

# Thibault Bertrand

POSTDOCTORAL FELLOW · UNIVERSITÉ PIERRE ET MARIE CURIE

Laboratoire Jean Perrin (UMR 8237 CNRS-UPMC), 4 Place Jussieu, Tour 32-33, 75252 Paris Cedex 05, FRANCE

☎ +33 6 45 17 19 28 | ✉ thibault.bertrand@yale.edu, bertrandtj@gmail.com | 🏠 <http://campuspress.yale.edu/tbertrand/> | 📧 bertrandtibo

## Education

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### Yale University

New Haven, CT, USA

PHD IN ENGINEERING AND APPLIED SCIENCE

MPHIL IN ENGINEERING AND APPLIED SCIENCE

September 2011 - May 2016

MS IN ENGINEERING AND APPLIED SCIENCE

- Thesis: "Shaking the Sandbox: Energy Transport, Shear Jamming and Protocol Dependence in Model Jammed Solids"
- Committee: Corey S. O'Hern (Yale, Chair/Advisor), Mark D. Shattuck (CCNY), Eric Brown (Yale), Eric Dufresne (ETH Zürich) and Eric Weeks (Emory, External reader)
- Research Areas: Jamming, Granular Materials, Glassy Materials, Mechanics of Gels
- Selected Coursework: Solidification & Phase Transformations, Advanced Statistical Physics, Parallel Programming Techniques, Stochastic Processes, Systems Modeling in Biology, Biological Physics, Numerical Simulations of Liquids

### École Normale Supérieure de Cachan

Paris, France

DIPLÔME DE PHYSIQUE DE L'ENS CACHAN (ÉLÈVE NORMALIEN)

September 2008 - June 2011

- Specialty in Soft Matter and Complex Fluids

### École Normale Supérieure de Cachan & Université Pierre et Marie Curie (Paris VI)

Paris, France

MS IN PHYSICS

September 2006 - June 2011

BS IN PHYSICS

- Élève Normalien
- Research Areas: Complex fluids, Granular suspensions, Hydrodynamic instability
- Selected Coursework: Quantum Mechanics, Statistical Physics, Solid State Physics, Soft Matter Physics, Statistical Approaches to Condensed Matter, Physics of the Environment, Non Linear Physics, Fluid Mechanics, Continuum Mechanics, Physical Chemistry of Polymers, Biophysics

## Research Experience

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### Université Pierre et Marie Curie (Paris VI)

Paris, France

POSTDOCTORAL FELLOW

November 2016 - Present

- Supervisor: Raphaël Voituriez, Laboratoire Jean Perrin (UMR 8237 CNRS-UPMC)
- Research themes: Non-equilibrium statistical physics of active matter (theory & simulations)

### Yale University

New Haven, CT, USA

POSTDOCTORAL FELLOW

May 2016 - November 2016

- Supervisor: Corey S. O'Hern, Department of Mechanical Engineering and Materials Science
- Research themes: Shear jamming in frictional granular packings; Experimental density of states of a model granular solid (experiments, theory & simulations)

### Yale University

New Haven, CT, USA

GRADUATE RESEARCH ASSISTANT

September 2011 - May 2016

- Supervisor: Corey S. O'Hern, Department of Mechanical Engineering and Materials Science
- Research themes: Energy Transport, Shear Jamming and Protocol Dependence in Model Jammed Solids (theory & simulations)

### Ecole Supérieure de Physique et Chimie Industrielles

Paris, France

MASTER'S STUDENT, LABORATOIRE DE PHYSIQUE ET MÉCANIQUE DES MILIEUX HÉTÉROGÈNES (PMMH)

January 2011 - July 2011

- Supervisors: Anke Lindner & Éric Clément
- Research themes: Dynamics of drop formation in model granular suspensions (experiments)

