

# Curriculum Vitae

## Jaroslav Trnka

Office Address: Center for Quantum Mathematics and Physics (QMAP)  
Department of Physics  
University of California, Davis, 95616, CA  
Phone: (609) 865-6198, Email: trnka@ucdavis.edu

### Academic positions

- since 2015 **University of California**, Davis, California, USA.  
Assistant Professor in Physics  
Founding Member of Center for Quantum Mathematics and Physics (QMAP)
- 2013 - 2015 **California Institute of Technology**, Pasadena, California, USA.  
David and Ellen Lee Postdoctoral Fellow

### Education

- 2008 - 2013 **Princeton University**, Princeton, New Jersey, USA.  
Ph.D in Physics, *Advisor: Nima Arkani-Hamed (IAS)*, award date 09/21/2013
- 2006 - 2008 **Charles University in Prague**, Czech Republic, M.S. in Theoretical Physics
- 2003 - 2006 **Charles University in Prague**, Czech Republic, B.S. in Physics

### Academic Honors and Awards

- 2018 **Young Scientist Prize** in Particles and Fields, International Union of Pure and Applied Physics (IUPAP)
- 2018 **UC Davis Award for Creativity and Innovation**, UC Davis.
- 2017 **DOE Grant Award**, no.de-sc0009999.
- 2013 **Prize Postdoctoral Award**, Caltech
- 2013 **Vaclav Votruba award** for best PhD thesis in theoretical physics
- 2012 **Milan Odehnal prize**, Czech Physical Society
- 2008 **Joseph Henry Prize**, Princeton University
- 2008 **Fulbright Science and Technology Award**, U.S. Department of State,  
*U.S. government award for international students*
- 2008 **McKinsey Award**
- 2007 **GAUK**, *Research grant for young students of Charles University in Prague*
- 2003 **Praemium Bohemiae Prize**
- 2003 **Honorary Sheet of Minister of Education of the Czech Republic**,  
*For representation of the Czech Republic at the International Physics Olympiad*

# List of Publications

(Authors ordered alphabetically)

1. C. Cheung, K. Kampf, J. Novotny, H. Shen, J. Trnka, C. Wen, *Vector Effective Field Theories from Soft Limits*, arxiv: 1801.01496.
2. J. Bourjaily, E. Herrmann, J. Trnka, *Prescriptive Unitarity*, **JHEP** **1706** (2017) **059**.
3. N. Arkani-Hamed, H. Thomas, J. Trnka, *Unwinding the Amplituhedron in Binary*, **JHEP** **1801** (2018) **016**.
4. N. Arkani-Hamed, L. Rodina, J. Trnka, *Locality and Unitarity from Singularities and Gauge Invariance*, arxiv: 1612.02797.
5. L. Dixon, M. von Hippel, A. McLeod, J. Trnka, *Multi-Loop Positivity of the Planar  $N=4$  SYM Six-Point Amplitudes*, **JHEP** **1702** (2017) **112**.
6. C. Cheung, K. Kampf, J. Novotny, H. Shen, J. Trnka, *A Periodic Table for Effective Field Theories*, **JHEP** **1702** (2017) **020**.
7. E. Herrmann, J. Trnka, *Gravity on-shell diagrams*, **JHEP** **1611** (2016) **136**.
8. Z. Bern, E. Herrmann, S. Litsey, J. Stankowicz, J. Trnka, *Evidence for a Nonplanar Amplituhedron*, **JHEP** **1606** (2016) **098**.
9. C. Cheung, K. Kampf, J. Novotny, H. Shen, J. Trnka, *On-Shell Recursion Relations for Effective Field Theories*, **Phys.Rev.Lett.** **116** (2016) **4**, **041601**.
10. J. Bourjaily, J. Trnka, *Local Integrand Representations of All Two-Loop Amplitudes in Planar SYM*, **JHEP** **1508** (2015) **119**.
11. C. Cheung, H. Shen, J. Trnka, *Simple Recursion Relations for General Field Theories*, **JHEP** **1506** (2015) **118**.
12. Z. Bern, E. Herrmann, S. Litsey, J. Stankowicz, J. Trnka, *Logarithmic Singularities and Maximally Supersymmetric Amplitudes*, **JHEP** **1506** (2015) **202**.
13. N. Arkani-Hamed, A. Hodges, J. Trnka, *Positive Amplitudes In The Amplituhedron*, **JHEP** **1508** (2015) **030**.
14. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, A. Postnikov, J. Trnka, *On-Shell Structures of MHV Amplitudes Beyond the Planar Limit*, **JHEP** **1506** (2015) **179**.
15. C. Cheung, K. Kampf, J. Novotny, J. Trnka, *Effective Field Theories from Soft Limits*, **Phys.Rev.Lett.** **114** (2015) **22**, **221602**
16. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, J. Trnka, *On the Singularity Structure of Maximally Supersymmetric Scattering Amplitudes*, **Phys.Rev.Lett.** **113** (2014) **26**, **261603**
17. S. Franco, D. Galloni, A. Mariotti, J. Trnka, *Anatomy of the Amplituhedron*, **JHEP** **1503** (2015) **128**
18. N. Arkani-Hamed, J. Trnka, *Into the Amplituhedron*, **JHEP** **1412** (2014) **182**
19. N. Arkani-Hamed, J. Trnka, *The Amplituhedron*, **JHEP** **1410** (2014) **030**
20. K. Kampf, J. Novotny, J. Trnka, *Tree-level Amplitudes in the Nonlinear Sigma Model*, **JHEP** **1305** (2013) **032**
21. J. Bourjaily, S. Caron-Huot, J. Trnka, *Infrared singularities and all one-loop amplitudes in  $N=4$  SYM*, **JHEP** **1501** (2015) **001**

22. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, A. Goncharov, A. Postnikov, J. Trnka, *Scattering Amplitudes and The Positive Grassmannian*, arxiv: 1212.5605, modified and published in *Cambridge University Press*, (2016).
23. K. Kampf, J. Novotny, J. Trnka, *Recursion Relations for Tree-level Amplitudes in the  $SU(N)$  Non-linear Sigma Model*, **Phys. Rev. D** **87** (2013)
24. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, J. Trnka, *Local Integrals for Planar Scattering Amplitudes*, **JHEP** **1206** (2012) **125**
25. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, A. Hodges, J. Trnka, *A Note on Polytopes for Scattering Amplitudes*, **JHEP** **1204** (2012) **081**
26. J. Drummond, J. Henn, J. Trnka, *New differential equations for on-shell loop integrals*, **JHEP** **1104** (2011) **083**
27. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, S. Caron-Huot, J. Trnka, *The All-loop Integrand For Scattering Amplitudes in Planar  $N=4$  SYM*, **JHEP** **1101** (2011) **041**
28. J. Bourjaily, J. Trnka, A. Volovich, C. Wen, *The Grassmannian and the Twistor String: Connecting All Trees in  $N=4$  SYM*, **JHEP** **1101** (2011) **038**
29. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, J. Trnka, *Unification of Residues and Grassmannian Dualities*, **JHEP** **1101** (2011) **049**
30. N. Arkani-Hamed, J. Bourjaily, F. Cachazo, J. Trnka, *Local Spacetime Physics from the Grassmannian*, **JHEP** **1101** (2011) **108**
31. K. Kampf, J. Novotny, J. Trnka, *Renormalization and additional degrees of freedom within the chiral effective theory for spin-1 resonances*, **Phys.Rev. D** **81** (2010) **116004**
32. J. J. Sanz-Cillero, J. Trnka, *High energy constraints in the octet  $SS$ - $PP$  correlator and resonance saturation at  $NLO$  in  $1/N(c)$* , **Phys.Rev. D** **81** (2010) **056005**
33. K. Kampf, J. Novotny, J. Trnka, *On different Lagrangian formalisms for vector resonances within chiral perturbation theory*, **Eur.Phys.J. C** **50** (2007) **385-403**

## Books and reviews

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

## Review articles of my research

1. New Scientist: *The hidden connections behind quantum weirdness*, Apr 5, 2017.
2. Discover magazine, The Top 10 Science Stories of 2013: *Amplituhedron Shapes the Future of Physics*.
3. E. Reich, Rethinking Particle Dynamics, *Nature*, **502**, 2013, 19.
4. R. Highfield, Physics Won't be the Same Again, *The Telegraph*, 8 October 2013.
5. N. Wolchover, A Jewel at the Heart of Quantum Physics, *Quanta Magazine*, 2013.
6. A. Hodges, Particle Physics: Theory with a Twistor, *Nature Physics*, **9**, 2013, 205-206.
7. N. Turok, Particle Physics: Beyond Feynman's Diagrams, *Nature*, **469**, 2011, 165-166.

