

Jaroslav Trnka

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RESEARCH INTERESTS High Energy Theory, Quantum Field Theory, New Methods for Scattering Amplitudes.

ACADEMIC POSITIONS **University of California, Davis, USA, Professor** 2022–
University of California, Davis, USA, Associate Professor 2019–2022
University of California, Davis, USA, Assistant Professor 2015–2019
California Institute of Technology, Pasadena, USA, Prize Postdoctoral Fellow 2013–2015

EDUCATION **Princeton University, Princeton, USA, PhD in Physics** 2013
Charles University, Prague, Czech Republic, MS in Theoretical Physics 2008
Charles University, Prague, Czech Republic, Bc in Physics 2006

HONORS & AWARDS **Chancellor's Fellow, UC Davis** 2021
Distinguished Teaching Award, UC Davis 2021
Henry Primakoff Award in Particle Physics, American Physical Society (APS) 2020
Undergraduate Teaching Award, College of Letters and Science, UC Davis 2020
Particle Physics Prize, International Union of Pure and Applied Physics (IUPAP) 2018
UC Davis Award for Creativity and Innovation, UC Davis 2018
Prize Postdoctoral Award, Caltech 2013
Vaclav Votruba Award, for best PhD thesis in theoretical physics 2013
Milan Odehnal Prize, Czech Physical Society 2012
Joseph Henry Prize, Princeton University 2008
Fulbright Science and Technology Award, Department of State 2008
McKinsey Award, Czech Republic 2008
GAUK, Student research grant, Czech Republic 2007
Praemium Bohemiae Prize, for representation of the Czech Republic at the IPhO 2003
Honorary Sheet, Minister of Education of the Czech Republic 2003

PUBLICATIONS & PREPRINTS *Total: 47 papers, 4600+ citations, h-index 33 (Google Scholar)*

- 47. Positive Geometry of Scattering Amplitudes**
arxiv:2203.13018. Chapter 7 of the SAGEX review on scattering amplitudes (with E. Herrmann)
- 46. Integrands of Less-Supersymmetric Yang-Mills at One Loop**
JHEP **03**, 126 (2022). (with J. Bourjaily, E. Herrmann, C. Langer, K. Patatoukos, M. Zheng)
- 45. Nonperturbative Negative Geometries: Amplitudes at Strong Coupling**
JHEP **03**, 108 (2022). (with N. Arkani-Hamed, J. Henn)
- 44. Multi-spin soft bootstrap and scalar-vector Galileon**
JHEP **07**, 153 (2021). (with K. Kampf, J. Novotny, F. Preucil)
- 43. Towards the Gravituhedron: New Expressions for NMHV Gravity Amplitudes**
JHEP **04**, 253 (2021)
- 42. Positive geometry, local triangulations, and the dual of the Amplituhedron**
JHEP **01**, 035 (2021). (with E. Herrmann, C. Langer, M. Zheng)
- 41. Building Bases of Loop Integrands**
JHEP **11**, 116 (2020). (with J. L. Bourjaily, E. Herrmann, C. Langer)
- 40. Positive Geometries for One-Loop Chiral Octagons**

arxiv:2007.12191. (with E. Herrmann, C. Langer, M. Zheng)

39. All-Multiplicity Non-Planar MHV Amplitudes in sYM at Two Loops

Phys. Rev. Lett. **124**, no. 11, 111603 (2020). (with J. Bourjaily, E. Herrmann, C. Langer, A. McLeod)

38. New Soft Theorems for Goldstone Boson Amplitudes

Phys. Rev. Lett. **124**, no. 11, 111601 (2020). (with K. Kampf, J. Novotny, M. Shifman)

37. Gravity loop integrands from the ultraviolet

SciPost Phys. **10** (2021) 016. (with A. Edison, E. Herrmann, J. Parra-Martinez)

36. Prescriptive Unitarity for Non-Planar Six-Particle Amplitudes at Two Loops

JHEP **1912**, 073 (2019). (with J. L. Bourjaily, E. Herrmann, C. Langer, A. J. McLeod)

35. Maximally supersymmetric amplitudes at infinite loop momentum

Phys. Rev. D **99**, no. 6, 066006 (2019). (with J. L. Bourjaily, E. Herrmann)

