MATT BIERBAUM

P H Y S I C S | S I M U L A T I O N | W E B

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425 Clark Hall
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Education

2009 - 2015 **Cornell University** - Ph.D. Physics, advisor James P. Sethna

2009 - 2012 **Cornell University** - M.S. Physics, advisor James P. Sethna

2005 - 2009 **Northwestern University** - B.A. Physics and Integrated Science, advisor Frederic Rasio

Research

Current

Collective motion at heavy metal concerts - describing the phase transition between mosh pit and circle pit, covered by NPR, Times, Atlantic, PopSci, NBC, NatGeo with 0.7M visitors
Zombie disease dynamics - modeling spread of zombieism across the entire US population, covered by WaPo, CBS, NBC, CBC, Smithsonian, HuffPo with 0.9M visitors
Colloidal stresses - developing experimental techniques to measure forces in suspensions
Continuum plasticity - dynamics of line defects in metals using PDEs
OpenKIM pipeline - frontend, backend, and testing framework for repository of interatomic models
Surface energies - using OpenKIM framework to create broken bond fits to surface energies
Phonon spectra - employing symmetries to create small parameter fits for phonon spectra
Smectic A - creation and dynamics of focal conic defects in layered materials

Past

Globular cluster dynamics - formation of intermediate mass black holes in primordial clusters
Hidden paintings - using subsurface scattering to infer paintings below the surface

Publications & Talks

Published

You Can Run, You Can Hide: The Epidemiology and Statistical Mechanics of Zombies -- Alemi, Bierbaum, Myers, Sethna arXiv:1503.01104 2015

Visualization, coarsening and flow dynamics of focal conic domains in simulated Smectic-A liquid crystals -- Liarte, Bierbaum, Zhang, Leahy, Cohen, Sethna arXiv:1412.8424 2014

Collective motion of humans in mosh and circle pits at heavy metal concerts -- Silverberg, Bierbaum, Sethna, Cohen PRL 110 (22) 228701 2013

Scaling theory of continuum dislocation dynamics in three dimensions: Self-organized fractal pattern formation -- Chen, Choi, Papanikolaou, Bierbaum, Sethna IJP 46, 94-129 2013

Formation of Massive Black Holes in Dense Star Clusters. II. Initial Mass Function and Primordial Mass Segregation -- Goswami, Umbreit, Bierbaum, Rasio APJ 752 (1), 43 2012

In-progress

The OpenKIM Processing Pipeline: A Virtual Machine Cloud-Based Automatic Materials Property Computation Engine -- Bierbaum, Alemi, Karls, Wennblom, Elliott, Sethna, Tadmor

Experience & Skills

General Numerical simulation (PDEs, automata, MC) ‖ High performance computing and GPUs ‖ Constraint satisfaction ‖ Analytical prediction ‖ Data analysis

Major Python ‖ C / C++ ‖ CUDA ‖ Javascript ‖ Linux ‖ Git ‖ Vim ‖ HTML5 / Canvas ‖ CSS ‖ AWS

Minor Web{Sockets,Workers} ‖ SQL ‖ MongoDB ‖ Java ‖ GLSL ‖ GIS ‖ Arduino ‖ Blender ‖ etc

Interests

Daily Bicycles - Carbon road, single speed road, single speed mountain bike
Short films / photography - filming, editing, timelapse
Fun physics - cost of a pot hole, physics of bubbles, projects below

Projects *Cupgame chaos* - formation of fractals from carnival games ‖ *Plinko simulation* - investigating 'Price is Right' game ‖ *Clicky* - one shared dot for the entire internet ‖ *Onelook* - Ludum dare game uses light as game mechanic ‖ *Billiards* - statistical study of pool shots