

Curriculum vitae - Paul Romatschke

as of January 30, 2019

Personal Information

- Nationality: Austrian
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Educational Background

- November 2003 Graduation to “Doktor der technischen Wissenschaften” with honors, Technical University of Vienna, Austria
- 04-06 Postdoctoral Position at Bielefeld University, Bielefeld, Germany
- 06-07 Postdoctoral Position at INT, University of Washington, Seattle, USA

Academic Employment History

- 07-10 Research Assistant Professor/INT 5-year fellow, University of Washington, Seattle, USA
- 10-11 Fellow, Frankfurt Institute for Advanced Studies (FIAS), Frankfurt, Germany
- 11-17 Assistant Professor, Department of Physics, University of Colorado Boulder, Boulder USA
- **currently (since 08/2017) Associate Professor**, Department of Physics, University of Colorado Boulder, Boulder USA

Contract and Grant Funding History

- PI, research grant from DFG (the German equivalent of NSF), **EUR 220k**, title 'Cavitation in strongly coupled field theories', Feb 2011 to Oct 2011; status: finished
- PI, Alfred P. Sloan Fellowship from the Sloan Foundation, **\$50k**, Sep 1st, 2012 to Aug 30, 2014; status: finished
- PI, Early Career Award from the Department of Energy, **\$750k**, title 'Early time dynamics in Heavy-Ion Collisions', July 1, 2012 to June 30, 2017; status: finished
- co-PI, research grant from the Department of Energy, **\$181k**, title 'JET Topical Collaboration', June 1st, 2012 to May 31st, 2015; status: finished.
- PI, sub-award from Lawrence Berkeley National Laboratory within the JET topical collaboration funded by the Department of Energy, title 'A realistic 3+1D viscous Hydro Algorithm', **\$103k**, Oct 1st, 2011 to May 31st, 2012; status: finished
- PI, research grant from the Department of Energy, **\$320k**, title 'Strong Coupling Methods for Nuclear Theory', July 1st, 2017 to June 30, 2019; status: active

Teaching

Different Lecture Courses Taught

1. "**New Developments in Viscous Hydrodynamics**" (2 credits), University of Jyväskylä, Finland (Summer 2008)
2. "**Hydrodynamics and Transport Theory**" (4 credits), Johann-Wolfgang von Goethe Universität Frankfurt, Germany (Fall 2010)
3. "**Thermal Quantum Field Theory**" (4 credits), Johann-Wolfgang von Goethe Universität Frankfurt, Germany (Spring 2011)
4. "**Energy and the Environment**" (PHYS 3070, 3 credits), University of Colorado, Boulder, USA (Spring 2012)
5. "**Electromagnetism I for Graduate Students**" (PHYS 7310, 3 credits), University of Colorado, Boulder, USA (Fall 2012 & Fall 2013)
6. "**Electromagnetism II for Graduate Students**" (PHYS 7320, 3 credits), University of Colorado, Boulder, USA (Spring 2013)

7. "**Quantum Mechanics II for Graduate Students**" (PHYS 5260, 3 credits), University of Colorado, Boulder, USA (Spring 2015& Spring 2017)
8. "**Classical Electromagnetism**" (PHYS 3320, 3 credits), University of Colorado, Boulder, USA (Fall 2015)
9. "**Introduction to Modern Physics**" (PHYS 2170, 3 credits), University of Colorado, Boulder, USA (Spring 2016 & Fall 2016)
10. "**Finite Temperature Quantum Field Theory**" (PHYS 7280, 3 credits), University of Colorado, Boulder, USA (Spring 2018)
11. "**General Relativity**" (PHYS 5770, 3 credits), University of Colorado, Boulder, USA (Spring 2019)