34. Deep Into the Amplituhedron: Amplitude Singularities at All Loops and Legs

Phys. Rev. Lett. **122**, no. 5, 051601 (2019). (with N. Arkani-Hamed, C. Langer, A. Y. Srikant)

33. UV cancellations in gravity loop integrands

JHEP **1902**, 084 (2019). (with E. Herrmann)

32. Vector Effective Field Theories from Soft Limits

Phys. Rev. Lett. **120**, no. 26, 261602 (2018). (with Cheung, Kampf, Novotny, Shen, Wen)

31. Unwinding the Amplituhedron in Binary

JHEP **1801**, 016 (2018). (with N. Arkani-Hamed, H. Thomas)

30. Locality and Unitarity from Singularities and Gauge Invariance

Phys. Rev. Lett. **120**, no. 23, 231602 (2018). (with N. Arkani-Hamed, L. Rodina)

29. Prescriptive Unitarity

JHEP **1706**, 059 (2017). (with J. L. Bourjaily, E. Herrmann)

28. Multi-loop positivity of the planar $\mathcal{N} = 4$ SYM six-point amplitude

JHEP **1702**, 112 (2017). (with L. J. Dixon, M. von Hippel, A. J. McLeod)

27. A Periodic Table of Effective Field Theories

JHEP **1702**, 020 (2017). (with C. Cheung, K. Kampf, J. Novotny, C. H. Shen)

26. Gravity On-shell Diagrams

JHEP **1611**, 136 (2016). (with E. Herrmann)

25. Evidence for a Nonplanar Amplituhedron

JHEP **1606**, 098 (2016). (with Z. Bern, E. Herrmann, S. Litsey, J. Stankowicz)

24. On-Shell Recursion Relations for Effective Field Theories

Phys. Rev. Lett. **116**, no. 4, 041601 (2016). (with C. Cheung, K. Kampf, J. Novotny, C. H. Shen)

23. Local Integrand Representations of All Two-Loop Amplitudes in Planar SYM

JHEP **1508**, 119 (2015). (with J. L. Bourjaily)

22. Simple Recursion Relations for General Field Theories

JHEP **1506**, 118 (2015). (with C. Cheung, C. H. Shen)

21. Logarithmic Singularities and Maximally Supersymmetric Amplitudes

JHEP **1506**, 202 (2015). (with Z. Bern, E. Herrmann, S. Litsey, J. Stankowicz)

20. Positive Amplitudes In The Amplituhedron

JHEP **1508**, 030 (2015). (with N. Arkani-Hamed, A. Hodges)

19. On-Shell Structures of MHV Amplitudes Beyond the Planar Limit

JHEP **1506**, 179 (2015). (with N. Arkani-Hamed, J. L. Bourjaily, F. Cachazo, A. Postnikov)

18. Effective Field Theories from Soft Limits of Scattering Amplitudes

Phys. Rev. Lett. **114**, no. 22, 221602 (2015). (with C. Cheung, K. Kampf, J. Novotny)

17. Anatomy of the Amplituhedron

JHEP **1503**, 128 (2015). (with S. Franco, D. Galloni, A. Mariotti)

16. Dual-Conformal Regularization of Infrared Loop Divergences

JHEP **1501**, 001 (2015). (with J. L. Bourjaily, S. Caron-Huot)

