Scott Waitukaitis

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EDUCATION

Ph.D. in Physics, The University of Chicago, Chicago, US **2007-2013**
Advisor: Heinrich Jaeger
Committee: Tom Witten, Wendy Zhang and Henry Frisch
Thesis: *Impact-activated solidification of cornstarch and water suspensions*

B.S. in Physics, The University of Arizona, Tucson, US **2004-2007**
Advisor: Alex Cronin
Thesis: *Resonant Faraday rotation in a hot lithium vapor*
Summa cum laude with Honors

RESEARCH APPOINTMENTS

Institute of Science and Technology Austria (ISTA), Assistant Professor **2019-present**

AMOLF, Veni laureate and postdoctoral fellow with Martin van Hecke **2016-2019**
Experiments in strongly coupled fluid-solid systems and simulations of origami-based mechanical metamaterials

Leiden University, Postdoctoral fellow with Martin van Hecke **2013-2016**
Theory and simulations of origami-based mechanical metamaterials

The University of Chicago, Research assistant with Heinrich Jaeger **2008-2013**
Experiments/simulations with non-Newtonian fluids and charged granular matter

GRANTS

Marie Skłodowska-Curie Doctoral Networks Grant, The European Research Council **2025-present**
Project: *LEIDENFORCE — Advanced Leidenfrost Effect*
€257,000 / 4 years

ERC Starting Grant, The European Research Council **2020-present**
Project: *TRIBOCHARGE—A multi-scale approach to an enduring problem in physics*
€1,500,000 / 5 years

Veni Research Grant, The Netherlands Organization for Scientific Research **2016-2020**
Project: *The active dynamics of the elastic Leidenfrost effect*
€250,000 / 4 years

HONORS AND AWARDS

Early Career Award for Soft Matter Research, The American Physical Society **2026**
Soft Matter Outstanding Reviewer, RSC Journal *Soft Matter* **2025**
Advanced Physics Lecturer, University of Liège **2022**
Membership in Young Academy, Austrian Academy of Sciences **2021**
Winner of Fysica Young Speakers Contest, NNF Fysica **2018**

Block Prize for Outstanding Young Researcher, Aspen Center for Physics	**2018**
C.J. Kok Discoverer of the Year Prize (2nd place), Leiden University	**2017**
The Springer Thesis Award, Springer Publishing	**2014**
**The Arts	Science Initiative Graduate Fellowship Prize**, The University of Chicago	**2012**
The Bruce Winstein Prize for Instrumentation, The University of Chicago	**2012**
Outstanding Oral Presentation Award, The Electrostatics Society of America	**2011**
Robert A. Millikan Fellowship, The Department of Physics at the University of Chicago	**2010**
The Robert G. Sachs Fellowship, The Department of Physics at the University of Chicago	**2007**
Outstanding Senior Award, The Department of Physics at the University of Arizona	**2007**
Outstanding Presentation Award, The Department of Physics at the University of Arizona	**2007**

SCIENTIFIC SERVICE

Lead Conference Organizer, Charged Matter, Klosterneuburg, AT	**2025**
'Soft Matter Electrified' Focus Session Organizer, APS March Meeting, Anaheim, US	**2024-present**
Guest Editor of 'Soft Matter Electrified' Special Collection, RSC Journal, *Soft Matter*	**2024-present**
Editorial Board Member, Journal of Electrostatics	**2022-present**
Co-Chair, Granular Gordon Research Seminar, Easton, US	**2018**
Co-Conference Organizer, The World in a Grain of Sand, Chicago, US	**2017**
Seminar Organizer, Soft Matter Seminar at the Leiden Institute of Physics, Leiden, NL	**2013-2014**
Conference Assistant, MarchCOM Meeting on Complexity, Havana, CU	**2012**
Workshop Assistant, Fluidity, adaptability & rigidity, Chicago, US	**2012**
Reviewer for: *Nature, Nature Physics, PNAS, Physical Review Letters, Soft Matter, Physical Review E, Physical Review Materials, Review of Scientific Instruments, Nano Energy, Granular Matter, Advanced Materials Interfaces, Journal of Applied Mechanics, Journal of Electrostatics, Journal of Applied Physics*	**2009-present**
Tour Guide and Volunteer, Physics with a Bang!, Chicago, US	**2009-2013**
Volunteer, SMART, Chicago, US	**2007**
President, The Society of Physics Students at the University of Arizona, Tucson, US	**2006-2007**

PUBLICATIONS

In Review

37. Adventitious carbon controls contact electrification between insulating oxides
Galien Grosjean, Markus Ostermann, Markus Sauer, Michael Hahn, Christian M. Pichler, Florian Fahrnberger, Felix Pertl, Daniel M. Balazs, Mason M. Link, Seong H. Kim, Devin L. Schrader, Adriana Blanco, Francisco Gracia, Nicolás Mujica, and Scott Waitukaitis
In review at Nature