Previous Student Supervision

- 2007-2009: **M. Luzum, graduate student**, co-supervision with G. Miller, U. of Washington, Seattle; **PhD 2009**, thesis was awarded the 2011 American Physical Society Dissertation Award in Nuclear Physics
- 2010-2011: **I. Sagert, postdoctoral researcher**, FIAS, Frankfurt, Germany
- 2010-2011: **B. Wu, postdoctoral researcher**, FIAS, Frankfurt, Germany;
- 2010-2011: **M. Habich, undergraduate student**, FIAS, Frankfurt, Germany; **BS 2011**
- 2010-2011: **S. Henneberg, undergraduate student**, FIAS, Frankfurt, Germany; **BS 2011**
- 2012-2013: **R. Young, graduate student**, U. Colorado, Boulder; **MS 2013**
- 2013-2016: **H. Bantilan, postdoctoral researcher**, U. Colorado, Boulder
- 2015-2016: **W. Xiang, postdoctoral researcher**, U. Colorado, Boulder
- 2012-2016: **T. Gorda, graduate student**, U. Colorado, Boulder; **PhD 2016**
- Summer 2013 **J.D. Hogg, undergraduate student**, CU Boulder
- 2013-2015: **J. Brewer, undergraduate student**, CU Boulder, **BA 2015**

- 2015-2017: **I. Takaaki**, postdoctoral researcher, U. Colorado, Boulder
- 2016-2017: **R. Weller**, undergraduate student, CU Boulder, **BA 2017**
- 2015-2017: **W. Lewis**, graduate student, CU Boulder, **PhD 2017**
- 2015-2017: **M. Habich**, graduate student, CU Boulder, **PhD 2017**

Honors and Awards

- 02/2012: Alfred P. Sloan Fellow 2012 (Sloan Foundation)
- 05/2012: Department of Energy Early Career Research Award

Recent Invited Talks

- “Simulation of Black Hole Collisions in AdS spacetimes”, **Holographic Methods for Strongly Coupled Systems**, Florence, Italy, April 2015
- ”Collective flow without hydrodynamics”, **Correlations and Fluctuations in p+A and A+A Collisions**, INT, University of Washington, Seattle July 2015
- “Experimental evidence for non-hydrodynamic modes”, **Equilibration Mechanisms in Weakly and Strongly Coupled Quantum Field Theory**, INT, University of Washington, Seattle Aug 2015
- “Summary of other reasonable theoretical ideas” (plenary), **Quark Matter 2015**, Kobe, Japan, October 2015
- “Predictions of novel collective modes in trapped Fermi gases from Lifshitz black holes”, **Numerical Methods for asymptotically AdS spaces**, Technion, Haifa, Israel, May 2016
- “Simulating Yang-Mills in 9+1 dimensions”, **Numerical Relativity and Holography**, Santiago de Compostela, Spain, June 2016
- ”String-theory Inspired Predictions for Novel Collective modes in Cold Atom Experiments”, **Workshop on Non-Equilibrium Physics and Holography**, Oxford, U.K., July 2016
- ”Non-Equilibrium Dynamics in Nuclear Collisions”, **The Big Bang and little bangs**, CERN, August 2016

- “Do nuclear collisions create an equilibrated QGP”, **Relativistic Hydrodynamics: Theory and Modern Applications**, Mainz, Germany, October 2016
- “Lattice Simulations of Yang-Mills in 10d and toroidal compactifications”, **Quantum Gravity, String Theory and Holography**, Kyoto, Japan, April 2017
- “What do hydrodynamic fits to data tell us about QCD properties?”, **Workshop on Flow in Small Systems**, Copenhagen, Denmark, May 2017
- “Creating QCD plasma droplets in p+p collisions at the LHC”, **EPS-HEP 2017**, Venice, Italy, July 2017
- “Hydrodynamics Off Equilibrium”, plenary, **Initial Stages 2017**, Krakow, Poland, September 2017
- “Holography for Heavy-Ion Collisions”, **Fire and Ice: Hot QCD meets cold and dense matter**, Saariselkä, Finland, April 2018
- “Holographic Heavy-Ion Collisions: new analytic solutions”, **Theoretical Foundations of Relativistic Hydrodynamics**, Trento, Italy, May 2018
- “Hydrodynamics Off Equilibrium”, plenary, **Strong and Electroweak Matter 2018**, Barcelona, Spain, June 2018
- “Small Collision Systems”, **Fourth Mont-Sainte-Odile Meeting**, Terzolas, Italy, May 2018
- “The Physics of Non-Hydrodynamic Modes”, **Numerical approaches to holography, quantum gravity and cosmology**, Edinburgh, UK, May 2018
- “Hydrodynamic evolution, flow, bulk properties”, 3 lectures, **Indian Summer School**, Prague, Czech Republic, September 2018
- “Real Time Quantum Gravity Dynamics from Yang-Mills Simulations”, **Quantum Gravity meets Lattice QFT**, Trento, Italy, September 2018
- “Relativistic Fluid Dynamics Out of Equilibrium”, 3 lectures, U Maryland, November 2018

