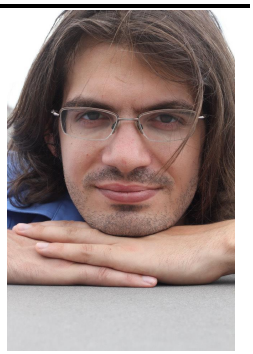
Robert A. Blackwell

Loewenichstr. 4
Erlangen, Germany 91054
robert.blackwell@fau.de
+49 (0)15 255 194906



Education

Ph.D. in Physics
University of Colorado at Boulder
Focus: Computational soft condensed matter and biophysics
Advisors: Matthew Glaser, Meredith Betterton
Graduation: May 2016
Thesis title: Modeling cytoskeletal active matter systems
Thesis description: Active networks of filamentous proteins and crosslinking motor proteins play a critical role in many important cellular processes. One of the most important microtubule-motor protein assemblies is the mitotic spindle, a self-organized active liquid-crystalline structure that forms during cell division and that ultimately separates chromosomes into two daughter cells. To evolve a better understanding of spindle formation, structure, and dynamics, I investigate course-grained models of active liquid-crystalline networks composed of microtubules in diffusive equilibrium with a reservoir of active crosslinks. In my work, I examine extensile and contractile stress generation in active networks, kinetochore capture dynamics, and spindle formation in S. Pombe.

B.S. in Physics
University of Georgia
Graduation: May 2007

Research Interests

My current research interests include membrane modeling, membrane-protein interactions, cytoskeletal modeling, and the mechanical basis for mitotic spindle formation. Broader interests include biophysics, non-equilibrium statistical mechanics, and soft condensed matter.

Awards and Honors

- **Award for Outstanding Doctoral Thesis Research in Biological Physics**
  American Physical Society Division of Biological Physics, (March 2017)
- **Postdoctoral Fellowship**
  Alexander von Humboldt Foundation (2017–2019)

Research Articles

- **A microtubule pushing mechanism promotes spindle bipolarity in the absence of kinesin-5**
  Sergio Rincon, Adam Lamson, Robert Blackwell, Viktoriya Syrovatkina, Vincent Fraisier, Anne Paoletti, Meredith Betterton, Phong Tran
  Accepted, Nature Communications (March 2017)

- **Contributions of microtubule dynamic instability and rotational diffusion to kinetochore capture**
  Robert Blackwell, Oliver Sweezy-Schindler, Christopher Edelmaier, Zachary Gergely, Patrick Flynn, Salvador Montes, Ammon Crapo, Alireza Doostan, J. McIntosh, Matthew Glaser, and Meredith D. Betterton
  Biophys. J, 112, 3, 552-563 (2017)
  DOI: 10.1016/j.bpj.2016.09.006
- **Physical determinants of bipolar mitotic spindle assembly and stability in fission yeast**
  Robert Blackwell, Christopher Edelmaier, Oliver Sweezy-Schindler, Adam Lamson, Zachary Gergely, Eileen OToole, Ammon Crapo, Loren E. Hough, J. Richard McIntosh, Matthew A. Glaser, Meredith D. Betterton
  Science Advances, e1601603 (2017)
  DOI: 10.1126/sciadv.1601603
  Press: *Physics sheds new light on cellular biology*
- **Microscopic origins of extensile versus contractile active stress in cytoskeletal motor-filament systems**
  R.A. Blackwell, Oliver Sweezy, Christopher Baldwin, M.A. Glaser, M.D. Betterton
  Soft Matter, 12, 2676-2687 (2016)
  DOI: 10.1039/C5SM02506K
- **Hysteresis, reentrance, and glassy dynamics in systems of self-propelled rods**
  Physical Review Letters, 92, 060501 (2015)
  Hui-Shun Kuan, R.A. Blackwell, M.A. Glaser, M.D. Betterton
  DOI: 10.1103/PhysRevE.92.060501
- **Multiscale modeling and simulation of microtubule-motor-protein assemblies**
  Tong Gao, R.A. Blackwell, M.A. Glaser, M.D. Betterton, M.J. Shelley
  Physical Review E, 92, 062709 (2015)
  DOI: 10.1103/PhysRevE.92.062709
- **Multiscale polar theory of microtubule and motor-protein assemblies.**
  Tong Gao, R.A. Blackwell, M.A. Glaser, M.D. Betterton, M.J. Shelley
  Physical Review Letters, 114, 048101 (2015)
  DOI: 10.1103/PhysRevLett.114.048101
- **Metal nanoparticle embedded porous thin films prepared by oblique angle coevaporation**
  Journal of Vacuum Science and Technology B, 26, 1344 (2008)
  R. Blackwell, Y.-P. Zhao
  DOI: 10.1116/1.2949106

Invited Talks

- **Modeling active flows and stress generation in microtubule-motor networks**
  SIAM CSE – Salt Lake City, UT
  March 15, 2015
  http://meetings.siam.org/sess/dsp_talk.cfm?p=68588

Contributed Talks

- **Non-equilibrium states of active filament networks**
  APS March Meeting – Denver, CO
  March 4, 2014