36. Geometry of the vapor layer under a Leidenfrost hydrogel sphere
Vicente L. Diaz-Melian, Isaac C. D. Lenton, Jack Binysh, Anton Souslov, and Scott Waitukaitis
In review at Physical Review Letters

35. Rolling at right angles: magnetic anisotropy enables dual-anisotropic active matter
Eavan Fitzgerald, Cécile Clavaud, Debasish Das, Isaac C.D. Lenton and Scott Waitukaitis
In review at Physical Review E

Accepted

34. **Electrostatics overcome acoustic collapse to assemble, adapt, and activate levitated matter**
Sue Shi, Maximilian C. Hübl, Galien Grosjean, Carl P. Goodrich, and Scott Waitukaitis
Accepted at PNAS

33. **Using optical tweezers to simultaneously trap, charge, and measure the charge of a microparticle in air**
Andrea Stoellner, Isaac C.D. Lenton, Artem G. Volosniev, James Millen, Renjiro Shibuya, Hisao Ishii, Dmytro Rak, Zhanybek Alpichshev, Grégory David, Ruth Signorell, Caroline Muller and Scott Waitukaitis
Accepted at Physical Review Letters

Published

32. **Spontaneous ordering of identical materials into a triboelectric series**
Juan Carlos Sobarzo, Felix Pertl, Daniel M. Balazs, Tommaso Costanzo, Markus Sauer, Annette Foelske, Markus Ostermann, Christian M. Pichler, Yongkang Wang, Yuki Nagata, Mischa Bonn and Scott Waitukaitis
Nature **638**, 664-669 (2025).

31. **No time for surface charge: How bulk conductivity hides charge patterns from Kelvin probe force microscopy in contact-electrified surfaces** (*editor's suggestion, featured in physics*)
Felix Pertl, Isaac C.D. Lenton, Tobias Cramer, and Scott Waitukaitis
Physical Review Letters **135**, 146202 (2025).

30. **A duality between surface charge and work function in scanning Kelvin probe microscopy**
Isaac C.D. Lenton, Felix Pertl, Lubuna Shafeek, and Scott Waitukaitis
Advanced Materials Interfaces **e00521**, (2025).

29. **Beyond the blur: Using experimentally determined point spread functions to improve scanning Kelvin probe imaging**
Isaac Lenton, Felix Pertl, Lubuna Shafeek and Scott Waitukaitis
Journal of Applied Physics **136**, 045305 (2024).

28. **Multiple charge carriers as a possible cause for triboelectric cycles**
Juan Carlos Sobarzo and Scott Waitukaitis
Physical Review E **109**, L032108 (2024).

27. **Asymmetries in triboelectric charging: Generalizing mosaic models to different-material samples and sliding contacts**
Galien Grosjean and Scott Waitukaitis
Physical Review Materials **7**, 065601 (2023).

26. **Accurate determination of the shapes of granular charge distributions**
Nicolás Mujica and Scott Waitukaitis
Physical Review E **107**, 034901 (2023).

25. **Modeling Leidenfrost levitation of soft elastic solids**
Jack Binysh, Indrajit Chakraborty, Mykyta V. Chubynsky, Vicente Luis Díaz Melian, Scott Waitukaitis, James E. Sprittles, and Anton Souslov
Physical Review Letters **131**, 168201 (2023).

24. **Single-collision statistics reveal a global mechanism driven by sample history for contact electrification in granular media** (*editor's suggestion, featured in physics*)
Galien Grosjean and Scott Waitukaitis
Physical Review Letters **130**, 098202 (2023).

23. **Quantifying nanoscale charge density features of contact-charged surfaces with an FEM/KPFM-hybrid approach**
Felix Pertl, Juan Carlos Sobarzo, Lubuna Shafeek, Tobias Cramer, and Scott Waitukaitis
Physical Review Materials **6**, 125605 (2022).

22. **Quantitatively consistent, scale-spanning model for same-material tribocharging**
Galien Grosjean, Sebastian Wald, Juan Carlos Sobarzo Ponce, and Scott Waitukaitis
Physical Review Materials **4**, 082602 (2020).

21. **Jigsaw puzzle design of pluripotent origami**
Peter Dieleman, Niek Vasmel, Scott Waitukaitis, and Martin van Hecke
Nature Physics **16**, 63-68 (2020).

20. **Non-Euclidean origami**
Scott Waitukaitis, Peter Dieleman, and Martin van Hecke
Physical Review E **102**, 031001(R) (2020).

19. **Microwave induced mechanical activation of hydrogel dimer**
Hamza Khattak, Scott Waitukaitis, and Aaron Slepkov
Soft Matter 15, 5804-5809 (2019).

