

# Andrey Gromov

CV

Brown Theoretical Physics Center  
Brown University  
US Citizen  
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## Research Interests

- Strongly correlated manybody systems
- Topology and geometry in condensed matter physics
- Effective field theory for condensed matter physics
- Phenomenology of Deep learning
- Metamaterials and active matter

## Professional Experience

- 2019–present **Assistant Professor**, *Brown University*.  
2018–2019 **Postdoctoral Fellow**, *UC Berkeley*.  
2015–2018 **Leo Kadanoff Postdoctoral Fellow**, *University of Chicago*.

## Education

- 2009–2015 **Ph.D. in Physics**, *Stony Brook University*.  
Area of study: Theoretical Condensed Matter Physics  
Dissertation advisor: Dr. Alexander G. Abanov  
Dissertation title: “Geometric aspects of quantum Hall states”  
2005–2009 **B.Sc. in Physics (with Honors)**, *Saint-Petersburg State University*.

## Publications

1. D.V. Else, S.J. Huang, A. Prem, **A. Gromov**  
“Quantum many-body topology of quasicrystals”  
*arXiv:2103.13393 (2021)*
2. D. Doshi, **A. Gromov**  
“Vortices and Fractons”  
*Nature Communications Physics 4 (1), 1-7 (2021) (8pp)*
3. Z. Liu, A.C. Balram, Z. Papic, **A. Gromov**  
“Quench dynamics of collective modes in fractional quantum Hall bilayers”  
*Phys. Rev. Lett. 126 (7), 076604 (2021) (15pp) (Editor’s Suggestion)*
4. P. Glorioso, **A. Gromov**, S. Ryu  
“Effective response theory for Floquet topological systems”  
*Physical Review Research 3 (1), 013117 (2021) (26pp)*
5. D.X. Nguyen, **A. Gromov**, S. Moroz  
“Fracton-elasticity duality of two-dimensional superfluid vortex crystals: defect interactions and quantum melting”  
*SciPost Phys. 9, 076 (2020) (28pp)*

6. **A. Gromov**  
 "A Duality Between  $U(1)$  Haah Code and 3D Smectic A Phase"  
*arXiv:2002.11817 (2020) (5pp)*
7. **A. Gromov**, A. Lucas, R. Nandkishore  
 "Fracton hydrodynamics"  
*Phys. Rev. Research 2, 033124 (2020) (15pp)*
8. A. Souslov, **A. Gromov**, V. Vitelli  
 "Anisotropic odd viscosity via time-modulated drive"  
*Phys. Rev. E 101 (5), 052606 (2020) (12pp) (Editor's Suggestion)*
9. **A. Gromov**, E. Martinec, S. Ryu  
 "Collective excitations at filling factor  $5/2$ : The view from superspace"  
*Phys. Rev. Lett. 125 (7), 077601 (2020) (6pp)*
10. **A. Gromov**, P. Surowka  
 "On a duality between Cosserat elasticity and fractons"  
*SciPost Phys. 8, 065 (2020) (16pp)*
11. **A. Gromov**  
 "Towards classification of fracton phases: the multipole algebra"  
*Phys. Rev. X 9 (3), 031035 (2019) (19pp)*
12. M. Lapa, **A. Gromov**, T. Hughes  
 "Geometric quench in the fractional quantum Hall effect: exact solution in quantum Hall matrix models and comparison with bimetric theory"  
*Phys. Rev. B 99 (7), 075115 (2019) (16pp)*
13. N. Schine, M. Chalupnik, T. Can, **A. Gromov**, J. Simon  
 "Measuring Electromagnetic and Gravitational Responses of Photonic Landau Levels"  
*Nature 565, 173-179 (2019) (9pp)*
14. **A. Gromov**  
 "Chiral Topological Elasticity and Fracton Order"  
*Phys. Rev. Lett. 122 (7), 076403 (2019) (6pp)*
15. Z. Liu, **A. Gromov**, Z. Papic  
 "Geometric quench dynamics and non-equilibrium in fractional quantum Hall states"  
*Phys. Rev. B 98, 155140(2018) (18pp)*
16. D.X. Nguyen, **A. Gromov**, D.T. Son  
 "Composite Fermi Liquid as Bimetric theory"  
*Phys. Rev. B 97, 195103 (2018) (12pp)*
17. L.V. Delacretaz, **A. Gromov**  
*Phys. Rev. Lett. 119, 226602 (2017) (5pp) (Editor's Suggestion)*
18. **A. Gromov**, D.T. Son  
 "Bimetric theory of fractional quantum Hall state"  
*Phys. Rev. X 7, 041032 (2017) (15pp)*
19. **A. Gromov**, S. D. Geraedts, B. Bradlyn  
 "Investigating anisotropic quantum Hall states with bimetric geometry"  
*Phys. Rev. Lett. 119, 146602 (2017) (6pp)*
20. M. Buican, **A. Gromov**  
 "Anyonic Chains, Topological Defects, and Conformal Field Theory"  
*Comm. Math. Phys. 10.1007/s00220-017-2995-6 (2017) (40pp)*
21. D. X. Nguyen, T. Can, **A. Gromov**