- 15. Singularity Structure of Maximally Supersymmetric Scattering Amplitudes**
Phys. Rev. Lett. **113**, no. 26, 261603 (2014). (with N. Arkani-Hamed, J. L. Bourjaily, F. Cachazo)
- 14. Into the Amplituhedron**
JHEP **1412**, 182 (2014). (with N. Arkani-Hamed)
- 13. The Amplituhedron**
JHEP **1410**, 030 (2014) (with N. Arkani-Hamed)
- 12. Tree-level Amplitudes in the Nonlinear Sigma Model**
JHEP **1305**, 032 (2013). (with K. Kampf, J. Novotny)
- 11. Recursion relations for tree-level amplitudes in the $SU(N)$ nonlinear sigma model**
Phys. Rev. D **87**, no. 8, 081701 (2013). (with K. Kampf, J. Novotny)
- 10. A Note on Polytopes for Scattering Amplitudes**
JHEP **1204**, 081 (2012). (with N. Arkani-Hamed, J. L. Bourjaily, F. Cachazo, A. Hodges)
- 9. Local Integrals for Planar Scattering Amplitudes**
JHEP **1206**, 125 (2012). (with N. Arkani-Hamed, J. L. Bourjaily, F. Cachazo)
- 8. New differential equations for on-shell loop integral**
JHEP **1104**, 083 (2011). (with J. M. Drummond, J. M. Henn)
- 7. The All-Loop Integrand For Scattering Amplitudes in Planar N=4 SYM**
JHEP **1101**, 041 (2011). (with N. Arkani-Hamed, J. L. Bourjaily, F. Cachazo, S. Caron-Huot)
- 6. The Grassmannian and the Twistor String: Connecting All Trees in N=4 SYM**
JHEP **1101**, 038 (2011). (with J. L. Bourjaily, A. Volovich and C. Wen)
- 5. Unification of Residues and Grassmannian Dualities**
JHEP **1101**, 049 (2011). (with N. Arkani-Hamed, J. Bourjaily, F. Cachazo)
- 4. Local Spacetime Physics from the Grassmannian**
JHEP **1101**, 108 (2011). (with N. Arkani-Hamed, J. Bourjaily, F. Cachazo)
- 3. Renormalization and additional degrees of freedom within the chiral effective theory**
Phys. Rev. D **81**, 116004 (2010). (with K. Kampf, J. Novotny)
- 2. High energy constraints in the octet SS-PP correlator and resonance saturation**
Phys. Rev. D **81**, 056005 (2010). (with J. J. Sanz-Cillero)
- 1. On different lagrangian formalisms for vector resonances within ChPT**
Eur. Phys. J. C **50**, 385 (2007). (with K. Kampf, J. Novotny)

BOOKS

Grassmannian Geometry of Scattering Amplitudes, Cambridge University Press (2016)
(with N. Arkani-Hamed, J. L. Bourjaily, F. Cachazo, A. Goncharov, A. Postnikov)

MENTORING

Taro Brown , PhD student, UC Davis	exp 2025
Umut Oktem , PhD student, UC Davis	exp 2025
Minshan Zheng , PhD student, UC Davis	exp 2022
Cameron Langer , PhD student, UC Davis (then postdoc at Penn State)	PhD 2020
Enrico Herrmann , PhD student, Caltech (then postdoc at SLAC, then UCLA)	PhD 2017

INVITED TALKS

Total: 50+ invited talks at conferences and workshops, 40+ invited seminars and colloquia.

Integrability in Gauge and String Theory , Budapest, Hungary	July 2022
Strings 2022 , Vienna, Austria	July 2022
Invited seminar , Paris Rencontres Theoriciennes seminar series, France (virtual)	May 2022
Invited seminar , Harvard University, Cambridge, MA	Apr 2022
Recent Developments in Scattering Amplitudes , CUNY, NY (virtual)	Nov 2021
Twistor Theory and Beyond , Cambridge, UK (virtual)	Sep 2021
Amplitudes 2021 , Copenhagen, Denmark (virtual)	Aug 2021