18. **From bouncing to floating: the Leidenfrost effect with hydrogel spheres**
Scott Waitukaitis, Kirsten Harth, and Martin van Hecke
Physical Review Letters 121, 048001 (2018).

17. **Collisional charging of individual sub-millimeter particles: using ultrasonic levitation to initiate and track charge transfer**
Victor Lee, Nicole M. James, Scott Waitukaitis, and Heinrich Jaeger
Physical Review Materials **2,** 035602 (2018).

16. **A high-speed tracking algorithm for dense granular media**
Cristobal Navarro, Juan Silva, Scott Waitukaitis, Nicolas Mújica, Nancy Hitschfeld-Kahler and Mauricio Cerda
Computer Physics Communications **227**, 8-16 (2018).

15. **The retention of dust in protoplanetary disks: evidence from agglomeratic olivine chondrules from the outer Solar System**
Devin Schrader, Kazuhide Nagashima, Scott Waitukaitis, Jemma Davidson, Timothy McCoy, Harold Connolly and Dante Lauretta
Geochimica et Cosmochimica Acta **223**, 405-421 (2018).

14. **Coupling the Leidenfrost effect and elastic deformations to power sustained bouncing** (*cover*)
Scott Waitukaitis, Antal Zuiderwijk, Anton Souslov, Corentin Coulais and Martin van Hecke,
Nature Physics **13**, 1095-1099 (2017).

13. **Origami building blocks: generic and special four-vertices**
Scott Waitukaitis and Martin van Hecke
Physical Review E **93**, 023003 (2016).

12. **Direct observation of particle interactions and clustering in charged granular streams**
Victor Lee, Scott Waitukaitis, Marc Miskin and Heinrich Jaeger
Nature Physics **11**, 733-737 (2015).

11. **Origami multistability: from single vertices to metasheets**
Scott Waitukaitis, Rémi Menaut, Bryan Chen and Martin van Hecke
Physical Review Letters **114,** 055503 (2015).

10. **Size-dependent, same-material tribocharging in insulating grains** (*editor's suggestion, featured in physics*)
Scott Waitukaitis, Victor Lee, James Pierson, Steve Forman and Heinrich Jaeger
Physical Review Letters **112,** 218001 (2014).

9. **Settling into dry granular media in different gravities**
Ernesto Altshuler, Harol Torres, Gustavo Sánchez-Colina, Carlos Pérez-Penichet, Scott Waitukaitis and Raul Hidalgo
Geophysical Research Letters **41,** 3032-3037 (2014).

8. **From nanoscale cohesion to macroscale entanglement: opportunities for designing granular aggregate behavior by tailoring grain shape and interactions**
Heinrich Jaeger, Marc Miskin, and Scott Waitukaitis
Powders and Grains **1542,** 3-6 (2013).

7. **Dynamic jamming fronts**
Scott Waitukaitis, Leah Roth, Vincenzo Vitelli, and Heinrich Jaeger
Europhysics Letters **102**, 44001 (2013).

6. ***In situ* granular charge measurement by free-fall videography**
Scott Waitukaitis and Heinrich Jaeger
Review of Scientific Instruments **84,** 025104 (2013).

5. **Impact-activated solidification of dense suspensions via dynamic jamming fronts**
Scott Waitukaitis and Heinrich Jaeger
Nature **487**, 205-209 (2012).

4. **Droplet and cluster formation in freely-falling granular streams**
Scott Waitukaitis, Helge Grütjen, John Royer and Heinrich Jaeger
Physical Review E **83**, 051302 (2011).

3. **High-speed tracking of rupture and clustering in freely-falling granular streams**
John Royer, D.J. Evans, Loreto Oyarte, Qiti Guo, Matthias Möbius, Scott Waitukaitis and Heinrich Jaeger
Nature **459,** 1110-1113 (2009).

2. **Reconnection in three dimensions: the role of spines in three eruptive flares**
Angela des Jardins, Richard Canfield, Dana Longcope, C. Fordyce and Scott Waitukaitis
Astrophysical Journal **693**, 1628-1636 (2009).

1. **Cover slip external cavity diode laser**
Victoria Carr, Yancey Sechrest, Scott Waitukaitis, John Perrault, Vincent Lonij and Alex Cronin
Review of Scientific Instruments **78**, 106108 (2007).

