Edan Lerner - Curriculum Vitae

Contact Information:

Present address:	Institute of Theoretical Physics University of Amsterdam Science Park 904 1098 XH Amsterdam, the Netherlands
e-mail:	e.lerner@uva.nl
Web:	https://staff.fnwi.uva.nl/e.lerner/

Education:

2007 - 2011	Weizmann Institute of Science, Israel, Ph.D. in Physics. Advisor: Prof. Itamar Procaccia. Thesis title: *"The formation and deformation of amorphous solids"*
2005 - 2007	Weizmann Institute of Science, Israel, M.Sc. in Physics. Advisor: Prof. Itamar Procaccia. Thesis title: *"The dynamics of supercooled liquids and the glass transition"*
2001 - 2005	Ben Gurion University of the Negev, Israel, B.Sc. in Physics, Cum Laude
2001 - 2005	Ben Gurion University of the Negev, Israel, B.Sc. in Computer Science

Professional Experience:

2019 - present	Associate Professor at the Institute for Theoretical Physics, University of Amsterdam
2014 - 2019	Assistant Professor at the Institute for Theoretical Physics, University of Amsterdam
2011 - 2014	Postdoc at the Center for Soft Matter Reseach, New York University, New York

Awards, Fellowships and Grants:

2018	Postdoc funding (168kE) from the Simons Foundation, together with L. Manning (Syracuse). Project title "Structural indicators of plastic deformation in glasses"
2017	Vidi grant (800kE), NWO. Project title "Marginal stability of amorphous solids and the yielding transition"
2017	PhD fellowship (204kE), from the Institute of Physics of the UvA, together with P. Schall (UvA) and C. Coulais (UvA)
2014	PhD fellowship (204kE), from the Delta Institute for Theoretical Physics (D-ITP), together with V. Vitelli (Chicago) and F. MacKintosh (Rice, USA).
2011	John F. Kennedy Prize for outstanding Ph.D.
2009	Otto Schwarz Graduate Scholarship Fund Award
2008	Levzion Excellence Fellowship
2002	Departmental Excellence Award, Department of Physics, Ben Gurion University

Teaching Experience:

2014, 2015, 2016, 2017, 2018	"Introduction to Physics" (1st year undergraduate), AUC
2018, 2019, 2020	"Advanced computational condensed matter" (MSc. level), UvA
2017, 2018, 2019 2020	"Statistical Physics of Soft and Living Matter" (MSc. level), UvA
2015	"Elasticity and Jamming", Mini-course at DRSTP CMT school.

Academic Activities:

2020	Co-organizer of a Lorentz Center workshop, title :"*Role of disorder in glass formation and deformation*"
2018	Co-organizer of the Dutch Soft Matter Day, Amsterdam
2016 - present	Affiliate of the Simons Foundation Collaboration "Cracking the Glass Problem".
2016 - present	Member of the Dutch Research School of Theorerical Physics (DRSTP), and co-organizer of the 2016, 2017, 2018, 2019 DRSTP condensed matter theory schools.

Alumni

2019	Dr. Luka Gartner,	Ph.D.
2019	Dr. Robbie Rens,	Ph.D.

Publications:

pre-prints

63) David Richard *et al.*, *Predicting plasticity in disordered solids from structural indicators*, arXiv:2003.11629.

62) David Richard, Karina González-López, Geert Kapteijns, Robert Pater, Talya Vaknin, Eran Bouchbinder, and Edan Lerner, *Universality of the nonphononic vibrational spectrum across different classes of computer glasses*, arXiv:2003.07616.

61) Corrado Rainone, Eran Bouchbinder, and Edan Lerner, *Statistical mechanics of local force dipole responses in computer glasses*, arXiv:2001.11430..

2020

60) Geert Kapteijns, David Richard and Edan Lerner, *Nonlinear quasilocalized excitations in glasses. True representatives of soft spots*, Phys. Rev. E **101**, 032130 (2020).

59) Edan Lerner, *Finite-size effects in the nonphononic density of states in computer glasses*, Phys. Rev. E **101**, 032120 (2020).