- "Particle-hole Duality in the Lowest Landau Level"  
*Phys. Rev. Lett.* 118 (20), 206602 (2017) (6pp)
22. D. X. Nguyen, **A. Gromov**  
"Exact Electromagnetic Response of Landau Level Electrons"  
*Phys. Rev. B* 95 (8), 085151 (2017) (20pp)
23. **A. Gromov**  
"Geometric Defects in Quantum Hall States"  
*Phys. Rev. B* 94, 085116 (2016) (24pp)
24. N. Schine, A. Ryou, **A. Gromov**, A. Sommer, J. Simon  
"Synthetic Landau levels for photons"  
*Nature* 534, 671–675 (2016) (5pp)
25. **A. Gromov**, K. Jensen, A. G. Abanov  
"Boundary effective action for quantum Hall states"  
*Phys. Rev. Lett.* 116, 126802 (2016) (5pp)
26. B. Bradlyn, **A. Gromov**  
"Supersymmetric waves in Bose-Fermi mixtures"  
*Phys. Rev. A* 93, 033642 (2016) (7pp)
27. **A. Gromov**, G. Y. Cho, Y. You, A. G. Abanov, E. Fradkin  
"Framing Anomaly in the Effective Theory of Fractional Quantum Hall Effect"  
*Phys. Rev. Lett.* 114, 016805 (2015) (5pp) (*Editor's Suggestion*)
28. F. Franchini, **A. Gromov**, M. Kulkarni, A. Trombettoni  
"Universal dynamics of a soliton after an interaction quench"  
*2015 J. Phys. A: Math. Theor.* 48 28FT01 (2015) (11pp)
29. **A. Gromov**, A. G. Abanov  
"Thermal Hall Effect and Geometry with Torsion "  
*Phys. Rev. Lett.* 114, 016802 (2015) (6pp)
30. **A. Gromov**, A. G. Abanov  
"Density-curvature response and gravitational anomaly"  
*Phys. Rev. Lett.* 113, 266802 (2014) (5pp)
31. **A. Gromov**, R. Santos  
"Entanglement Entropy in 2D Non-Abelian gauge theory"  
*Physics Letters B* 737 (2014) 60-64 (2014) (5pp)
32. A. G. Abanov, **A. Gromov**  
"Electromagnetic and gravitational responses of two-dimensional noninteracting electrons in constant magnetic field"  
*Phys. Rev. B* 90, 014435 (2014) (5pp)
33. A. G. Abanov, **A. Gromov**, M. Kulkarni  
"Soliton solutions of Calogero model in Harmonic potential"  
*J. Phys. A: Math. Theor.* 44 295203 (2011) (21pp)