Invited Talks

Colloquia

4. **Physics Colloquium,** Aarhus University, Aarhus, DK **Nov 2025**
Title TBD
3. **Physics Colloquium,** Brandeis University, Waltham, US **Feb 2018**
The elastic Leidenfrost effect: Coupling vapor release and elastic deformations to power sustained bouncing
2. **Colloquium,** Deutsches Zentrum für Luft und Raumfahrt, Cologne, DE **Nov 2016**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging

1. **Physics Colloquium,** St. Olaf College, Northfield, US **Sept 2013**
Why you can run on water (and cornstarch)

Invited Conference Talks

17. **Invited Talk,** APS March Meeting, Denver, US **Mar 2026**
Title TBD
16. **Invited Talk,** Levitated Matter, Chicago, US **Oct 2025**
Title TBD
15. **Invited Talk**, IFPRI Annual Meeting, Marseille, FR **June 2025**
Particulate tribocharging
14. **Invited Talk,** COAST25, Vienna, AT **May 2025**
Surface memories in the contact electrification of polymers
13. **Invited Talk,** APS March Meeting, Anaheim, US **Mar 2025**
No touching allowed! How levitation is revealing the secrets of charged matter
12. **Invited Talk**, Southern Workshop on Granular Materials, Puerto Varas, CL **Dec 2024**
Granular goes electric: big challenges in the new frontier of granular matter
11. **Invited Talk**, Granular Gordon Conference, Easton, US **June 2024**
Using acoustic levitation to probe and control granular tribocharging
10. **Invited Talk,** Mesoscopic Triboelectricity, Bad Honnef, DE **Jan 2022**
Making patch models for contact electrification quantitative
9. **Invited Talk**, SIAM Conf. on Mathematical Aspects of Material Science, Bilbao, ES **Mar 2020**
**canceled due to pandemic*
8. **Invited Talk,** Southern Workshop on Granular Materials, Puerto Varas, CL **Dec 2018**
Bouncing, active granular matter with the elastic Leidenfrost effect
7. **Invited Talk,** Granular Gordon Conference, Easton, US **Jul 2016**
Animating granular matter with the elastic Leidenfrost effect
6. **Invited Talk,** European Planetary Science Congress, Nantes, FR **Oct 2015**
Tribocharging and charged interactions in same-material, microscopic grains
5. **Invited Talk,** European Solid Mechanics Conference, Madrid, ES **Jul 2015**
Multishape origami metasheets
4. **Invited Talk,** The Southern Granular Matter Workshop, Santiago, CL **Nov 2015**
Tribocharging and charged interactions in same-material, microscopic grains
3. **Invited Talk,** Dutch Soft Matter Meeting, Eindhoven, NL **June 2015**
Multishape origami metasheets
2. **Invited Talk,** 64th Meeting of Arbeitsgemeinschaft Getreideforschung, Detmold, DE **Apr 2013**
Impact-activated solidification of a dense cornstarch suspension
1. **Invited Talk,** APS March Meeting, Baltimore, US **Mar 2013**
Impact-activated solidification of dense suspensions

Invited Seminars

51. **Invited Seminar,** University of Manchester, UK **Jan 2026**
Title TBD
50. **Invited Seminar,** ETH Zürich, Zürich, CH **Dec 2025**
Title TBD
49. **Invited Seminar,** Université de Rennes, Rennes, FR **Feb 2025**
**canceled due to illness*
48. **Invited Seminar,** PMMH, Paris, FR **Nov 2024**
Le lapin électrostatique : static electricity is an unpredictable little bunny
47. **Invited Seminar**, The University of Amsterdam, Amsterdam, NL **Oct 2024**
Static electricity is nasty
46. **Invited Seminar,** Cornell University, Ithaca, US **June 2024**
Static electricity is laughing at us, but we are getting a couple giggles, too
45. **Invited Seminar,** Syracuse University, Syracuse, US **June 2024**
Static electricity is laughing at us, but we are getting a couple giggles, too

44. **Invited Seminar,** EPFL, Lausanne, CH **Apr 2024**
Charges dropped: new understandings of symmetry breaking in same-material contact electrification

43. **Invited Seminar,** Universität Duisburg-Essen, Duisburg, DE
When identical is not the same: the dependence of contact electrification on the subtlest of differences **Apr 2024**

42. **Invited Seminar,** MPI Mainz, Mainz, DE **Feb 2024**
Toward minimal ingredients for systematic contact electrification

41. **Invited Seminar,** Loughborough University, Loughborough, UK **Mar 2023**
Triboelectric charging from the everyday to the nanoscale

40. **Invited Seminar,** BOKU, Vienna, AT **Dec 2021**
Rabbits, dust devils, volcanoes, planets: mysteries of granular tribocharging

39. **Invited Seminar,** Arizona State University, Phoenix, US **Oct 2021**
Rabbits, dust devils, volcanoes, planets: mysteries of granular tribocharging

38. **Invited Seminar,** Deutsches Zentrum für Luft und Raumfahrt, Cologne, DE **Dec 2020**
The Leidenfrost effect and hydrogels

37. **Invited Seminar,** TU Wien, Vienna, AT **Nov 2020**
Rabbits, dust devils, volcanoes, planets: mysteries of granular tribocharging

36. **Invited Seminar,** École Polytechnique, Palaiseau, FR **June 2019**
Non-linear dynamics of hydrogels interacting with hot surfaces

