z. Xu, M.N. Kim, W. Oh, J. Glimm, R. Samulyak, X.L. Li, and C. Tzanos, Discrete bubble modeling of unsteady cavitating flow, *Int. J. Multiscale Comp. Eng.*, 4 (2006), 601 - 616.
16. 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.
17. 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.
18. R. Ryne et al., SciDAC advances and applications in computational beam dynamics, *Journal of Physics: Conf. Series*, 16 (2005), 210 - 214.
19. 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.
20. R. Samulyak, T. Lu, Y. Prykarpatsky, Direct and homogeneous numerical approaches to multiphase flows, *Lecture Notes in Comp. Sci.*, 3039 (2004), 653 - 660.
21. 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.
22. 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.
23. A. Hassanein, et al., An R&D program for targetry and capture at a neutrino factory and muon collider source, *Nuclear Instruments and Methods in Physics Research, A* 503 (2003) 70 - 77.
24. 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.

25. 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.
26. 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.
27. 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.
28. 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.
29. R. Samulyak, Numerical simulation of hydro- and magnetohydrodynamic processes in the Muon Collider target, Lecture Notes in Comp. Sci., 2331 (2002), 391 - 400.
30. 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.
31. 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>.
32. 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
33. 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
34. 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.
35. H. Kirk, R. Samulyak et al., Target studies with BNL E951 at the AGS, In Particles and Accelerators 2001, June 18 - 22, Chicago, IL.
36. 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.
37. D. Blackmore, R. Samulyak, M.C. Leu, Singularity theory approach to swept volumes, *International Journal of Shape Modeling*, 6 (2000), No.1, 105 - 129.
 38. 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.
 39. D. Blackmore, R. Samulyak, A. Rosato, New mathematical models for granular flow dynamics, *Nonlinear Mathematical Physics*, 6 (1999), No. 2, 198- 221.
 40. D. Blackmore, R. Samulyak, M.C. Leu, Trimming swept volumes, *Computer Aided Design*, 31 (1999), 215 - 223.
 41. 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.
 42. 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.
 43. 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.
 44. 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.
 45. 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.
 46. R. Samulyak, Generalized Dicke type dynamical system as the inverse nonlinear Schrodinger equation. *Ukr. Math. J.*, 47 (1995), No 1, 149-151.
 47. R. Samulyak, Hamiltonian analysis of exact integrability of the quantum 3-level superradiance Dicke model, *Ukr. Math. J.*, 44 (1992), No 9, 1149-1155.

48. L. Ivankiv, A. Prykarpatsky, R. Samulyak, Nonequilibrium statistical mechanics of many particle systems and adsorption phenomena, IAPMM Preprint, IAPMM-10-91, NAS Publisher, Lviv.

Seminars, Invited Conference Talks and Other Selected Presentations

1. Simulation of formation and implosion of plasma liners for magnetized target fusion, 51st Annual Meeting of the Division of Plasma Physics, November 2 - 6, 2009, Atlanta, Georgia.
2. Intrinsic rotation of pellet ablation clouds, 51st Annual Meeting of the Division of Plasma Physics, November 2 - 6, 2009, Atlanta, Georgia.
3. Simulations of Multiphase Flows in Nuclear Fusion Applications, Physics Department Colloquium, Stony Brook University, October 16, 2009, Stony Brook, NY.
4. Multi-Physics Simulations of the Failure of Fuel Rods During Accidents in Sodium-Cooled Fast Reactors, Workshop on Characterization of Advanced Materials Under Extreme Environments for the Next Generation Energy Systems, September 25-26, 2009, Brookhaven National Laboratory, Upton, NY.
5. Simulations of High-Intensity Pulsed Beam Targeting, Workshop on Applications of High Intensity Proton Accelerators, October 19-21, 2009, Fermi National Accelerator Laboratory, Batavia, IL.
6. Simulation of mercury targets for Neutrino Factory / Muon Collider, MUTAC, April 6 - 8 2009, Fermi National Accelerator Laboratory, Batavia, IL.
7. ITAPS Based Software for Multiphase Flows in Nuclear Fusion Applications, SIAM Conference on Computational Science and Engineering, March 2-6, 2009, Miami, Florida.
8. Computational models for the fracture of inhomogeneous brittle materials, Plasticity 2009, St. Thomas, US Virgin Islands, January 3-8, 2009
9. Simulation of Plasma Jet Driven MTF, 50th Annual Meeting of the Division of Plasma Physics, November 17-21, 2008, Dallas, Texas
10. Simulation of mercury targets for Neutrino Factory / Muon Collider, 2nd Princeton/Oxford Meeting on High Power Targets, November 6-7, 2008, Princeton, NJ.
11. Simulations of Multiphase Magnetohydrodynamic Flows for Nuclear Fusion Applications, Invited talk at the Workshop on the Role of