58) Corrado Rainone, Eran Bouchbinder, and Edan Lerner, *Pinching a glass reveals key properties of its soft spots*, PNAS **117**, 5228 (2020).

2019

57) Stefan Kooij and Edan Lerner, *Characterizing nonaffinity upon decompression of soft-sphere packings*, Phys. Rev. E **100**, 042609 (2019).

56) Martin Brandenbourger, Xander Locsin, Edan Lerner, and Corentin Coulais, *Non-reciprocal robotic metamaterials*, Nat. Commun. **10**, 4608 (2019).

55) Avraham Moriel, Geert Kapteijns, Corrado Rainone, Jacques Zylberg, Edan Lerner, and Eran Bouchbinder, *Wave attenuation in glasses: Rayleigh and generalized-Rayleigh scattering scaling*, J. Chem. Phys. **151**, 104503 (2019).

54) Robbie Rens and Edan Lerner, *Rigidity and auxeticity transitions in networks with strong bond-bending interactions*, Eur. Phys. J. E **42**, 114 (2019).

53) Edan Lerner, *Mechanical properties of simple computer glasses*, J. Non-Cryst. Solids **522**, 119570 (2019).

52) Zohar Schwartzman-Nowik, Edan Lerner, and Eran Bouchbinder, *Anisotropic structural predictor in glassy materials*, Phys. Rev. E **99**, 060601(**R**) (2019).

51) Wencheng Ji, Marko Popovic, Tom W. J. de Geus, Edan Lerner, and Matthieu Wyart, *Theory for the density of interacting quasi-localised modes in amorphous solids*, Phys. Rev. E **99**, 023003 (2019).

50) Geert Kapteijns, Wencheng Ji, Carolina Brito, Matthieu Wyart, and Edan Lerner, *Fast generation of ultrastable computer glasses by minimization of an augmented potential energy*, Phys. Rev. E **99**, 012106 (2019).

2018

49) Robbie Rens, Carlos Villarroel, Gustavo Düring, and Edan Lerner, *Micromechanical theory of strain-stiffening of biopolymer networks*, Phys. Rev. E **98**, 062411 (2018).

48) Edan Lerner, Itamar Procaccia, Corrado Rainone, and Murari Singh, *On the protocol dependence of plasticity in ultra-stable amorphous solids*, Phys. Rev. E **98**, 063001 (2018).

47) Carolina Brito, Edan Lerner, and Matthieu Wyart, *Theory for Swap Acceleration near the Glass and Jamming Transitions for Continuously Polydisperse Particles*, Phys. Rev. X **8**, 031050 (2018).

46) Edan Lerner, *Quasilocalized states of self stress in packing-derived networks*, Eur. Phys. J. E **41**, 93 (2018).

45) Geert Kapteijns, Eran Bouchbinder, and Edan Lerner, *Universal non-phononic density of states in 2D, 3D and 4D glasses*, Phys. Rev. Lett. **121**, 055501 (2018).

44) Eran Bouchbinder and Edan Lerner, *Universal disorder-induced broadening of phonon bands: from disordered lattices to glasses*, New J. Phys. **20**, 073022 (2018).

43) Edan Lerner and Eran Bouchbinder, *A characteristic energy scale in glasses*, J. Chem. Phys. **148**, 214502 (2018).

42) Edan Lerner and Eran Bouchbinder, *Frustration-induced internal stresses are responsible for quasilocalized modes in structural glasses*, Phys. Rev. E **97**, 032140 (2018).

2017

41) Edan Lerner and Eran Bouchbinder, *Effect of instantaneous and continuous quenches on the density of vibrational modes in model glasses*, Phys. Rev. E **96**, 020104(**R**) (2017).

40) Stefan Kooij and Edan Lerner, *Unjamming in models with analytic pairwise potentials*, Phys. Rev. E **95**, 062141 (2017).

39) Jacques Zylberg, Edan Lerner, Yohai Bar-Sinai, and Eran Bouchbinder, *Local thermal energy as a structural indicator in glasses*, PNAS **114**, 7289 (2017).