35. **Invited Seminar,** ESPCI, Paris, FR **Feb 2019**
The Leidenfrost effect and hydrogels

34. **Invited Seminar**, The University of Edinburgh, Edinburgh, UK **Oct 2018**
Rabbits, volcanoes, dust devils: the surprising science of granular tribocharging

33. **Invited Seminar,** The University of Chile, Santiago, CL **Aug 2018**
The elastic Leidenfrost effect: coupling vapor release and elastic deformations to power sustained bouncing

32. **Invited Seminar,** MIT, Cambridge, US **Mar 2018**
Granular tribocharging: from fundamental mysteries to macroscale self-assembly

31. **Invited Seminar**, University of California San Diego, San Diego, US **Mar 2018**
Granular tribocharging: from fundamental mysteries to macroscale self-assembly

30. **Invited Seminar,** ISTA, Klosterneuburg, AT **Feb 2018**
Rabbits, planets, volcanoes, dust devils: The surprising physics of granular tribocharging

29. **Invited Seminar,** University of Massachusetts Amherst, Amherst, US **Feb 2018**
The elastic Leidenfrost effect: coupling vapor release and elastic deformations to power sustained bouncing

28. **Invited Seminar,** Boston University, Boston, US **Feb 2018**
Transforming soft materials into engines by coupling the Leidenfrost effect to elastic deformations

27. **Invited Seminar,** Leiden University, Leiden, NL **Jan 2018**
Out of the lab and into the frying pan: hacking hydrogels to create active matter

26. **Invited Seminar,** Centre de Recherche Paul Pascal, Bordeaux, FR **Dec 2017**
Using the Leidenfrost effect and hot hydrogels to make better bouncy balls

25. **Invited Seminar,** Laboratoire Ondes et Matière d'Aquitaine, Bordeaux, FR **Dec 2017**
Using the Leidenfrost effect and hot hydrogels to make better bouncy balls

24. **Invited Seminar,** The University of Liège, Liège, BE **Nov 2017**
Coupling the Leidenfrost effect and elastic deformations to power sustained bouncing

23. **Invited Seminar,** École Normale Supérieure de Lyon, Lyon, FR **Oct 2017**
Using the Leidenfrost effect to harness mechanical energy from vaporizable soft solids

22. **Invited Seminar**, The University of Edinburgh, Edinburgh, UK **Oct 2017**
Creating soft engines by coupling the Leidenfrost effect to elastic deformations

21. **Invited Seminar,** Université Claude Bernard Lyon, Lyon, FR, **Oct 2017**
Using the Leidenfrost effect and hot hydrogels to make better bouncy balls

20. **Invited Seminar,** The University of Amsterdam, Amsterdam, NL **June 2017**
A soft engine powered by a single object and made from a single material

19. **Invited Seminar,** The University of Chicago, Chicago, US **Mar 2017**
A soft engine powered by a single object and made from a single material

18. **Invited Seminar,** Saint-Gobain Recherche, Paris, FR **Dec 2016**
Rabbits, Planets, volcanoes, dust devils: The surprising physics of granular tribocharging
17. **Invited Seminar,** The University of Oregon, Eugene, US **Nov 2016**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging
16. **Invited Seminar,** PMMH, Paris, FR **June 2016**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging
15. **Invited Seminar,** Université Paris Diderot, Paris, FR **June 2016**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging
14. **Invited Seminar,** Wageningen University, Wageningen, NL **Apr 2016**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging
13. **Invited Seminar,** MPI, Göttingen, DE **Jan 2016**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging
12. **Invited Seminar,** Leiden University, Leiden, NL **Oct 2015**
Rabbits, planets, volcanoes, dust devils: the surprising physics of granular tribocharging
11. **Invited Seminar,** The Otto-von-Guericke-Universität Magdeburg, Magdeburg, DE **June 2015**
How to walk on water (and cornstarch)
10. **Invited Seminar**, The University of Massachusetts at Amherst, Amherst, US **Mar 2015**
The delicate dance of charged grains in zero gravity
9. **Invited Seminar**, Cornell University, Ithaca, US **Mar 2015**
The delicate dance of charged grains in zero gravity
8. **Invited Seminar,** Leiden University Department of Physics, Leiden, NL **Sept 2014**
Multishape origami metasheets
7. **Invited Seminar,** The University of Amsterdam, Amsterdam, NL **June 2014**
How to walk on water (and cornstarch)
6. **Invited Seminar,** The University of Twente, Enschede, NL **Jan 2014**
How to walk (run) on water (and cornstarch)
5. **Invited Seminar**, École Normale Supérieure, Paris, FR **Mar 2014**
Why you can walk (run) on water (and cornstarch)
4. **Invited Seminar,** Leiden University, Leiden, NL **Oct 2013**
Impact-activated solidification of cornstarch and water suspensions
3. **Invited Seminar,** Leiden University, Leiden, NL **Apr 2013**
Why you can run on water (and cornstarch)
2. **Invited Seminar,** PMMH, Paris, FR **Mar 2013**
Impact-activated solidification of dense suspensions
1. **Invited Seminar**, The University of Chicago, Chicago, US **Mar 2012**
Same material tribocharging in insulating grains