Positive Geometries of Scattering Amplitudes , Mainz, Germany (virtual)	Jun 2021
Invited seminar , Max Planck Institute, Munich (virtual)	Jun 2021
APS April meeting (plenary talk, virtual)	Apr 2021
California Amplitudes Meeting (virtual)	Apr 2021
APS Annual Leadership Meeting (virtual)	Jan 2021
Invited colloquium , Sacramento State University, CA (virtual)	Oct 2020
Invited colloquium , University of California, Davis, CA (virtual)	Oct 2020
ICHEP 2020 (panel discussion), Prague, Czech Republic (virtual)	Jul 2020
Invited seminar , UCLA, Los Angeles, CA (virtual).	Apr 2020
Invited seminar , Caltech, Pasadena, CA (virtual).	Apr 2020
QCD meets gravity IV , University of California, Los Angeles, CA	Dec 2019
Invited seminar , IPMU, Tokyo, Japan.	Dec 2019
String theory workshop , KEK, Japan	Dec 2019
Invited seminar , at Brown University, Providence, MA	Nov 2019
From Scattering to Expansion , Northwestern, Chicago, IL	Oct 2019
Quantum Mechanics and Spacetime , CMSA, Harvard University, MA	Oct 2019
Invited seminar , SLAC, Menlo Park, CA	Sep 2019
Invited seminar , Czech Academy of Sciences, Prague, Czech Republic	Aug 2019
Invited seminar , Humboldt University, Berlin, Germany	Aug 2019
Invited seminar , Max-Planck Institute, Munich, Germany	Jul 2019
Invited seminar , Niels Bohr Institute, Copenhagen, Denmark	Jul 2019
Integrable Systems and Quantum Symmetries , Prague, Czech Republic	Jul 2019
Lie Groups and Their Applications in Physics Varna, Bulgaria	Jun 2019
Invited seminar , University of Michigan, Ann Arbor, MI	May 2019
Invited seminar , Lund University, Sweden	Dec 2018
Invited seminar , University of Minnesota, Minneapolis, MN	Nov 2018
Amplitudes at LHC , Galileo Galilei Institute, Florence, Italy	Oct 2018
Supergravity and Superstring Theory , Penn State, State College, PA	Sep 2018
Current Themes in High Energy Physics , Niels Bohr Institute, Denmark	Aug 2018
Invited seminar , Humboldt University, Berlin, Germany	Jul 2018
Group Theoretical Methods in Physics , Prague, Czech Republic	Jul 2018
ICHEP 2018 (plenary talk), Seoul, Korea	Jul 2018
Cluster Algebras and Mathematical Physics , Michigan State, East Lansing, MI	May 2018
California Amplitudes Meeting , SLAC, Menlo Park, USA	Apr 2018
Invited seminar , Texas A&M, College Station, TX	Apr 2018
Invited seminar , Charles University, Prague, Czech Republic	Dec 2017
Bay Area Particle Theory Meeting , San Francisco, CA	Oct 2017
Mathematics and Physics of Scattering Amplitudes , Munich, Germany	Aug 2017
Invited seminar , University of Oregon, Eugene, OR	Apr 2017
Invited seminar , University of California, Irvine, CA	Apr 2017
Invited colloquium , San Francisco State University, CA	Apr 2017
Invited seminar , SLAC, Menlo Park, CA	Jan 2017
Invited seminar , University of Mainz, Germany	Nov 2016
Amplitudes in Asia , Beijing, China	Oct 2016
New Formulations for Scattering Amplitudes , Munich, Germany	Sep 2016
IGST 2016 Focus program , Berlin, Germany	Aug 2016
Electroweak matter 2016 , University of Stavanger, Norway	Jul 2016
Amplitudes 2016 , Nordita, Stockholm, Sweden	Jul 2016
Twistors, Gravity and Amplitudes , Newton Institute, Cambridge, UK	Jun 2016
Invited seminar , University of Chicago, IL	May 2016
Invited seminar , California Institute of Technology, Pasadena, CA	May 2016