38) Edan Lerner, *Comment on "Spatial structure of states of self stress in jammed systems" by D. M. Sussman, C. P. Goodrich, and A. J. Liu, Soft Matter, 2016, 12, 3982*, Soft matter **13**, 1530 (2017).

2016

37) Luka Gartner and Edan Lerner, *Nonlinear modes disentangle glassy and Goldstone modes in structural glasses*, SciPost Phys. **1**, 016 (2016).

36) Oleg Gendelman, Edan Lerner, Yoav G. Pollack, Itamar Procaccia, Corrado Rainone, and Birte Riechers, *Emergent inter-particle interactions in thermal amorphous solids*, Phys. Rev. E **94**, 051001(**R**) (2016).

35) Edan Lerner, Gustavo Düring, and Eran Bouchbinder, *Statistics and properties of low-frequency vibrational modes in structural glasses*, Phys. Rev. Lett. **117**, 035501 (2016).

34) Gustavo Düring, Edan Lerner, and Matthieu Wyart, *Effect of particle collisions in, dense suspension flows*, Phys. Rev. E **94**, 022601 (2016).

33) Edan Lerner, *The micromechanics of nonlinear plastic modes*, Phys. Rev. E **93**, 053004 (2016).

32) Luka Gartner and Edan Lerner, *Nonlinear plastic modes in disordered solids*, Phys. Rev. E **93**, 011001(**R**) (2016).

2015

31) Eric DeGiuli, Gustavo Dring, Edan Lerner, and Matthieu Wyart, *Unified theory of inertial granular flows and non-Brownian suspensions*, Phys. Rev. E **91**, 062206 (2015).

30) Eric DeGiuli, Edan Lerner, and Matthieu Wyart, *Theory of the jamming transition at finite temperature*, J. Chem. Phys. **142**, 164503 (2015).

2014

29) Edan Lerner, Nicholas P. Bailey, and Jeppe C. Dyre, *Density scaling and quasiuniversality of flow-event statistics for athermal plastic flows*, Phys. Rev. E **90**, 052304 (2014).

28) Eric DeGiuli, Edan Lerner, Carolina Brito, and Matthieu Wyart, *The distribution of forces affects vibrational properties in hard sphere glasses in amorphous solids*, PNAS **111**, 17054 (2014).

27) Jie Lin, Edan Lerner, Alberto Rosso, and Matthieu Wyart, *Scaling description of the yielding transition in soft amorphous solids at zero temperature*, PNAS **111**, 14382 (2014).

26) Eric DeGiuli, Adrien Laversanne-Finot, Gustavo Düring, Edan Lerner, and Matthieu Wyart, *Effects of coordination and pressure on sound attenuation, boson peak and elasticity in amorphous solids*, Soft Matter **10**, 5628 (2014).

25) Edan Lerner, Eric DeGiuli, Gustavo Düring, and Matthieu Wyart, *Breakdown of continuum elasticity in amorphous solids*, Soft Matter **10**, 5085 (2014).

24) Gustavo Düring, Edan Lerner, and Matthieu Wyart, *Length scales and self-organization in dense suspension flows*, Phys. Rev. E **89**, 022305 (2014).

23) Jie Lin, Alaa Saade, Edan Lerner, Alberto Rosso, and Matthieu Wyart, *On the density of shear transformations in amorphous solids*, Europhys. Lett. **105**, 26003 (2014).

2013 22) Gustavo Düring, Edan Lerner, and Matthieu Wyart, *Phonon gap and localization lengths in floppy materials*, Soft Matter **9**, 146 (2013).

21) Edan Lerner, Gustavo Düring, and Matthieu Wyart, *Low-energy non-linear excitations in sphere packings*, Soft Matter **9**, 8252 (2013).

20) Edan Lerner, Gustavo Düring, and Matthieu Wyart, *Simulations of driven overdamped frictionless hard spheres*, Comp. Phys. Comm. **184**, 628 (2013).