Invited Public Talks

5. **Invited Talk**, Bessensap, Amsterdam, NL **June 2018**
4. **Invited Talk,** Amsterdam Science Now, Amsterdam, NL **May 2018**
3. **Invited Talk,** This Week's Discoveries, Leiden University, Leiden, NL **Nov 2017**
2. **Invited Talk,** Science Meets Business, Leiden, NL **Oct 2016**
1. **Panelist,** Cabinet on Narrative, Arts-Science Initiative, Chicago, US **Apr 2013**

IN THE NEWS

Scientific Features

9. **Charge transfer happens too fast to see**
Rachel Berkowitz
Physics 18, s122 (2025).

8. **The secrets of static electricity are finally being revealed**
   Dan Lacks and Mamadou Sow
   Nature **638**, 616-618 (2025).

7. **Water is behind the electrification of sand**
   Marco Mazza
   Physics **16**, 22 (2023)

6. **A fold strategy**
   Christina Santangelo
   Nature Physics **16**, 7-8 (2020).

5. **Clicks for doughnuts**
   Scott Waitukaitis
   Nature Physics **4**, 777–778 (2018).

4. **Granular matter: charges dropped**
   Frank Spahn and Martin Seiß
   Nature Physics **11**, 709–710 (2015).

3. **Electrons not the cause of charged grains**
   Michael Schirber
   Physics **7**, 58 (2014).

2. **Soft matter: running on cornflour**
   Martin van Hecke
   Nature **487**, 174-175 (2012).

1. **Granular media: structures in sand streams**
   Detlef Lohse and Deveraj van der Meer,
   Nature **459**, 1064-1065 (2009).

Popular Articles

New Scientist, *"Solving the 250-year-old puzzle of how static electricity works", 1 July 2025.*
Meteored, "*Resuelto el misterio de la carga electrostática: los físicos descifran la misteriosa electricidad de fricción",* March 21, 2025.
Die Presse, *"Au, ein Schlag! Bei Elektrostatik ist die Vorgeschichte der Kontakte entscheidend",* Feb 22, 2025.
Der Standard, *"Fortschritt bei jahrtausendealtem Rätsel um statische Elektrizität",* Feb 20, 2025.
Español News, "*Los científicos desbloquean la pista vital para extraña peculiaridad de electricidad estática",* Feb 22, 2025.
Deutschlandfunk Nova, "*Das Rätsel hinter dem Strom im Luftballon"*, Feb 20, 2025.
EurekaAlert!, *"An electrifying turn in an age old quest",* Feb 19, 2025.
Ars Technica, *"Scientists unlock vital clue to strange quirk of static electricity"*, Feb 19, 2025.
The Debrief, *"Static Electricity Gets a Jolt as Scientists Solve Decades-Old Mystery",* Feb 19, 2025.
Geo, *"Vergangene Berührungen beeinflussen, wie Materialien sich aufladen",* Feb 19, 2025.
Phys.org, "*Static electricity depends on materials' contact history, physicists show",* Feb 19, 2025.
Salzburger Nachrichten, *"Material-Erinnerung spielt bei statischer Elektrizität große Rolle",* Feb 19, 2025.
ORF, *"Material erinnert sich an Kontakte",* Feb 20, 2025.
Die Presse,"*Das jahrtausendealte Rätsel der Reibungselektrizität"*, Oct 7, 2020.
Nederlands Tijdschrift voor Natuurkunde, *"Een ongewoon Leidenfrosteffect"*, June 15, 2018.
Amsterdam Science, *"Pancake Science",* May 10, 2018.
IFLS, *"Physicist saw a video on IFLS and ended up writing a scientific study about it***"**, October 3, 2017.
Discover, *"Dancing balls lead to a physics discovery***"**, July 26, 2017.
NRC Handelsblad, *"Springende gelballetjes piepen in de koekepan",* July 26, 2017.
Engineers Online, *"Waarom balletjes op een hete plaat piepen en springen",* July 26, 2017.