## Invited Talks

- **Condensed Matter Seminar**, Stony Brook University, 02/2014; "Entanglement Entropy in 2D Yang-Mills Theory".
- **Invited Speaker**, Quantum Anomalies and Hydrodynamics, Stony Brook, 05/2014; "Effective field theory for the free electrons in external electromagnetic and gravitational fields".
- **Kadanoff Center Seminar**, Kadanoff Center for Theoretical Physics Seminar, Chicago, 10/2014;

*“Geometric Response of Fractional Quantum Hall States”.*

- **Informal Condensed Matter Seminar**, Institute for Condensed Matter Theory, Urbana-Champaign, 10/2014; *“Thermal Transport and Geometry with Torsion”.*
- **Condensed Matter Seminar**, Perimeter Institute, Waterloo, 11/2014; *“Geometric Response of Fractional Quantum Hall States”.*
- **Condensed Matter Seminar**, Stony Brook University, 12/2014; *“Framing Anomaly in the Effective Theory of Quantum Hall States”.*
- **Invited Poster**, Symmetry and Topology in Quantum Matter, Los Angeles, 01/2015; *“Geometric Response of Fractional Quantum Hall States”.*
- **Invited Poster**, Symmetries and Interactions in Topological Matter, Minneapolis, 04/2015; *“Geometric Response of Fractional Quantum Hall States”.*
- **Invited Speaker**, Large  $N$  Limits in Kahler Geometry, 05/2015; *“Geometric Response of Quantum Hall States”.*
- **Invited Speaker**, Geometric aspects of the Quantum Hall Effect, Cologne, Germany, 12/2015; *“Geometric Response at the Edge”.*
- **Invited Speaker**, Urbana-Chicago Fest, Urbana-Champaign, 04/2016; *“Geometric Response at the Edge”.*
- **Invited Speaker**, Workshop on Geometry of Quantum States in Condensed Matter Systems, Stony Brook, 04/2016; *“Geometric Defects in Quantum Hall States”.*
- **Invited Speaker**, Workshop on Geometrical Degrees of Freedom in Topological Phases, Banff, Canada, 08/2016; *“Geometric Defects in Quantum Hall States”.*
- **SITP Seminar**, Stanford University, 10/2016; *“Composite Fermions in Curved Space”.*
- **Condensed Matter Seminar**, University of California at Berkeley, 10/2016; *“Composite Fermions in Curved Space”.*
- **Invited Speaker**, Workshop on Applied Newton-Cartan geometry, Stony Brook, 03/2017; *“Geometry of Anisotropic Quantum Hall States”.*
- **Kadanoff Center Seminar**, Kadanoff Center for Theoretical Physics Seminar, Chicago, 09/2017; *“Bimetric theory of fractional quantum Hall states”.*
- **Condensed Matter Seminar**, Institute for Condensed Matter Theory, Urbana-Champaign, 09/2017; *“Bimetric theory of fractional quantum Hall states”.*
- **Condensed Matter Seminar**, Purdue University, West Lafayette, 10/2017; *“Bimetric theory of fractional quantum Hall states”.*
- **Invited Speaker**, Workshop on Chaos, Duality and Topology in Condensed Matter Theory, University of Illinois at Urbana-Champaign, 11/2017; *“Bimetric theory of fractional quantum Hall states”.*
- **Condensed Matter Seminar**, Perimeter Institute, Waterloo, 11/2017; *“Bimetric theory of fractional quantum Hall states”.*
- **Condensed Matter Seminar**, MIT, Boston, 11/2017; *“Bimetric theory of fractional quantum Hall states”.*
- **QMAP Seminar**, University of California at Davis, Davis, 01/2018; *“Bimetric theory of fractional quantum Hall states”.*
- **Condensed Matter Seminar**, Brown University, Providence, 02/2018; *“Geometry of strongly correlated quantum matter”.*
- **Condensed Matter Seminar**, Johns Hopkins University, Baltimore, 02/2018; *“Geometry of strongly correlated quantum matter”.*
- **Invited Speaker**, Aspen Center for Physics, Aspen, 03/2018; *“Bimetric theory of fractional*

*quantum Hall states*".