2012 19) Edan Lerner, Gustavo Düring, and Matthieu Wyart, *Toward a microscopic description of flow near the jamming threshold*, Europhys. Lett. **99**, 58003 (2012).

18) Edan Lerner, Gustavo Düring, and Matthieu Wyart, *A unified framework for non-Brownian suspension flows and soft amorphous solids*, PNAS **109**, 4798-4803 (2012).

17) Smarajit Karmakar, Edan Lerner, and Itamar Procaccia, *Direct estimate of the static length-scale accompanying the glass transition*, Physica A **391**, 1001 (2012).

2011 16) Smarajit Karmakar, Edan Lerner, Itamar Procaccia, and Jacques Zylberg, *Effect of the interparticle potential on the yield stress of amorphous solids*, Phys. Rev. E **83**, 046106 (2011).

15) H.G.E. Hentschel, Smarajit Karmakar, Edan Lerner, Itamar Procaccia, *Do athermal amorphous solids exist?*, Phys. Rev. E **83**, 061101 (2011).

2010 14) Smarajit Karmakar, Edan Lerner, and Itamar Procaccia, *Statistical physics of the yielding transition in amorphous solids*, Phys. Rev. E **82**, 055103(**R**) (2010).

13) Smarajit Karmakar, Edan Lerner, Itamar Procaccia, and Jacques Zylberg, *Statistical physics of elastoplastic steady states in amorphous solids: finite temperatures and strain rates*, Phys. Rev. E **82**, 031301 (2010).

12) Smarajit Karmakar, Edan Lerner, and Itamar Procaccia, *Athermal nonlinear elastic constants of amorphous solids*, Phys. Rev. E **82**, 026105 (2010).

11) Smarajit Karmakar, Edan Lerner, and Itamar Procaccia, *Plasticity-induced anisotropy in amorphous solids: the Bauschinger effect*, Phys. Rev. E **82**, 026104 (2010).

10) Smarajit Karmakar, Anaël Lemaître, Edan Lerner, and Itamar Procaccia, *Predicting plastic flow events in athermal shear-strained amorphous solids*, Phys. Rev. Lett. **104**, 215502 (2010).

9) H. G. E. Hentschel, Smarajit Karmakar, Edan Lerner, and Itamar Procaccia, *Size of plastic events in strained amorphous solids at finite temperatures*, Phys. Rev. Lett. **104**, 025501 (2010).

2009 8) Edan Lerner and Itamar Procaccia, *Scaling theory for steady-state plastic flows in amorphous solids*, Phys. Rev. E **80**, 026128 (2009).

7) Edan Lerner, Itamar Procaccia, and Jacques Zylberg, *Statistical mechanics and dynamics of a three-dimensional glass-forming system*, Phys. Rev. Lett. **102**, 125701 (2009).

6) Edan Lerner and Itamar Procaccia, *Locality and nonlocality in elastoplastic responses of amorphous solids*, Phys. Rev. E **79**, 066109 (2009).

5) Edan Lerner, Itamar Procaccia, Emily S. C. Ching, and H. G. E. Hentschel, *Relations between material mechanical parameters and interparticle potential in amorphous solids*, Phys. Rev. B **82**, 180203(**R**) (2009).

4) Laurent Boué, Edan Lerner, Itamar Procaccia, and Jacques Zylberg, *Predictive statistical mechanics for glass forming systems*, J. Stat. Mech. P11010 (2009).

3) Edan Lerner, Itamar Procaccia, and Ido Regev, *Quantitative theory of a time-correlation function in a one-component glass-forming liquid with anisotropic potential*, Phys. Rev. E **79**, 031501 (2009).

2008 2) Edan Lerner and Itamar Procaccia, *Quantitative theory of a relaxation function in a glass-forming system*, Phys. Rev. E **78**, 020501(**R**) (2008).

2007 1) Valery Ilyin, Edan Lerner, T.-S. Lo, and Itamar Procaccia, *Statistical mechanics of the glass transition in one-component liquids with an anisotropic potential*, Phys. Rev. Lett. **99**, 135702 (2007).