## Conferences and Invited Talks

- 06/2018 **Amplitudes 2018**, SLAC, USA, (*organizer*).
- 06/2018 **QMAP Amplitudes Summer School**, UC Davis, USA, (*organizer*).
- 05/2018 **Cluster algebras and mathematical physics**, Michigan State, USA  
Presented: *Non-planar On-shell Diagrams*.
- 04/2017 **California Amplitudes Meeting**, SLAC, USA  
Presented: *New formula for gravity scattering amplitude*.
- 04/2018 **Invited seminar** at Texas AM.
- 12/2017 **Invited seminar** at Charles University in Prague, Czech Republic.
- 12/2017 **QCD meets gravity**, UCLA, CA, (*organizer*).
- 10/2017 **Invited seminar** at Bay Area Particle Theory Meeting, San Francisco, CA.
- 08/2017 **Mathematics and Physics of Scattering Amplitudes**, Munich, Germany  
Presented: *Prescriptive Unitarity*.
- 07/2017 **Amplitudes 2017**, Edinburgh, UK, (*lecturer at the summer school*).
- 05/2017 **ICTP summer school on particle physics**, Trieste, Italy, (*lecturer*).
- 04-06/2017 **KITP program on scattering amplitudes**, UC Santa Barbara, CA, (*organizer*).
- 04/2017 **Invited seminar** at University of Oregon, Eugene, OR.
- 04/2017 **Invited seminar** at UC Irvine, CA.
- 04/2017 **Invited colloquium** at San Francisco State University, CA.
- 02/2017 **Amplitudes: Practical and Theoretical developments**, University of Mainz, Germany, (*organizer*).
- 01/2017 **Invited seminar** at SLAC, CA.
- 12/2016 **Recent Developments in Fields, Strings and Gravity** at UC Davis, CA, (*organizer*).
- 12/2016 **QCD meets gravity** at UCLA, CA, (*organizer*).
- 11/2016 **Invited seminar** at University of Mainz, Germany.
- 10/2016 **Amplitudes in Asia**, Beijing, China,  
Presented: *Geometry of Non-planar Amplitudes*.
- 10/2016 **Amplitudes in California** at UCLA, CA, (*organizer*).
- 09/2016 **New formulations for scattering amplitudes**, Munich, Germany,  
Presented: *Evidence for Non-planar Amplituhedron*.
- 08/2016 **IGST 2016 Focus program**, Berlin, Germany,  
Presented: *Triangulations of Amplituhedron*.
- 07/2016 **Electroweak matter 2016**, University of Stavanger, Norway,  
Presented: *Geometric picture for scattering amplitudes*.
- 07/2016 **Amplitudes 2016**, Nordita, Stockholm, Sweden,  
Presented: *Singularity structure of gravity amplitudes*.
- 06/2016 **Twistors, Gravity and Amplitudes**, Newton Institute, Cambridge, UK,  
Presented: *Singularity structure of gravity amplitudes*.
- 06/2016 **Amplitudes in California** at UC Davis, CA, (*organizer*).
- 05/2016 **Invited seminar** at University of Chicago, IL.
- 05/2016 **Invited seminar** at Caltech non-commutative, and high-energy theory seminars, Pasadena, CA.
- 05/2016 **Invited seminar** at Perimeter Institute, Waterloo, Canada.