Poster Presentations

- **A biophysical model for the formation of mitotic spindle bipolarity**
  R.A. Blackwell, C. Edelmaier, O. Sweezy-Schindler, Z. Gergely, E. O'Toole, P. Flynn, S. Montes, A. Crapo, L.E. Hough, J.R. McIntosh, M.A. Glaser, and M.D. Betterton
  EMBL, Microtubules: from atoms to complex systems (2016)

- **A computational model for fission yeast mitotic spindle formation**
  R.A. Blackwell, C. J. Edelmaier, M. A. Glaser, M. D. Betterton
  Physics of Cells (2015)
- **Modeling the microscopic to macroscopic dynamics of actively streaming microtubule suspensions**
  R.A. Blackwell, Tong Gao, M.A. Glaser, M.J. Shelley, M.D. Betterton
  Biophysical Society Meeting (2014)
- **A computational model for fission yeast mitotic spindle formation**
  R.A. Blackwell, C.J. Edelmaier, Oliver Sweezy, M.A. Glaser, M.D. Betterton
  APS March Meeting (2014)
- **A computational model for fission yeast mitotic spindle formation**
  R.A. Blackwell, C.J. Edelmaier, Oliver Sweezy, M.A. Glaser, M.D. Betterton
  Front Range Cytoskeleton Meeting (2014)
- **Non-equilibrium states of active liquid crystalline networks**
  R.A. Blackwell, M.D. Betterton, M.A. Glaser
  University of Colorado Materials Research Day (2013)
- **Non-equilibrium states of active liquid crystalline networks**
  R.A. Blackwell, M.D. Betterton, M.A. Glaser
  Active Jammed Systems (2012)
- **Non-equilibrium states of active liquid crystalline networks**
  R.A. Blackwell, M.D. Betterton, M.A. Glaser
  Frontiers of Soft Matter (2012)
- **Non-equilibrium phase diagram of 2D self-propelled hard rods**
  R.A. Blackwell, M.A. Glaser, Tatiana Kuriabova, M.D. Betterton
  The Cellular Cytoskeleton (2010)

Employment and Research Experience

Postdoctoral Researcher
January 2016-
Friedrich-Alexander-Universität Erlangen-Nürnberg
Intitut für Theoretische Physik
Current research topic: Modeling equilibrium membrane-substrate interactions for giant unilamellar vesicles.

Graduate Research Assistant
Computational Active Soft Matter and Biophysics
Department of Physics
University of Colorado at Boulder
Fall 2007 – Present

- Developed a computationally efficient statistical-mechanical model to simulate motor protein/microtubule composite systems at the microtubule level. I used this model to demonstrate the microscopic origins of extensile stress in microtubule/motor systems and showed the importance of the excluded volume interactions when considering certain motor/filament solutions.
- Used these simulations to calculate the average stress generated by motor protein/filament suspensions to inform values in a Doi-Onsager continuum model developed by Michael Shelley and Tong Gao. The polarity sorting predicted by my microscopic model allowed us to connect microscopic structure to large scale flow structures and defects seen in experimental systems.
- Extended the model to study both mitotic spindle formation and spindle stability in fission and budding yeasts. Using experimental values for various protein properties to inform the parameters in my model, I demonstrated that a simple model can lead to spontaneous formation of bipolar spindles.
- Trained and led a small team of graduate students, research assistants, and undergraduate researchers to work on projects including flock formation in self propelled particles, contractile stress generation in active suspensions, centromere centering and kinetochore capture dynamics.

Undergraduate Research Assistant
Condensed Matter Experiment
Science and Engineering Center
University of Georgia
Summer 2006 – Fall 2007

- Used deposition techniques, specifically thermal evaporation, developed an oblique angle deposition method for evaporating 2 materials at once using thermal evaporation onto the same substrate with limited resources. I used this technique to combine various ratios of MgF2 and Ag to adjust the optical absorption properties of the resulting materials.
- Performed measurements using a XRD system, SEM, TEM, optical microscope, and UV-Vis spectrometer.

Teaching Experience

Advanced Undergraduate Quantum Mechanics
Friedrich-Alexander-Universität Erlangen-Nürnberg
Teaching Assistant
Spring 2016

Graduate Foundations of Interdisciplinary Biology
Interdisciplinary Quantitative Biology Program
University of Colorado at Boulder
Teaching Assistant
Fall 2011, Fall 2012

- Responsible for office hours, grading, and direct student assistance with weekly computational lab section.
- Worked with leading researchers in multiple fields to guide curriculum development and provide effective faculty-student communication.
- Worked closely with students to address core deficiencies common computational biology skills.
- Learned a broad survey of both techniques and problems common in computational biology.

Calculus-Based Introductory Physics I
Department of Physics
University of Colorado at Boulder
Recitation Teaching Assistant
Spring 2012

- Responsible for in-recitation learning, office hours, test administration, and homework grading.
- Provided extra-curricular study sessions, appointments with students, and study guides for difficult topics.

Interests

Classical violin and piano, snowsports, drawing, hiking, chess.