Invited talks and seminars

2020
- Meeting title: "Recent progress in glassy systems", Les Houches, France
  Title of talk: *"Low-energy excitations in disordered solids"*

2019
- Meeting title: "International Workshop on Glass Physics", Beijing, China
  Title of talk: *"Wave attenuation rates in disordered solids: finite-size effects and the thermodynamic limit"*
- Meeting title: "Workshop on Amorphous Solids", UNAM, Cuernavaca, Mexico
  Title of talk: *"Nonphononic spectra of glassy solids"*
- Meeting title: "Viscous liquids and the glass transition XVI", Søminestationen, Denmark
  Title of talk: *"Wave attenuation rates in disordered solids: finite-size effects and the thermodynamic limit"*.
- Meeting title: "Granular Matter Across Scales", Leiden University, NL
  Title of talk: *"Quantifying mechanical disorder in solids"*.
- Seminar at the European Space Research and Technology Centre, Noordwijk, NL
  Title of talk: *"Quantifying mechanical disorder in solids"*.
- Meeting title: "BioSoft Day", Tel-Aviv University, Israel
  Title of talk: *"Quantifying mechanical disorder in solids"*.

2018
- Meeting title: "Marie Curie Symposium", Radboud University, Nijmegen
  Title of talk: *"The mysteries of glass formation and deformation"*.
- Meeting title: "Viscous liquids and the glass transition XV", Søminestationen, Denmark
  Title of talk: *"Disorder-induced broadening of phonon bands: from disordered lattices to glasses"*.
- Meeting title: "Unifying Concepts in Glass Physics VII", Bristol, UK
  Title of talk: *"A characteristic energy scale in glasses"*.

2017
- Meeting title: "Yielding of amorphous solids", Paris, France
  Title of talk: *"Nonlinear plastic modes — micromechanics and statistics"*.
- Meeting title: "Material Theories", Oberwolfach Institute for Mathematics, Germany
  Title of talk: *"Nonlinear plastic modes"*.
- Seminar at the Physics Department, EPFL, Switzerland
  Title of seminar: *"Low-energy excitations in glassy solids"*.
- Meeting title: "Bridging the Scales in Glasses III", Mainz, Germany
  Title of talk: *"Soft glassy modes in disordered solids"*.

2016
- Seminar at the Physics Department, Heinrich-Heine University, Düsseldorf, Germany
  Title of seminar: *"Nonlinear plastic modes"*.
- Seminar at ICSD Group, IUSTI CNRS, Aix Marseille University, France
  Title of seminar: *"Nonlinear plastic modes"*.

2015
- Seminar at the Department of Applied Physics, Eindhoven University of Technology
  Title of seminar: *"Connecting microscopic structure to rheology in non-Brownian suspensions"*.
- Meeting title: "Workshop on Amorphous Solids", UNAM, Cuernavaca, Mexico
  Title of talk: *"Breakdown of continuum elasticity in amorphous solids"*.

2014
- Meeting title: "Dutch Soft Matter Day", Leiden, the Netherlands
  Title of talk: *"Connecting microscopic structure to rheology in non-Brownian suspensions"*.
- Seminar at the Institute of Physics, University of Amsterdam, the Netherlands
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach"*.

2013
- Physical Chemistry Seminar Series, Columbia University, New York
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach"*.
- Seminar at the Physics Department, Bar Ilan University, Israel
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach"*.
- Meeting title: "Turbulence and amorphous materials", Eilat, Israel
  Title of talk: *"Bond-space perspective on the elasticity of disordered solids"*

- Seminar at the Materials Engineering Department, Ben-Gurion University, Be'er-Sheva, Israel
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach".*
- Seminar at the Physics Department, Ben-Gurion University, Be'er-Sheva, Israel
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach".*
- Seminar at the Department of Materials Science, Technion, Haifa, Israel
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach".*
- Seminar at the Department of Chemical Physics, Tel-Aviv University, Tel-Aviv, Israel
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach".*
- Seminar at the School of Engineering, UC Merced, Merced, CA
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach".*
- Seminar at the Department of Materials and Interfaces,
  Weizmann Institute of Science, Rehovot, Israel.
  Title of seminar: *"Self organization and rheology of dense non-Brownian flows – a geometric approach".*