Refereed Publications

1. P. Romatschke and M. Strickland, *Collective Modes of an Anisotropic Quark-Gluon Plasma*, **Phys.Rev.D68:036004, 2003**
2. A. Rebhan and P. Romatschke, *HTL Quasiparticle Models of Deconfined QCD at Finite Chemical Potential*, **Phys.Rev.D68:025022, 2003**
3. P. Romatschke and M. Strickland, *Energy Loss of a Heavy Fermion in an Anisotropic QED Plasma*, **Phys.Rev.D69:065005, 2004**
4. P. Romatschke and M. Strickland, *Collective Modes of an Anisotropic Quark-Gluon Plasma II*, **Phys.Rev.D70:116006, 2004**
5. P. Romatschke and M. Strickland, *Collisional Energy Loss of a Heavy Quark in an Anisotropic Quark-Gluon Plasma*, **Phys.Rev.D71:125008, 2005**
6. A. Rebhan, P. Romatschke and M. Strickland, *Hard-Loop Dynamics of Non-Abelian Plasma Instabilities*, **Phys.Rev.Lett.94:102303, 2005**
7. E.S. Fraga and P. Romatschke, *The Role of Quark Mass in Cold and Dense Perturbative QCD*, **Phys.Rev.D71:105014, 2005**
8. A. Rebhan, P. Romatschke and M. Strickland, *Dynamics of Quark-Gluon-Plasma Instabilities in Discretized Hard-Loop-Approximation*, **JHEP 0509:041, 2005**
9. P. Romatschke and R. Venugopalan, *Collective Non-Abelian Instabilities in a Melting Color Glass Condensate*, **Phys.Rev.Lett.96:062302, 2006**
10. R. Baier, P. Romatschke and U.A. Wiedemann, *Dissipative hydrodynamics and heavy ion collisions*, **Phys.Rev. C73:064903, 2006**
11. P. Romatschke and R. Venugopalan, *The Unstable Glasma*, **Phys.Rev. D74:045011, 2006**
12. P. Romatschke and A. Rebhan, *Plasma Instabilities in an Anisotropically Expanding Geometry*, **Phys.Rev.Lett. 97:252301, 2006**
13. P. Romatschke, *Momentum broadening in an anisotropic plasma*, **Phys.Rev. C75:014901, 2007**
14. R. Baier and P. Romatschke, *Causal viscous hydrodynamics for central heavy-ion collisions*, **Eur.Phys.J.C51:677-687, 2007**
15. M. Laine, O. Philipsen, P. Romatschke and M. Tassler, *Real-time static potential in hot QCD*, **JHEP 0703:054, 2007**