### Yale University

New Haven, CT, USA

VISITING ASSISTANT OF RESEARCH, O'HERN RESEARCH GROUP

March 2010 - September 2010

- Supervisor: Corey S. O'Hern, Department of Mechanical Engineering and Materials Science
- Research themes: Vibrations in model jammed solids (theory & simulations)

### Ecole Supérieure de Physique et Chimie Industrielles

Paris, France

UNDERGRADUATE RESEARCHER, LABORATOIRE DE PHYSIQUE ET MÉCANIQUE DES MILIEUX HÉTÉROGÈNES (PMMH)

January 2009 - May 2009

- Supervisors: Éric Clément & Bruno Andreotti
- Research themes: Dynamical arrest in avalanches in granular media (experiments)

## Honors & Awards

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2016	<b>Harding Bliss Prize for exceptional achievement in Engineering and Applied Science</b> School of Engineering and Applied Science	<i>Yale University</i>
2015-2016	<b>Tananbaum Fellowship</b> Graduate School of Arts and Sciences	<i>Yale University</i>
2015-2016	<b>Advanced Graduate Leadership Program (AGLP) Fellow</b> School of Engineering and Applied Science	<i>Yale University</i>
2015-2016	<b>Graduate Affiliate Coordinator</b> Head of the Graduate Affiliate Program, Trumbull College	<i>Yale University</i>
2015	<b>FGSA Travel Award for Excellence in Graduate Research</b> Forum on Graduate Student Affairs	<i>American Physical Society</i>
2015	<b>Grant-In-Aid of Research (Grant # G201503151200640)</b> "Self-Assembly of Phononic Granular Crystals"	<i>Sigma Xi</i>
2015	<b>Graduate Student Speaker Award Finalist</b> Topical Group on Statistical and Non Linear Physics	<i>American Physical Society</i>
2015	<b>Conference Travel Fellowship</b> Yale Graduate Student Assembly	<i>Yale University</i>
2014-2015	<b>Graduate Affiliate</b> Trumbull College	<i>Yale University</i>
2014	<b>Conference Travel Fellowship</b> Yale Graduate Student Assembly	<i>Yale University</i>
2012-2015	<b>Elihu Elias Dickerman Fellowship</b> Graduate School of Arts and Sciences	<i>Yale University</i>

## Publications List

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Citations: 156, h-index: 6

### ARTICLES

1. **T. Bertrand**, C.S. O'Hern, and M.D. Shattuck, "Experimental Determination of the Density of States of a Granular Solid", *in preparation* (2016)
2. **T. Bertrand**, C.S. O'Hern, and M.D. Shattuck, "Jamming at Finite Temperature : A review", *in preparation* (2016)
3. Q. Wu, **T. Bertrand**, C.S. O'Hern, and M.D. Shattuck, "Statistics of Contact Breaking in Vibrated Jammed Solids", *in preparation* (2016)
4. J. Barés, D. Wang, **T. Bertrand**, D. Wang, and R.P. Behringer, "Local and global avalanches in a 2D sheared granular medium", *in preparation* (2016)
5. **T. Bertrand**, J. Peixinho, S. Mukhopadhyay, and C.W. MacMinn,, "Dynamics of swelling and drying in a spherical gel", *Physical Review Applied*, 6 064010 (2016) (Selected as Editor's Suggestion)
6. **T. Bertrand**, R.P. Behringer, B. Chakraborty, C.S. O'Hern, and M.D. Shattuck, "Protocol Dependence of the Jamming Transition", *Physical Review E* 93 012901 (2016)
7. **T. Bertrand**, K. Kaczmarek, and L. Wilen, "Musical Acoustics & Instrument Design: when Engineering meets Music", Proceedings of the 41st International Computer Music Conference (ICMC 2015)
8. **T. Bertrand**, C.F. Schreck, C.S. O'Hern and M.D. Shattuck, "Hypocoordinated solids in particulate media", *Physical Review E* 89 062203 (2014)
9. M.S. van Deen, **T. Bertrand**, N. Vu, D. Quééré, E. Clément, and A. Lindner, "Particles accelerate the detachment of viscous liquids", *Rheologica Acta* 52 (5) 403-412 (2013)
10. C. Bonnoit\*, **T. Bertrand\***, E. Clément, and A. Lindner, "Accelerated drop detachment in granular suspensions", *Physics of Fluids* 24 (4) 043304 (2012) (\* These authors contributed equally to this work)
11. **T. Bertrand**, C. Bonnoit, E. Clément, and A. Lindner, "Dynamics of drop formation in granular suspensions: the role of volume fraction", *Granular Matter* 14 169-174 (2012)
12. C.F. Schreck, **T. Bertrand**, C.S. O'Hern, and M.D. Shattuck, "Repulsive contact interactions make jammed particulate systems inherently nonharmonic", *Physical Review Letters* 107 (7) 078301 (2011)