2012
- Center for Nonlinear and Complex Systems Seminar, Duke University, Durham, NC.
  Title of seminar: *"Stability of jammed packings".*
- Condensed Matter & Biological Physics Seminar, Syracuse University, Syracuse, NY.
  Title of seminar: *"The Affine Solvent Model of dense non-Brownian suspension flows".*
- Seminar at the School of Engineering & Applied Sciences, Yale University, New Haven, CT.
  Title of seminar: *"The Affine Solvent Model of dense non-Brownian suspension flows".*
- Meeting title: "Granular & Granular-Fluid Flow; Gordon Research Conference",
  Davidson College, Davidson, North Carolina.
  Title of talk: *"The Affine Solvent Model of dense non-Brownian suspension flows".*
- Meeting title: "Statistical and Nonlinear Physics of Amorphous Solids",
  The Weizmann Institute of Science, Rehovot, Israel.
  Title of talk: *"A unified framework for dense non-Brownian suspension flows and soft amorphous solids".*
- Seminar at the 'Glass and Time' Center, Roskilde University, Roskilde, Denmark.
  Title of seminar: *"Simulations of driven overdamped hard-spheres".*
- Seminar at the 'Glass and Time' Center, Roskilde University, Roskilde, Denmark.
  Title of seminar: *"A unified framework for dense non-Brownian suspension flows and soft amorphous solids".*

2011
- Meeting title: "Statistical Physics of the Mechanical Properties of Amorphous Solids",
  UNAM, Cuernavaca, Mexico.
  Title of talk: *"Non-Brownian suspension flows".*
- Meeting title: "The 4th Discussion Meeting on Glass Transitions (DMGT2011)",
  Tohoku University, Sendai, Japan.
  Title of talk: *"Statistical Physics of Athermal Elastic Constants of Amorphous Solids".*
- Seminar at the Applied Physics Department, University of Tokyo, Tokyo, Japan.
  Title of seminar: *"Statistical Physics of Athermal Elastic Constants of Amorphous Solids".*

2010
- Soft Condensed Matter Seminar, University of Pennsylvania, Philadelphia, PA.
  Title of seminar: *"Elasto-Plasticity of Athermal Amorphous Solids".*
- LASSP Seminar, Physics Department, Cornell University, Ithaca, New York.
  Title of seminar: *"Elasto-Plasticity of Athermal Amorphous Solids".*
- Seminar at the School of Engineering & Applied Sciences, Yale University, New Haven, CT.
  Title of seminar: *"Elasto-Plasticity of Athermal Amorphous Solids".*
- Seminar at the Center of Soft Matter Research, New York University, New York.
  Title of seminar: *"Elasto-Plasticity of Athermal Amorphous Solids".*

Contributed talks

2017
- Meeting title: "8th IDMRCS", Wisla, Poland
  Title of talk: *"Stiffening of underlying inherent states of supercooled liquids"*.

2016
- Meeting title: "Nonlinear response in complex matter", Primošten, Croatia
  Title of talk: *"Nonlinear plastic modes"*.
- Meeting title: "STAT PHYS", Lyon, France
  Title of talk: *"Nonlinear plastic modes"*.
- Meeting title: "International Workshop on Jamming and Granular Matter", London, UK
  Title of talk: *"Low-frequency vibrational modes in glassy solids"*.

2015
- Meeting title: "Particles 2015", Barcelona, Spain
  Title of talk: *"Simulations of elasto-plasticity at constant pressure close to unjamming"*.

2014
- Meeting title: "Jam-packed", Erlangen, Germany
  Title of talk: *"Marginal stability of frictionless hard-sphere packings"*.

2013
- Meeting title: "Society of Engineering Science Technical Meeting",
  Brown University, Providence, Rhode Island.
  Title of talk: *"Self organization and rheology of dense non-Brownian flows – a geometric approach"*.