- **Invited Speaker**, Workshop on Perspectives in Topological phases: From Condensed Matter to High-Energy Physics, Quy Nhon, Vietnam 07/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, CU Boulder, Boulder, 08/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Physics Seminar**, Simons Center for Geometry and Physics, Stony Brook, 09/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, Graduate Center, CUNY, New York, 09/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Invited Speaker**, Station Q, Santa Barbara, 10/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, Caltech, Pasadena, 10/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, UCLA, Los Angeles, 10/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, UC Berkeley, Berkeley, 10/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, Weizmann Institute of Science, Rehovot, 12/2018; "*Bimetric theory of fractional quantum Hall states*".
- **Invited Speaker**, Workshop on "Fluid flows, from Graphene to planet atmospheres" Weizmann Institute of Science, Rehovot, 12/2018; "*Remarks on Hall Viscosity*".
- **Condensed Matter Seminar**, Brown, 01/2019; "*Bimetric theory of fractional quantum Hall states*".
- **Condensed Matter Seminar**, Princeton, 03/2019; "*Bimetric theory of fractional quantum Hall states*".
- **High Energy Theory Seminar**, Brown, 04/2019; "*Multipole Gauge Theories and Fractons*".
- **Invited Speaker**, Perimeter, 04/2019; "*Multipole Gauge Theories and Fractons*".
- **Invited Speaker**, Nordita workshop on "Effective Theories of Quantum Phases of Matter", 05/2019; "*Bimetric theory of fractional quantum Hall states*".
- **Invited Speaker**, Imperial College London, 06/2019; "*Bimetric theory of fractional quantum Hall states*".
- **Invited Speaker**, Queen Mary's University, London, 06/2019; "*Bimetric theory of fractional quantum Hall states*".
- **Invited Speaker**, Leeds University, Leeds, 06/2019; "*Bimetric theory of fractional quantum Hall states*".
- **Invited Speaker**, Mittag-Leffler workshop on "New Directions in Mathematics of Coulomb Gases and Quantum Hall Effect", 07/2019; "*Introduction to Quantum Hall Effect for mathematicians*".
- **Invited Speaker**, Mittag-Leffler Institut, workshop on "New Directions in Mathematics of Coulomb Gases and Quantum Hall Effect", 07/2019; "*Collective modes in Moore-Read state: view from the superspace*".
- **Invited Speaker**, CUNY Graduate Center, workshop on "Fluid phases of matter: From electron liquids to active matter", 07/2019; "*On duality between fractons and elasticity*".
- **Invited Speaker**, Harvard CMSA, workshop on "Quantum Matter", 07/2019; "*Multipole Gauge theories*".
- **Invited Speaker**, CU Boulder, Condensed Matter Seminar, 01/2020; "*Multipole Gauge theories*".

- **Invited Speaker**, Workshop “Fractons and Beyond”, Banff 02/2020; “*Multipole Gauge theories*”.
- **Invited Speaker**, Carnegie Melon University (Online), Theoretical Physics Seminar, 11/2020; “*Vortices and Fractons*”.
- **Invited Speaker**, Nordita (Online), non-Lorentzian geometry workshop, 11/2020; “*Tensor gauge theories*”
- **Invited Speaker**, Leeds(Online), Invitation to the Symposium on the interplay between quantum matter and gravity, 05/2021; “*Tensor gauge theories*”