Invited seminar, Perimeter Institute, Waterloo, Canada	May 2016
QCD meets gravity, Edinburgh, UK	Apr 2016
MHV at 30, Fermilab, Chicago, IL	Mar 2016
Emergent Themes in String Theory, University of Michigan, Ann Arbor, MI	Mar 2016
Invited seminar, University of California, Berkeley, CA	Mar 2016
Invited seminar, National Taiwan University, Taipei, Taiwan	Jan 2016
Invited seminar, City College of New York, NY	Sep 2015
Hidden Symmetries and Integrability Methods, CRM Montreal, Canada	Aug 2015
Positive Grassmannians, CRM Montreal, Canada	Jul 2015
Invited seminar, LMU Munich, Germany	Jun 2015
Radcor 2015, University of California, Los Angeles, CA	Jun 2015
Gravity: From UV to IR, University of California, Santa Barbara, CA	May 2015
String, Branes and Holography, Texas A&M, TX	Apr 2015
Eurostrings 2015, Cambridge, UK	Mar 2015
Invited seminar, Charles University, Prague, Czech Republic	Mar 2015
Invited seminar, University of California, Los Angeles, CA	Mar 2015
Invited seminar, University of California, Davis, CA	Mar 2015
Invited seminar, Arizona State University, Phoenix, AZ	Dec 2014
IAS Focused Program on Scattering Amplitudes, Hong Kong	Nov 2014
Geometry of Scattering Amplitudes, Oxford, UK	Sep 2014
Strings 2014, Princeton, NJ	Jun 2014
Invited seminar, University of Texas, Austin, TX	May 2014
Invited seminar, Stanford University, Stanford, CA	May 2014
Invited seminar, University of Michigan, Ann Arbor, MI	Mar 2014
Invited seminar, Brown University, Providence, RI	Mar 2014
Invited seminar, Harvard University, Cambridge, MA	Mar 2014
Invited seminar, University of California, Berkeley, CA	Feb 2014
Invited seminar, University of California, Los Angeles, CA	Feb 2014
Invited seminar, Czech Technical University, Prague, Czech Republic	Jan 2014
Geometry of Scattering Amplitudes, Stony Brook, NY	Dec 2013
Invited seminar, Humboldt University, Berlin, Germany	Oct 2013
Physics and Mathematics of Scattering Amplitudes, Stony Brook, NY	Oct 2013
Integrability in Gauge and String Theory 2013, Utrecht, Netherlands	Aug 2013
Amplitudes, Strings and Branes, CERN, Geneva, Switzerland	Jul 2013
Polylogarithms: Number Theory and Particle Physics, Durham, UK	Jul 2013
Amplitudes 2013, Schloss Ringelberg, Germany	Apr 2013
Amplitudes and Periods, IHES, Paris, France	Dec 2012
Invited seminar, Czech Academy of Sciences, Prague, Czech Republic	Nov 2012
Invited seminar, Princeton University	Oct 2012
Geometry of Scattering Amplitudes, Banff, Canada	Aug 2012
Scattering Amplitudes: from QCD to Super Yang-Mills, Trento, Italy	Jul 2012
Amplitudes 2012, Munich, Germany	Mar 2012
Invited seminar, Charles University, Prague, Czech Republic	Dec 2011
Amplitudes 2011, University of Michigan, Ann Arbor, MI	Nov 2011
Exact results in Gauge/Gravity dualities, Perimeter Institute, Waterloo, Canada	Sep 2011
Invited seminar, Humboldt University, Berlin, Germany	Jan 2011
Invited seminar, Albert Einstein Institute, Potsdam, Germany	Jan 2011
Quarks 2010, Kolomna, Russia	Jun 2010
Effective Field Theories: from pion to upsilon, Valencia, Spain	Feb 2009
14th International QCD Conference, Montpellier, France	Jul 2008
EuroFlavor 07, Orsay, France	Nov 2007