16. P. Romatschke, *Causal viscous hydrodynamics for central heavy-ion collisions. II. Meson spectra and HBT radii*, **Eur.Phys.J.C52:203-209, 2007**
17. P. Romatschke and U. Romatschke, *Viscosity information from relativistic nuclear collisions: How perfect is the fluid observed at RHIC?*, **Phys.Rev.Lett. 99:172301, 2007**
18. R. Baier, P. Romatschke, D.T. Son, M. Stephanov and A. Starinets, *Relativistic viscous hydrodynamics, conformal invariance, and holography*, **JHEP 0804:100, 2008**
19. D. Grumiller and P. Romatschke, *On the collision of two shock waves in AdS_5* , **JHEP 0808:027, 2008**
20. M. Luzum and P. Romatschke, *Conformal Relativistic Viscous Hydrodynamics: Applications to RHIC results at $\sqrt{s_{NN}} = 200\text{-GeV}$* , **Phys.Rev. C78:034915, 2008**
21. M. Luzum and P. Romatschke, *Viscous Hydrodynamic Predictions for Nuclear Collisions at the LHC*, **Phys.Rev.Lett. 103:262302, 2009**
22. P. Romatschke, *New Developments in Relativistic Viscous Hydrodynamics*, **Int.J.Mod.Phys.E19:1-53, 2010**
23. P. Romatschke and D.T. Son, *Spectral sum rules for the quark-gluon plasma*, **Phys.Rev. D80:065021, 2009**
24. P. Romatschke, *Relativistic Viscous Fluid Dynamics and Non-Equilibrium Entropy*, **Class.Quant.Grav.27:025006, 2010**
25. A. Kurkela, P. Romatschke and A. Vuorinen, *Cold Quark Matter*, **Phys.Rev.D81:105021, 2010**
26. P. Kovtun, G.D. Moore and P. Romatschke, *The stickiness of sound: An absolute lower limit on viscosity and the breakdown of second order relativistic hydrodynamics*, **Phys.Rev.D84:025006, 2011**
27. P. Romatschke, M. Mendoza and S. Succi, *A fully relativistic lattice Boltzmann algorithm*, **Phys.Rev.C84:034903, 2011**
28. Bin Wu and P. Romatschke, *Shock wave collisions in AdS_5 : approximate numerical solutions*, **Int.J.Mod.Phys. C22:1317-1342, 2011**
29. P. Romatschke, *Relativistic (Lattice) Boltzmann Equation with Non-Ideal Equation of State*, **Phys. Rev. D85:065012, 2012**

30. P. Romatschke and R. Young, *Implications of hydrodynamic fluctuations on the minimum shear viscosity of the dilute Fermi gas at unitarity*, **Phys.Rev. A87:053606, 2013**
31. P. Romatschke and J.D. Hogg, *Pre-Equilibrium Radial Flow from Central Shock-Wave Collisions in AdS₅*, **JHEP 1304:048, 2013**
32. W. van der Schee, P. Romatschke and S. Pratt, *A fully dynamical simulation of central nuclear collisions*, **Phys.Rev.Lett.111:222302, 2013**
33. A. Adare et al., *Examination whether heavy quarks carry information on the early-time coupling of the quark-gluon plasma*, **Phys.Rev. C90:024911, 2014**
34. J.L. Nagle et al., *Exploiting Intrinsic Triangular Geometry in Relativistic He³+Au Collisions to Disentangle Medium Properties*, **Phys.Rev.Lett. 113:112301, 2014**
35. M. Habich and P. Romatschke, *Onset of cavitation in the quark-gluon plasma*, **JHEP 1412:054, 2014**
36. P. Kovtun, G.D. Moore and P. Romatschke, *Towards an effective action for relativistic dissipative hydrodynamics*, **JHEP 1407:123, 2014**
37. T. Gorda and P. Romatschke, *Precision studies of v_n fluctuations*, **Phys.Rev. C90:054908, 2014**
38. P. Arnold, W. van der Schee and P. Romatschke, *Absence of a local rest frame in far from equilibrium quantum matter*, **JHEP 1410:110, 2014**
39. M. Habich, J.L. Nagle and P. Romatschke, *Particle spectra and HBT radii for simulated central nuclear collisions of C + C, Al + Al, Cu + Cu, Au + Au, and Pb + Pb from $\sqrt{s}=62.4 - 2760$ GeV*, **Eur.Phys.J. C75:15, 2015**
40. H. Bantilan and P. Romatschke, *Simulation of Black Hole Collisions in Asymptotically Anti-de Sitter Spacetimes*, **Phys.Rev.Lett. 114 (2015) 8, 081601**
41. T. Gorda and P. Romatschke, *Equation of state in two-, three-, and four-color QCD at nonzero temperature and density*, **Phys.Rev. D92 (2015) 1, 014019**
42. P. Romatschke, *Light-Heavy Ion Collisions: A window into pre-equilibrium QCD dynamics?*, **Eur.Phys.J. C75 (2015) 7, 305**