## Workshops, Programs and Schools

- American Physical Society
  - March Meeting 2012
  - March Meeting 2013
  - March Meeting 2014
  - March Meeting 2015
  - March Meeting 2017
  - March Meeting 2018
  - March Meeting 2019
- Aspen Center for Physics
  - Entanglement Matters, 2016
  - Field Theory Dualities and Strongly Correlated Matter, 2018
- Simons Center for Geometry and Physics, Stony Brook
  - Facets of Integrability, 2013
  - Geometrical Aspects of Hydrodynamics, 2014
  - Large N limits in Kahler geometry, 2015
  - Quantum Geometry, Stochastic Geometry, Random Geometry, you name it, 2015
  - Geometry of Quantum States in Condensed Matter Systems, 2016
  - Applied Newton-Cartan Geometry, 2017
- Perimeter Institute
  - Quantum Materials and Entanglement, 2019
- NORDITA
  - Effective Theories of Quantum Phases of Matter, 2019
- Mittag-Leffler Institut
  - New Directions in Mathematics of Coulomb Gases and Quantum Hall Effect, 2019
- The Abdus Salam International Centre for Theoretical Physics, Trieste
  - Summer School and Workshop on Innovations in Strongly Correlated Electrons, 2012
  - Conference on Geometrical Aspects of Quantum States in Condensed Matter, 2013
- Banff International Research Station
  - Geometrical Degrees of Freedom in Topological Phases, 2016
  - Fractons and Beyond, 2020
- Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign
  - Urbana-Chicago Fest, 2016
  - Chaos, Duality, and Topology in Condensed Matter Theory, 2017

- University of Cologne
  - Geometric Aspects of Quantum Hall Effect, 2015
- Weizmann Institute of Science
  - Fluid flows, from Graphene to planet atmospheres, 2018
- Boulder Summer School in Condensed Matter Physics
  - Disorder and Dynamics in Quantum Systems, 2013
  - Topological Phases of Quantum Matter, 2016
- Les Houches Summer School on Topological Aspects of Condensed Matter Physics, 2014
- Princeton Summer School on Condensed Matter Physics
  - Spin Liquids, Matrix Product States and Entanglement, 2012
  - New Insights Into Quantum Matter, 2015
- Tallahassee Winter School on Topological Phases of Condensed Matter, 2014
- Windsor Summer School in Condensed Matter Theory on Low-Dimensional Materials, 2012

### Other skills

- Python, including PyTorch
- Mathematica
- LaTeX

### Teaching history

- |  |             |
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| ○ PHYS 2420, "Solid State Physics II", Enrollment: 25, | Spring 2021 |
| ○ PHYS 2410, "Solid State Physics I", Enrollment: 28,  | Fall 2020   |
| ○ Teaching relief                                      | Spring 2020 |
| ○ PHYS 2410, "Solid State Physics I", Enrollment: 26,  | Fall 2019   |
| ○ PHYS 2420, "Solid State Physics II", Enrollment: 13, | Spring 2019 |

### Grant history

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| ○ NSF CAREER    | 08/2021 – |
| ○ Salomon Award | 08/2021 – |

### Professional Services and Scientific Outreach

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| ○ Co-organizer of various seminars and colloquium at Brown               | 2019 - present |
| ○ Physical Review Letters, Physical Review, J. Phys. A Referee           |                |
| ○ Organizer of the Kadanoff Center Seminar                               | 2016 - 2018    |
| ○ Lecturer in the Academic Enrichment Program for Children "SchoolNova"  | 2012 - 2014    |
| ○ Counselor/Lecturer in the Science Summer Camp for Children "SigmaCamp" | 2013           |

### References

- Dr. Alexander G. Abanov (Thesis Advisor)  
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 Department of Physics and Astronomy  
 Stony Brook University,

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Phone: +1 (631) 632-2820

- Dr. Eduardo Fradkin  
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1110 W. Green St, Urbana, IL 61801-3080  
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Phone: +1 (217) 333-4409
  
- Dr. Jonathan Simon  
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E-mail: simonjon@uchicago.edu  
Phone: +1 (773) 702-9661
  
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- Dr. Vincenzo Vitelli  
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James Franck Institute  
University of Chicago 929 E. 57th Street  
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