pro-physik.de, "*Hüpfendes Hydrogel als Mikroantrieb*", July 26, 2017.
Kijk Magazine, *"Waarom deze balletjes gillen en stuiteren in een hete pan*", July 25, 2017.
The Washington Post, "*These bouncing balls on a hot pan led to a new physics discovery*", July 24, 2017.
Welt der Physik, *"Leidenfrost-Effekt lässt weiche Kügelchen hüpfen"*, July 24, 2017.
Phys.org, *"Elastic Leidenfrost enables soft engines"*, July 24, 2017.
De Volkskrant, *"Van grap en YouTube-hit tot Nature-publicatie: waarom hydrogelballetjes stuiteren in een pan"*, July 24, 2017.
New Scientist, *"Screaming gel balls reveal a way to power soft but noisy robots"*, July 24, 2017.
Inverse, *"Let's power robots with shrieking balls"*, July 24, 2017.
RTL4 Nieuws Holland, *"Doorbraak in de aandrijving van zachte robots"*, July 24, 2017.
Physics Central, *"Leidenfrost effect puts perpetual bounce into Hydrogel Beads"*, March 29, 2016.
Inside Science News, *"Hydrogel beads key recipe for sustained bouncing"*, March 24, 2016.
Nature Physics, *"Granular matter: charges dropped"*, July 13, 2015.
Tendencias Científicas, *"Simulan en laboratorio cómo empiezan a formarse los planetas,"* Aug 19, 2015.
Daily Mail, *"Creating 'Planets' in a laboratory: How particles clump together to create new worlds observed for the first time"*, Aug 6, 2015.
Futurity, "*Clumps of particles mimic how planets form"*, Aug 3, 2015.
APS Focus, *"Electrons not the cause of charged grains"*, May 30, 2014.
Gizmodo, "*We still don't know how static electricity works"*, May 21, 2014.
Science News, "*Static electricity defies simple explanation"*, May 15, 2014.
Scientific Computing, *"Clearing up the oobleck physics mystery"*, July 23, 2012.
Time, *"Geek party! How to run across a pool of goo"*, July 18, 2012.
Discover, *"Running on Physics: Why you can walk on Water and Cornstarch*", July 17, 2012.
Science News, "How to walk on water," July 16, 2012.
Futurity, "Mystery solved: why impact turns liquid solid", July 13, 2012.
Chemistry World, "Why can we walk on custard?", July 12, 2012.
BBC, *"Cornflour's gooey trick revealed,"* July 12, 2012.
Nature Podcast, *"How to walk on custard,"* July 12, 2012.
Science News, *"Cornstarch physics is shear nonsense"*, July 11, 2012.
Wired, *"Defying gravity: when strange liquids act like solids"*, July 11, 2012.
Live Science, *"How to walk on water with help from Dr. Seuss's oobleck"*, July 11, 2012.
Ars Technica, *"A striking experiment shows how you can run on quicksand*", July 11, 2012.
Popular Mechanics, *"The reason you can walk on water (and cornstarch)*" , July 11, 2012.
WBEZ Chicago Clever Apes Blog, *"Clever Apes: Uncanny Slime"*, Nov 3, 2011.
Live Science, "*Sand found to flow like water"*, July 1, 2009.

Group Members

Current Postdocs

John Hoffman	**2024-present**

Current PhD Students

Vicente Diaz	**2020-present**
Felix Pertl	**2021-present**
Andrea Stoellner	**2021-present**
Sue Shi	**2022-present**
Eavan Fitzgerald	**2022-present**

Former Postdocs

Galien Grosjean **2019-2025**
**Currently Assistant Professor at Universitat Autonoma de Barcelona*
Cécile Clavaud **2020-2023**
**Currently Maître de Conférences at Université de Rennes*
Isaac Lenton **2020-2024**
**Currently Research Scientist at University of Manchester*

Former PhD Students

Juan Carlos Sobarzo **2019-2025**
Successfully defended July 16, 2025

Masters Students and Interns

Jacob Mittoo **2025**
Anna Paola Garcia **2025**
Mars O'Connor **2025**
Aarnav Panda **2025**
Elian Louwers **2025**
James Nicholas **2024**
Cecelia Mweka **2022-2024**
Anna Drummond Young **2022**
Yihong Hu **2022**
Markus Felber **2021-2022**
Benedict Weihs **2020**

TEACHING

Physics Track Core Course (ISTA) **Spring 2025**
4 *ECTS, graduate level*
Physics Track Core Course (ISTA) **Spring 2024**
4 *ECTS, graduate level*
Physics Track Core Course (ISTA) **Spring 2023**
4 *ECTS, graduate level*
Physics Track Core Course (ISTA) **Spring 2022**
6 *ECTS, graduate level*
Statistical Physics Topics in Experimental Soft Matter (ISTA)
3 *ECTS, graduate level* **Spring 2021**
Statistical Physics Topics in Experimental Soft Matter (ISTA) **Spring 2020**
3 *ECTS, graduate level*
TA Honors Electricity and Magnetism (University of Chicago) **Winter 2012**
Course led by Henry Frisch
TA Honors Waves (University of Chicago) **Spring 2011**
Course led by Henry Frisch

TA Honors Waves (University of Chicago) **Spring 2010**
Course led by Mark Oreglia
TA Mechanics (University of Chicago) **Fall 2007**
Course led by Ed Blucher
TA Advanced Electricity and Magnetism (University of Chicago) **Winter 2007**
Course led by Doug Toussaint
Tutor in Math and Physics (Math and Science Center, University of Arizona) **2006-2007**

LAY SUMMARY OF TOP THREE PUBLICATIONS
(Since Starting as Assistant Professor)

Spontaneous ordering of identical materials into a triboelectric series

Juan Carlos Sobarzo, Felix Pertl, Daniel M. Balazs, Tommaso Costanzo, Markus Sauer, Annette Foelske, Markus Ostermann, Christian M. Pichler, Yongkang Wang, Yuki Nagata, Mischa Bonn and Scott Waitukaitis
Nature **638**, 664-669 (2025).