	Hadron Structure , Modra, Slovakia	Sep 2007
LECTURING AT SUMMER SCHOOLS	Amplitudes 2022 Summer School , Prague, Czech Republic.	Aug 2022
	Cluster Algebras School , ICTS, Bangalore, India.	Dec 2018
	Qspace training school , Benasque, Spain.	Sep 2018
	Amplitudes 2017 Summer School , Edinburgh, UK.	Jul 2017
	Summer School on Particle Physics , ICTP, Trieste, Italy	Apr 2017
	School on Amplitudes in Beijing , Beijing, China	Nov 2016
	Asian Winter School , Okinawa, Japan	Jan 2016
	Winter School on Geometry and Physics , Srni, Czech Republic	Jan 2014
ORGANIZATION: CONFERENCES AND WORKSHOPS	<i>Organizer of 23 conferences, workshops and scientific programs.</i>	
	Conference Amplitudes 2022 , Prague, Czech Republic	Aug 2022
	Conference ICHEP 2022 (session convener), Bologna, Italy	Jul 2022
	Program Novel Developments in Scattering Amplitudes , Munich, Germany	Jul 2022
	Workshop Geomplitudes III , UC Davis (virtual)	Jun 2021
	Workshop Geomplitudes II , UC Davis (virtual)	Feb 2021
	Workshop Geomplitudes I , UC Davis (virtual)	Sep 2020
	KITP reunion: Scattering Amplitudes and Beyond , KITP, CA (virtual)	Aug 2020
	Conference ICHEP 2020 (session convener), Prague Czech Republic (virtual)	Jul 2020
	Conference Amplitudes 2020 , University of Michigan, Ann Arbor, MI (virtual)	May 2020
	Conference Amplitudes 2019 , Dublin, Ireland	Jul 2019
	Fourth workshop Amplitudes in California , University of California, Davis	Jun 2019
	Conference Amplitudes 2018 , SLAC, Menlo Park, CA	Jun 2018
	QMAP Amplitudes Summer School , University of California, Davis	Jun 2018
	Workshop QCD meets gravity , University of California, Los Angeles	Dec 2017
	Program Scattering Amplitudes and Beyond , KITP, Santa Barbara	Apr-Jun 2017
	Program Amplitudes, Motives and Beyond , Mainz, Germany	Feb 2017
	Conference Recent Developments in Fields, String, Gravity , UC Davis	Dec 2016
	Workshop QCD meets gravity , University of California, Los Angeles	Dec 2016
	Second workshop Amplitudes in California , University of California, Los Angeles	Oct 2016
	First workshop Amplitudes in California , University of California, Davis	Jun 2016
	Workshop Amplitudes in Asia , Taipei, Taiwan	Nov 2015
	Program From Scattering Amplitudes to Conformal Bootstrap , Aspen, CO	Jul 2015
Conference Grassmannian Geometry of Scattering Amplitudes , Pasadena, CA	Dec 2014	
Workshop Amplitudes at Caltech , Pasadena, CA	Feb 2014	
GRANTS	Collaborative Interdisciplinary Research Grant , UC Davis, \$25,000	2021–2022
	DOE Grant Award , Department of Energy, \$731,000 (with two colleagues)	2020–2023
	NSF Award , conference organization, \$5,000	2018
	DOE Grant Award , Department of Energy, \$857,000 (with two colleagues)	2017–2020
PROFESSIONAL ACTIVITIES	Topical group convener for the 2022 Snowmass process (TF04 scattering amplitude)	
	Panelist : Department of Energy Comparative Reviews.	
	Reviewer : European Research Council (ERC), National Science Foundation (NSF), STFC Particle Physics Grant Panel, Department of Energy (DOE), Swiss National Science Foundation.	
	Referee : Journal of High Energy Physics, Physical Review D, Physical Review Letters, Nuclear Physics B, Journal of Cosmology and Astroparticle Physics, Journal of Physics A, Physical Letters B, Classical and Quantum Gravity, Canadian Journal of Mathematics	
	Member : APS Selection Committee for Henry Primakoff Prize.	
	Editor : Special issue of Advances in High Energy Physics on Scattering Amplitudes.	
	Outreach : invited talks at undergraduate students physics clubs (UC Davis, Stony Brook).	

TEACHING

University of California, Davis

Instructor, PHY 105B Classical Mechanics II	Spring 2022
Instructor, PHY 9B Classical Physics	Fall 2021
Instructor, PHY 232 Topics in String theory (virtual)	Winter 2021
Instructor, PHY 9B Classical Physics (virtual)	Fall 2020
Instructor, PHY 232 Topics in String theory (virtual)	Spring 2020
Instructor, PHY 9B Classical Physics	Winter 2020
Instructor, PHY 250 Topic course on string amplitudes	Spring 2019
Instructor, PHY 9B Classical Physics	Winter 2019
Instructor, PHY 250 Topic course on superstrings	Spring 2018
Instructor, PHY 9B Classical Physics	Winter 2018
Instructor, PHY 250 Topic course on bosonic strings	Winter 2017
Instructor, PHY 9B Classical Physics	Winter 2017
Instructor, PHY 250 Topic course on scattering amplitudes	Winter 2016

CAMPUS
SERVICE

Department Representative , College of Letters and Science Assembly	2021 –
Member , Campus Judicial Board	2021 –
Chair , College of Letters and Science Teaching Awards committee	2020 –
Member , Graduate Council - Courses Subcommittee	2020 –
Reviewer , Graduate Students Teaching Awards	2020