

Curriculum Vitae

Maciej Swat

Educational Background:

PhD Degree in Theoretical Physics (2003)

Thesis: “*Study of eta pi Spectra – Search for Exotic Meson*”

Thesis Advisor: Prof. Adam Szczepaniak

Indiana University – Bloomington, Indiana

Master Degree in Electrical Engineering (1998)

Bachelor Degree in Electrical Engineering (1997)

Technical University of Lodz – Poland

Professional Experience

Biocomplexity Institute(BI) – Bloomington, IN

2005 to Present

Research Associate / Lead Software Developer

Design, develop and promote CompuCell3D (<http://www.compuCell3d.org/>) – an environment for biophysical simulations. Refactor and expand existing code-base, implement Qt/VTK-based user interfaces and visualization tools, embed scripting languages to create fully customizable environment for scientific computations. Research biophysics, develop and implement mathematical models and numerical algorithms. Assist and guide graduate students and postdocs in designing numerical and scientific programs. Prepare grant proposals, present scientific reports at meetings and workshops. Collaborate with Biocomplexity Institute research staff on improving their throughput. Serve on faculty search committees, screen and interview job candidates for BI positions. Active member of NIH IMAG model sharing working groups.

- ◆ Deployed CompuCell3D as a fully extensible simulation environment for multi-scale biological modeling.
- ◆ Organized (with James Glazier) a series of training and scientific workshops.
- ◆ Co-authored numerous grant proposals and scientific publications.
- ◆ Collaborated with outside researchers on designing next generation bio-modeling tools.

Indiana University – Bloomington, IN

Postdoctoral Fellow

2003-2005

Research Assistant

1998-2003

Accountable for providing research, data analysis and systems development expertise to the Physics Department's Experimental Group. Research theoretical physics, develop and perform quantitative analysis of mathematical models. Present research results at international conferences and workshops. Conceptualize, design, develop, test and support software to perform numerical analysis on gathered data. Deliver Laboratory Physics and General Physics classes to undergraduate students. Supervise 2 students. Oversee embedded systems client-server programming projects.

- ◆ Credited with conceiving, designing and developing high-performance Partial Wave Analysis scientific software, capable of running on parallel computers, to analyze very large data sets, reduce costs and automate manual process.
- ◆ Acknowledged for redesigning the Data Analysis System, reducing processing time from 1 week to 1 hour.

- ◆ Recognized for conducting numerous data analysis and modeling studies, resulting in several publications in professional journals.
- ◆ Administered, optimized and enhanced Linux technical infrastructure for the Nuclear Theory Center.

Technical Proficiency:

- ◆ **Languages:** C, C++ including STL, Python, Perl, Java, SQL, Linux/Unix system programming
- ◆ **Tools, Toolkits and Software:** SWIG, Lex/Yacc, CMake, Qt, PyQt, VTK, Message Passing Interface (MPI), OpenMP, MAPLE, MATLAB including Fuzzy Logic Toolbox, Root, NetBeans, Eclipse, Keil uVision2, MS Visual Studio, XCode
- ◆ **Databases:** MySQL
- ◆ **Scientific Libraries:** LAPACK, CERN Library, GNU Scientific Library, Matrix Template Library (MTL), Boost libraries, Swing, JNI

Publications:

1. "A Computer Simulation of Long-Range Patterning in the Drosophila Pupal Eye," David Larson, Ruth Johnson, Maciej Swat, J. Cordero, James Glazier, Ross Cagan, *PLoS Comput Biol* **6**, e1000841. doi:10.1371/journal.pcbi.1000841(2010).
2. "Workflows for Parameter Studies of Multi-Cell Modeling," Randy W. Heiland, Maciej Swat, Benjamin L. Zaitlen, James A. Glazier, Andrew Lumsdaine, *HPC2010 Conference Proceedings*, Orlando, FL, April 12-15 (2010).
3. "3D Multi-Cell Simulation of Tumor Growth and Angiogenesis," Abbas Shirinifard, John S. Gens, Benjamin L. Zaitlen, Nikodem J. Popławski, Maciej Swat, James A. Glazier, *PLoS ONE* **4**: e7190, doi:10.1371/journal.pone.0007190 (2009).
4. "Front Instabilities and Invasiveness of Simulated Avascular Tumors", Nikodem Popławski, Ubirajara Agero, J. Scott Gens, Maciej Swat, James A. Glazier, *Bulletin of Mathematical Biology*, **5**(71), pp. 1189-1227 (2009).
5. "Multi-Cell Simulations of Development and Disease Using the CompuCell3D Simulation Environment," Maciej Swat, Susan D. Hester, Randy W. Heiland, Benjamin L. Zaitlen, James A. Glazier. In Ivan V. Maly ed., *Systems Biology Series: Methods in Molecular Biology*, pp. 138-190.
6. "Coordinated Action of N-CAM, N-cadherin, EphA4, and ephrinB2 Translates Genetic Prepatterns into Structure during Somitogenesis in Chick," James A. Glazier, Ying Zhang, Maciej Swat, Benjamin Zaitlen and Santiago Schnell, *Current Topics in Developmental Biology* **81**, 205-247 (2008).
7. "Simulation of Single-species Bacterial-Biofilm Growth using the Glazier-Graner-Hogeweg Model and the CompuCell3D Modeling Environment," Nikodem J. Popławski, Abbas Shirinifard, Maciej Swat and James A. Glazier, *Mathematical Biosciences and Engineering* **5**, 355-388 (2008).
8. "From genes to organisms via the cell: a problem-solving environment for multicellular development," Trevor Cickovski, Karim Aras, Mark S. Alber, Jesus A. Izaguirre, Maciej Swat, James A. Glazier, Roeland M.H. Merks, Tilmann Glimm, H. George E. Hentschel, Stewart A. Newman, *Computers in Science and Engineering* **9**, 50-60 (2007).
9. "The Glazier-Graner-Hogeweg model: extensions, future directions, and opportunities for further study," Ariel Balter, Roeland M. H. Merks, Nikodem J. Popławski, Maciej Swat, James A. Glazier, in: Alexander R. A. Anderson, Mark A. J. Chaplain, Katarzyna A. Rejniak, eds., *Single-Cell-Based Models in Biology and Medicine*, pp. 151-168. Mathematics and Biosciences in Interaction, Birkhauser, Basel, Boston and Berlin (2007).

10. "Adhesion between cells, diffusion of growth factors, and elasticity of the AER produce the paddle shape of the chick limb," Nikodem J. Popławski, Maciej Swat, J. Scott Gens and James A. Glazier, *Physica A* **373**, 521-532 (2007).
11. "A Partial Wave analysis of the $\pi^- \pi^- \pi^+$ and $\pi^0 \pi^0 \pi^-$ and the Search for $J^{PC}=1^-+$ Meson," Alexander Dzierba, Maciej Swat, Ryan Mitchel, Adam Szczepaniak, Scott Teige, *Physical Review D* **73**, 072001 (2006).
12. "Reply to Comments on "The Evidence for a Pentaquark Signal and Kinematic Reflections," Alexander Dzierba, Dan Krop, Maciej Swat, Adam Szczepaniak, Scott Teige, *Physical Review D* **71**, 098502,(2005).
13. "The evidence for a pentaquark signal and kinematic reflections," Alexander Dzierba, Dan Krop, Maciej Swat, Adam Szczepaniak, Scott Teige, *Physical Review D*, **69**, 051901 (2004).
14. "Exotic meson searches: E852 data analysis", Maciej Swat, *Proceedings of 10th International Conference on Hadron Spectroscopy, Aschaffenburg, Germany, AIP Conf.Proc.***717**:462-466,(2004).
15. "Study of the $\eta \pi^-$ and $\eta' \pi^-$ Spectra and Interpretation of Possible Exotic $J^{PC} = 1^-+$ Mesons," Adam Szczepaniak, Maciej Swat *et al.*, *Physical Review Letters* **91**, **09** (2003).
16. "Search for a $J^{PC} = 1^-+$ Exotic Meson in the $\eta \pi^0$ System," Alexander Dzierba, Maciej Swat, Adam Szczepaniak, Scott Teige, *Physical Review D*, **67**, 094015 (2003).
17. "Role of Photoproduction in Exotic Meson Searches," Adam Szczepaniak, Maciej Swat, *Physics Letters B*, **516**, 72-76 (2001).
18. "Fuzzy modeling of dynamics of chamber resistance furnaces," Jacek Kucharski, Maciej Swat, *Proceedings of 5th International Symposium on Methods and Models in Automation and Robotics MMAR'98* (1998).

Seminars & Speaking Engagements:

1. "The Genes Are Not Enough - Multi-Scale Modeling Using CompuCell3D", Cancer Modeling Workshop and Summer School, University of Dundee, Scotland, August 2010 - invited lecture
2. "Towards Virtual Tissues – Multi-Scale Modeling Using CompuCell3D and SBW", University of Madrid (UAM), December 2009 – invited talk and tutorial
3. "From Genes to Tissues – Multi-Scale Modeling of Complex Biological Systems Using CompuCell3D and SBW", University of Madrid (UAM), December 2008 – invited talk and tutorial
4. "From regulatory networks to tissue level phenomena – multi-scale modeling of biological systems using CompuCell3D and SBW", University Of Barcelona, Spain , December 2008 – invited talk
5. "Biological and Biomedical Modeling Using CompuCell3D", Q-Bio Conference on Cellular Information Processing August 2008 – invited tutorial
6. "Modeling Complexity of Biological Systems – approaches, challenges and partial answers. Multi-cell modeling with CompuCell3D", 8th Understanding Complex Systems Symposium, May 2008 – invited talk
7. "CompuCell3D Progress and Roadmap" Applications of Methods of Stochastic Systems and Statistical Physics in Biology, University of Notre Dame, 2005 invited talk
8. "High Performance Computing in Very Large Data Sets Analysis – Design and Implementation," Argonne National Laboratory, 2003.
9. "Search for Exotic Hybrid Meson in the $\eta \pi$ Systems," Hadron 2003 International Conference, Aschaffenburg, Germany, conference talk, 2003
10. "Nature of Low Mass Exotic Mesons," Indiana University, HALL D Collaboration Meeting, 2002.
11. "Theoretical Analysis of $\eta \pi^0$ System - Exotic Meson," Florida State University, E852 Collaboration Meeting, 2002.

12. "Progress in Analysis of eta pi Channels," University of Regina (Canada), Glue X collaboration Meeting, 2002.

Achievements & Awards:

- ◆ Outstanding Research Award - Indiana University, 2003
- ◆ Master Thesis with Honors - Technical University of Lodz, Poland, 1998
- ◆ Fellowship - Technical University of Denmark, 1997
- ◆ Finalist of Physics Olympiad, 1993

Grants:

1. NIH/NIGMS 1 RO1GM077138-01A1 (PI J.A.Glazier) 09/28/07 - 08/31/10. Development and Improvement of Tissue Simulation Toolkit. Significantly contributed to grant proposal preparation. Role: Lead developer of the CompuCell3D toolkit
2. CompuCell3D project is a significant part of the following awards: Texas-Indiana Virtual Star Center – EPA grant (PI: J. A. Glazier) , NIH “Segmentation in Vertebrates” (PI: J. A. Glazier). Between 2007 and 2010 the CompuCell3D project brought an estimated \$2 million in direct funding.

Event Organization:

1. “Mini-Workshop on Model Sharing,” 4/10/07, NIH, Bethesda Maryland (with James Glazier). Workshop on model sharing techniques in the biological sciences for NIH, NSF, DOE and NASA Program Directors and Computational Biology Researchers.
2. Training Workshop, “1st Annual CompuCell3D User Training Workshop,” Indiana University, Bloomington, Indiana, 8/13/07-8/17/07 (with James Glazier).
3. Training Workshop, “2nd Annual CompuCell3D User Training Workshop,” Indiana University, Bloomington, Indiana, 6/16/08-6/20/08 (with James Glazier and Benjamin Zaitlen).
4. Symposia, “IMAG: Cell and Multi-Cellular Modeling—Parts I and II,” SIAM Conference on the Life Sciences, Montreal, Canada, 8/4/08 and 8/5/08 (with James Glazier).
5. International “Cell Behavior Ontology Workshop,” National Institutes of Health, Bethesda, Maryland, 5/4/09-5/7/09 (with James Glazier, Benjamin Zaitlen, Randy Heiland and Herbert Sauro).
6. Training Workshop, “3rd Annual CompuCell3D User Training Workshop,” Indiana University, Bloomington, Indiana, 8/17/09-8/22/09 (with James Glazier and Benjamin Zaitlen).
7. Biophysics Workshop , “Biocomplexity X: Quantitative Tissue Biology and Virtual Tissues,” Indiana University, 10/28/2009-11/02/09 (with James Glazier and Benjamin Zaitlen).
8. Training Workshop, “3rd Annual CompuCell3D User Training Workshop,” Indiana University, Bloomington, Indiana, 8/17/09-8/21/09 (with James Glazier and Benjamin Zaitlen).
9. Training Workshop, “Joint CompuCell3D and SBW User Training Workshop,” Indiana University, Bloomington, Indiana, 8/02/010-8/13/10 (with James Glazier and Herbert Sauro).
10. International “Cell Behavior Ontology and Standards for Multicellular Model Specification,” a part of International Conference on Systems Biology 10/15/10 – 10/16/10 , Edinburgh, Scotland (with James Glazier and Nick Monk).

Teaching Activities:

Graduate Mathematical Biology (Indiana University, Physics 548) – responsible for part of the course

Introductory Physics 201, 202 – lab and discussion sections
CompuCell3D Training Workshops – teaching advanced biomedical modeling using CompuCell3D and SBW.

Departmental Service:

Serving on Systems Biology/Biocomplexity Faculty Search Committee
Responsible for selecting and interviewing job candidates for various positions in Biocomplexity Institute.
Participation in Physics Open House events.

Other Service:

Serving as a reviewer for “*Computational and Mathematical Methods in Medicine*”.

Referees:

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