## BOOKS

"Computational Methods", with C.S. O'Hern, in *Handbook of Granular Materials* ed. by M.D. Shattuck and S.F. Franklin (CRC Press, New York, 2013).

## Talks & Posters

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### INVITED TALKS

- 2017      **Simulations of Shear Jamming in Packings of Frictionless and Frictional Particles (upcoming)**      *New Orleans, LA, USA*  
APS March Meeting
- 2015      **Stress Anisotropy in Particulate Jammed Systems**      *San Antonio, TX, USA*  
APS March Meeting

### CONTRIBUTED TALKS

- 2017      **Experimental Measurements of the Density of States for a Granular Crystal (upcoming)**      *New Orleans, LA, USA*  
APS March Meeting
- 2015      **Dynamics of swelling and drying in a spherical gel**      *Boston, MA, USA*  
APS Division of Fluid Dynamics
- 2015      **Protocol Dependence of the Jamming Transition**      *Madrid, Spain*  
9th European Solid Mechanics Conference
- 2015      **Musical Acoustics & Instrument Design: When Engineering Meets Music**      *Denton, TX, USA*  
41st International Computer Music Conference
- 2015      **Shear Jamming in Frictionless Particulate Media**      *San Antonio, TX, USA*  
APS March Meeting - GNSP Student Speaker Award
- 2014      **Shear Jamming in Frictionless Particulate Media**      *Paris, France*  
Congrès CMD25-JMC14
- 2013      **Vibrations in jammed solids: Beyond linear response**      *Kyoto, Japan*  
Workshop on Physics of Glassy and Granular Materials (Satellite Meeting of STATPHYS25), Yukawa Institute for Theoretical Physics
- 2013      **Vibrational modes of jammed and unjammed packings**      *Baltimore, MD, USA*  
APS March Meeting
- 2013      **Vibrations and stress relaxation in two-dimensional granular solids**      *San Diego, CA, USA*  
APS Division of Fluid Dynamics
- 2012      **Vibrations and thermal transport in model jammed packings**      *Graz, Austria*  
8th European Solid Mechanics Conference
- 2012      **Density of vibrational modes in partially crystalline granular packings**      *Boston, MA, USA*  
APS March Meeting
- 2011      **Accelerated drop detachment in granular suspensions**      *Baltimore, MD, USA*  
APS Division of Fluid Dynamics

### POSTERS

- 2014      **Shear Jamming in Frictionless Particulate Media**      *Easton, MA, USA*  
Gordon Research Conference on Granular and Granular-Fluid Flow
- 2014      **Shear Jamming in Frictionless Particulate Media**      *La Plata, Argentina*  
Pan-American Advanced Studies Institute on Frontiers in Particulate Media: From Fundamentals to Applications

### OUTREACH

- 2016      **The Mysteries of Sand**      *New Haven, CT, USA*  
Center for Research on Interface, Structures and Phenomena (CRISP) Public Lecture (Southern Connecticut State University, 4/2016 & Yale University, 10/2016)

## Teaching

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### Musical Acoustics and Instrument Design, ENAS344/MUSI371

YALE UNIVERSITY (CO-INSTRUCTOR AND CO-DEVELOPER)

Fall '14, Spring '16

Exploration of the acoustic principles of musical instruments using a highly interactive hands-on approach. Understanding of the physics of musical instruments and how they are designed. Concepts such as standing waves, harmonics, musical scales, forced oscillations, radiation, interference, electronic interfaces, and spectral analysis.