- High Performance Computation in Economic Development, Rensselaer Polytechnic Institute, Troy, New York, October 22 - 24, 2008.
12. Front tracking simulation of pellet ablation for tokamak fuelling, Invited presentation at SciDAC annual meeting, July 13 - 17, 2008, Seattle.
 13. Visualization on New York Blue, BlueGene tutorial, June 12, Stony Brook University, July, 2008.
 14. MHD simulation of liquid mercury jet targets, Annual Meeting of the Neutrino Factory / Muon Collider Collaboration, March 17-20, 2008, Fermilab, IL.
 15. Charging and Rotation of Pellet Ablation Cloud, 49th Annual Meeting of the Division of Plasma Physics November 12 - 16, 2007, Orlando, Florida
 16. Models and Computational Algorithms for Multiphase Magnetohydrodynamics, Applied Mathematics Research Program Annual PI Meeting, DOE Office of Advanced Scientific Computing Research, May 22 - 24, 2007, Lawrence Livermore National Laboratory.
 17. 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.
 18. 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.
 19. MHD Simulation of Pellet Ablation in Tokamaks, Computational Plasma Physics Seminar, Princeton Plasma Physics Laboratory, Princeton University, July 26, 2006.
 20. 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.
 21. Numerical Algorithms for MHD of Multiphase Systems and Applications to Fusion Science, Computational Science Center Seminar, Brookhaven National Laboratory, March 9, 2006
 22. New Algorithm for Riemann Problem at the Phase Transition Boundary, presentation at the Annual SIAM Conference, July 11 - 15, 2005, New Orleans, LA.
 23. Direct Numerical Simulation of Bubbly/Cavitating Flows and Applications to Cavitation Mitigation, invited talk at the Workshop on Mit-

- igation of Cavitation Damage Erosion in Liquid Metal Spallation Targets, November 30 - December 1, 2005 ORNL/SNS.
24. 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.
 25. Magnetohydrodynamics Simulations of Free Surface Flows. invited talk at the 2nd High-Power Targetry Workshop, October 10 - 14, 2005, Oak Ridge, TN.
 26. 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.
 27. Direct and Homogeneous Numerical Approach to Multiphase Flows and Applications, minisymposium talk at the 4th International Conference on Computational Sciences, June 2004, Krakow, Poland.
 28. Computational Models for Multiphase MHD Flows, Seminar at the Department of Mechanical Engineering, NJIT, March 25, 2004.
 29. Liquid Targets for Advanced Accelerators: Modeling and Simulations, Seminar at National Superconducting Cyclotron Laboratory, Michigan State University, February 5, 2004.
 30. 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.
 31. Algorithms for Multiphase MHD and Applications, minisymposium presentation at 7th US Congress on Computational Mechanics, July 28 - 30, 2003, Albuquerque, NM.
 32. 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.
 33. Numerical Simulation of the Hg-Jet Target, invited talk at the Neutrino Factory/Muon Collider Collaboration Meeting, May 9 - 15, 2002, Shelter Island, NY.
 34. 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.

35. Computational Methods in Accelerator Physics, Center for Data Intensive Computing Seminar, Brookhaven National Laboratory, October 9, 2001, Upton, NY.
36. Computational Hydro- and Magnetohydrodynamics of 3D free surface flows of real materials. NJIT Applied Mathematics Colloquium, September 7, 2001.
37. Computational Free Surface Hydrodynamics and Magnetohydrodynamics and Applications to the Muon Collider Target Design. Seminar at Princeton Plasma Physics Laboratory, October 12, 2000, Princeton.
38. 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.
39. Front Tracking Simulations of 3D Jets and Accelerator Target Applications, Center for Data Intensive Computing Seminar, Brookhaven National Laboratory, March 24, 2000, Upton, NY.
40. 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.
41. Mathematical Models for Particle Flow Dynamics. Department of Mathematics Seminar. Duke University, April 1999, Durham, NC.
42. 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

Society for Industrial and Applied Mathematics

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

Postdocs and graduate students supervised

Viktor Kilchyk, Shuqiang Wang, Wurigen Bo: current postdocs at BNL and SUNY AMS Department

Lingling Wu, Hongnen Wei, Tongfei Guo, Xiaolei Zhou: current graduate students at the Department of Applied Mathematics and Statistics, SUNY at Stony Brook.

Tianshi Lu, postdoctoral research associate, Computational Science Center, BNL, 2005 - present; graduate student at the AMS Department, SUNY at Stony Brook, 2002 - 2005.

Jian Du, graduate student at the AMS Department, SUNY at Stony Brook, 2004 - present.

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

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