When two materials are touched together and separated, they almost always exchange electrical charge. It has long been thought that this "contact electrification" should be transitive: if material A charges positive to B, and B to C, then A should charge positive to C. Yet experiments on this effect are notoriously unpredictable, casting doubt on the existence of transitivity. In this work, we uncover a hidden connection between unpredictability and order in contact electrification. Nominally 'identical' rubber samples initially exchange charge unpredictably, but with repeated contacts evolve into a fully transitive sequence. This evolution is driven by the act of contact itself—samples with more contacts in their history develop a "memory", and consistently charge negatively against those with fewer contacts. Incorporating this memory into a simple model, we reproduce both the initial unpredictability and evolution to perfect order. What's more, we demonstrate that this memory can be exploited to design charging sequences of one's choosing. Using a wide array of surface science techniques to look for the physical cause of the effect, the only correlate we find is in nanoscale morphological alterations, pointing to a mechanism strongly coupled to contact mechanics. Our results provide the first evidence of "memory" in polymer contact electrification, and clarify why experiments have long led to such unpredictable outcomes.

Single-collision statistics reveal a global mechanism driven by sample history for contact electrification in granular media (*editor's suggestion, featured in physics*)

Galien Grosjean and Scott Waitukaitis
Physical Review Letters **130**, 098202 (2023).

The prevailing model for 'same-material' contact electrification has long been that the surfaces of materials are composed of nanometer-scale regions or "patches" of charge acceptors and donors. This renders charge exchange a probabilistic process. During contact, some donor patches on A give charge to acceptors on B, and *vice versa*. As a consequence, the charge behavior after repeated contacts between two objects made of the same material should be a random walk, with each object acquiring both positive and negative charge along the way. In this work, we use acoustic levitation to collide spherical particles against planar target plates made of the same material, and we find that—without exception—all objects charge *systematically*. This means that, as far as charge exchange is concerned, every *object* behaves as a completely different *material*, even if they are all made from the *same material*. Remarkably, we find that charging polarity can be altered by re-cleaning samples, baking samples, or even just adjusting the humidity during an experiment. The inescapable conclusion is that same-material contact electrification is not governed by random microscopic surface fluctuations on objects, but instead by their histories. Our work overturns the model that has dominated explanations of same-material contact electrification for the last fifty years.

Adventitious carbon controls contact electrification between insulating oxides

Galien Grosjean, Markus Ostermann, Markus Sauer, Michael Hahn, Christian M. Pichler, Florian Fahrnberger, Felix Pertl, Daniel M. Balazs, Mason M. Link, Seong H. Kim, Devin L. Schrader, Adriana Blanco, Francisco Gracia, Nicolás Mujica, and Scott Waitukaitis

In review at Nature

Oxide materials, such as silica and alumina, are among the most abundant solid compounds in the universe, and play central roles in geophysical and astrophysical processes. Arguably the most consequential is their capacity to exchange electrical charge during contact, which even occurs between samples of the same oxide. For instance, in protoplanetary disks charging between oxide dust is crucial for the early stages of rocky planet formation. In volcanic plumes, oxide-ash charging leads to 'volcanic lightning', which has been proposed as the energy source for prebiotic chemistry. Despite these consequences, and nearly a century of scientific effort, the symmetry breaking parameter that causes same-material oxides to charge has never been identified. In this work, we show that adventitious carbon, *i.e.*, the thin layer of carbonaceous molecules that adsorbs on all surfaces in all environments, is the long-sought symmetry breaker. Using acoustic levitation to collide individual oxide spheres against target plates of the same material, we find that charging polarity between a given pair is fixed but unpredictable for co-prepared samples, but can be systematically controlled by removing carbon through baking or plasma cleaning. Following such treatment, the charging relaxes on a timescale of hours, which directly correlates with the reappearance of carbon in mass spectrometry, ion scattering, and infrared spectroscopy. Moreover, we demonstrate that surface carbon can compete with, and even override, intrinsic material tendencies when *different* oxides are brought into contact. These findings solve the century-old mystery of how identical oxide particles can exchange charge during contact, with implications ranging from the formation of the Earth to the chemical origins of life.