43. P. Romatschke, *Collective flow without hydrodynamics: simulation results for relativistic ion collisions*, **Eur.Phys.J. C75** (2015) **9**, 429
44. J. Brewer, M. Mendoza, R.E. Young and P. Romatschke, *Lattice Boltzmann simulations of a strongly interacting two-dimensional Fermi gas*, **Phys.Rev. A93** (2016) **1**, 013618
45. J. Brewer and P. Romatschke, *Nonhydrodynamic Transport in Trapped Unitary Fermi Gases*, **Phys.Rev.Lett.** **115** (2015) **19**, 190404
46. P. Romatschke, *Retarded correlators in kinetic theory: branch cuts, poles and hydrodynamic onset transitions*, **Eur.Phys.J. C77** (2016) **6**, 352
47. L. Keegan, A. Kurkela, P. Romatschke, W. van der Schee and Y. Zhu, *Weak and strong coupling equilibration in nonabelian gauge theories*, **JHEP** **1604** (2016) **013**
48. M. Habich, G.A. Miller, P. Romatschke, W. Xiang, *Testing hydrodynamic descriptions in $p+p$ collisions at $\sqrt{s} = 7$ TeV*, **Eur.Phys.J. C76** (2016) **7**, 408
49. H. Bantilan, J. Brewer, T. Ishii, W.E. Lewis, and P. Romatschke, *String Theory Based Predictions for Nonhydrodynamic Collective Modes in Strongly Interacting Fermi Gases*, **Phys.Rev.** **A94** (2016), 033621
50. P. Romatschke, *Do nuclear collisions create a locally equilibrated quark-gluon plasma?*, **Eur.Phys.J. C77** (2017), 21
51. I. Ghioiu, T. Gorda, A. Kurkela, P. Romatschke, M. Säppi, A. Vuorinen, *On high-order perturbative calculations at finite density*, **Nucl.Phys. B915** (2017) **102**
52. W. Lewis and P. Romatschke, *Higher-Order Collective Modes in a Trapped Gas from Second-Order Hydrodynamics*, **New J.Phys.** **19** (2017) 023042
53. M. Hanada and P. Romatschke, *Lattice Simulations of 10d Yang-Mills toroidally compactified to 1d, 2d and 4d*, **Phys. Rev. D96** (2017) 094502
54. R.D. Weller and P. Romatschke, *One fluid to rule them all: viscous hydrodynamic description of event-by-event central $p+p$, $p+Pb$ and $Pb+Pb$ collisions at $\sqrt{s}=5.02$ TeV*, **Phys. Lett. B774** (2017) 351
55. H. Bantilan, P. Figueras, M. Kunesch and P. Romatschke, *Nonspherically Symmetric Collapse in Asymptotically AdS Spacetimes*, **Phys. Rev. Lett.** **119** (2017), 191103

56. P. Romatschke, *Relativistic Hydrodynamic Attractors with Broken Symmetries: Non-Conformal and Non-Homogeneous*, **JHEP** **1712** (2017) **079**
57. P. Romatschke, *Relativistic Fluid Dynamics Far From Local Equilibrium*, **Phys. Rev. Lett.** **120** (2018), **012301**
58. P. Romatschke and U. Romatschke, *Relativistic Fluid Dynamics In and Out of Equilibrium*, Cambridge Monographs in Physics, Cambridge University Press, in press
59. P. Romatschke, *Azimuthal Anisotropies at High Momentum from Purely Non-Hydrodynamic Transport*, **Eur. Phys. J.C78** (2018) **636**
60. H. Bantilan, T. Ishii and P. Romatschke, *Holographic Heavy-Ion Collisions: Analytic Solutions with Longitudinal Flow, Elliptic Flow and Vorticity*, **Phys. Lett.** **B785** (2018) **201**
61. T. Gorda, A. Kurkela, P. Romatschke, M. Säppi, A. Vuorinen, *NNNLO pressure of cold quark matter: leading logarithm*, **Phys. Rev. Lett.**, in press
62. M. Hanada and P. Romatschke, *Real Time Quantum Gravity Dynamics from Classical Statistical Yang-Mills Simulations*, **JHEP** **1901** (2019) **201**