### Introduction to Engineering, Innovation and Design, ENAS118

YALE UNIVERSITY (TEACHING FELLOW AND CO-DEVELOPER)

Spring '13

Hands-on introduction to engineering, MATLAB, Mechanical Engineering (CAD with SolidWorks, 3D printing), Electrical Engineering (Arduino, servos, LEDs and sensors), Chemical Engineering (Clean water technologies), Biomedical Engineering (Cell culture, nanotechnology, drug delivery, tissue engineering)

### Mechanical Engineering III: Dynamics, MENG383

YALE UNIVERSITY (TEACHING FELLOW)

Fall '12, '13, '15

Kinematics and dynamics of rigid bodies, energy and momentum methods, vibration

### Musical Acoustics and Instrument Design, Yale Pathways to Science SCHOLARS program

YALE UNIVERSITY (CO-INSTRUCTOR AND CO-DEVELOPER)

Summer '16

Hands-on introduction to the principles of physical acoustics and musical instruments design as well as Scientific Reasoning to high school students.

### Introduction to Material Science, Yale Pathways to Science SCHOLARS program

YALE UNIVERSITY (CO-INSTRUCTOR AND CO-DEVELOPER)

Summer '13

Hands-on introduction to Metals, Ceramics, Polymers, Semi-conductors as well as Scientific Reasoning to high school students.

### Oral examinations in Physics (Freshman, Sophomore years)

LYCÉE CONDORCET, PARIS

Fall '08, Spring '09

Thermodynamics, Fluid Mechanics, Classical Mechanics, Statistical Mechanics, Electromagnetism

## Mentoring

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Mentored **7 undergrads** (Dominic Kwok, Yale, Physics '13; Maxwell Micali, Yale, MechE '12; Georgia Lill, Yale, Applied Math '13; Grant Phelps, Yale, MechE '14; Mikayla Thompson, Yale, Physics '15; Jiabin Liu, Bryn Mawr College, Physics '14; Hans Kassier, Yale, MechE '16), **1 master's student** (Torrey Levin-Russel, Southern Connecticut State University, Physics '16), **2 graduate student** (Qikai Wu, Yale, Engineering and Applied Science and Andreas Bacher, Roskilde University) and **1 postdoctoral associate** (Bhaskar Sen Gupta, Yale, Engineering and Applied Science).

## Professional Activities

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2016	<b>Committee Member for the Mellon Research Grant</b> Trumbull College, Yale University	<i>New Haven, CT, USA</i>
2015,2016	<b>Committee Member for the Trumbull College Richter Fellowship</b> Trumbull College, Yale University	<i>New Haven, CT, USA</i>
2013, 2015	<b>Committee Member for the Ackerman Teaching and Mentoring Award</b> School of Engineering and Applied Science	<i>New Haven, CT, USA</i>
2012-2013	<b>Graduate Student Assembly of Yale Graduate School of Arts and Sciences</b> Representative for the Engineering and Applied Science Department	<i>Yale University</i>
2009-2010	<b>Career Fair of the École Normale Supérieure de Cachan, Forum for Careers in Research</b> Vice-President	<i>École Normale Supérieure de Cachan</i>
2005-2007	<b>Village de la Madeleine</b> Tour guide and Speaker, Archaeological and Medieval Site	<i>Tursac, France</i>

### Peer reviewer/referee for scientific journals including:

Physical Review journals, Granular Matter, Chemical Engineering Science

### Professional Societies:

American Physical Society, Member

American Association for the Advancement of Science, Member

Sigma Xi, the Research Society, Associate Member