- 04/2016 **QCD meets gravity**, Edinburgh, UK,  
Presented: *On-shell diagrams: From Yang-Mills to gravity.*
- 03/2016 **MHV at 30**, Fermilab, Chicago, IL,  
Presented: *Geometry of non-planar amplitudes.*
- 03/2016 **Emergent Themes in String Theory**, University of Michigan, Ann Arbor, MI,  
Presented: *Geometric picture for scattering amplitudes.*
- 03/2016 **Invited seminar** at University of California, Berkeley.
- 01/2016 **Invited seminar** at National Taiwan University, Taipei, Taiwan.
- 09/2015 **Invited seminar** at CCNY, New York, NY.
- 07/2015 **Hidden symmetries and integrability methods**, CRM Montreal, Canada.  
Presented: *Hidden properties of non-planar amplitudes in  $N=4$  SYM.*
- 07/2015 **Positive Grassmannians**, CRM Montreal, Canada.  
Presented: *Positivity of scattering amplitudes from Amplituhedron.*
- 07/2015 **From Scattering Amplitudes to Conformal Bootstrap**, Aspen, CO, (*organizer*).
- 06/2015 **Invited seminar** at Ludwig Maximilian University, Munich, Germany.
- 06/2015 **Radcor 2015**, UCLA, Los Angeles, CA  
Presented: *Singularity structure of maximally supersymmetric scattering amplitudes.*
- 05/2015 **Gravity: From UV to IR**, KITP, Santa Barbara, CA.
- 04/2015 **String, Branes and Holography**, Texas A&M, TX  
Presented: *Scattering Inequalities.*
- 03/2015 **Eurostrings 2015**, Cambridge, UK  
Presented: *Scattering Inequalities.*
- 03/2015 **Invited seminar** at Charles University in Prague, Czech Republic.
- 03/2015 **Invited seminar** at UCLA, Los Angeles, CA.
- 03/2015 **Invited seminar** at UC Davis, Davis, CA.
- 12/2014 **Grassmannian Geometry of Scattering Amplitudes**, Caltech, Pasadena, CA, (*organizer*).
- 12/2014 **Invited seminar** at Arizona State University, Phoenix, AZ.
- 11/2014 **Scattering Amplitudes in Hong Kong**, Hong Kong.  
Presented: *On the Singularity Structure of Maximally Supersymmetric Scattering Amplitudes.*
- 09/2014 **Geometry of Scattering Amplitudes**, Oxford, UK.  
Presented: *New structures in non-planar Yang-Mills amplitudes.*
- 06/2014 **Strings 2014**, Princeton, NJ.  
Presented: *Four point scattering from Amplituhedron.*
- 06/2014 **Amplitudes 2014**, Paris, France.
- 05/2014 **Invited seminar** at University of Texas at Austin, Austin, TX.
- 05/2014 **Invited seminar** at Stanford University, Stanford, CA.
- 03/2014 **Invited seminar** at University of Michigan, Ann Arbor, MI.
- 03/2014 **Invited seminar** at Brown University, Providence, RI.
- 03/2014 **Invited seminar** at Harvard University, Cambridge, MA.
- 02/2014 **Invited seminar** at UC Berkeley (two seminars), Berkeley, CA.
- 02/2014 **Invited seminar** at UCLA high energy seminar, Los Angeles, CA.
- 02/2014 **Amplitudes at Caltech** at Caltech, CA, (*organizer*).

- 01/2014 **Invited seminar** at Czech Technical University, Prague.
- 12/2013 **Geometry of scattering amplitudes**, Stony Brook, NY.  
Presented: *The Amplituhedron*.
- 10/2013 **Invited seminar** at Humboldt University, Berlin, Germany.
- 10/2013 **Physics and Mathematics of Scattering Amplitudes**, Stony Brook, NY.  
Presented: *Four point amplitudes from positivity*.
- 08/2013 **Integrability in Gauge and String Theory 2013**, Utrecht, Netherlands.  
Presented: *The Amplituhedron*.
- 07/2013 **Amplitudes, Strings and Branes**, CERN, Geneva, Switzerland.  
Presented: *Amplitudes from Positive Geometry*.
- 07/2013 **Polylogarithms as a Bridge between Number Theory and Particle Physics**, Durham, UK.  
Presented: *Locality and Unitarity from Positivity*.
- 04/2013 **Amplitudes 2013**, Schloss Ringelberg, Germany.  
Presented: *Locality and Unitarity from Positivity*.
- 12/2012 **Amplitudes and Periods**, IHES, Paris, France.  
Presented: *Scattering Amplitudes and the Positive Grassmannian*.
- 11/2012 **Invited seminar** at Institute of Physics, Academy of Science, Prague, Czech Republic.
- 10/2012 **Invited seminar** at Department of Physics, Princeton University.
- 08/2012 **Geometry of Scattering Amplitudes**, Banff, Canada.  
Presented *Non-planar leading singularities*.
- 07/2012 **Scattering Amplitudes**: from QCD to maximally supersymmetric Yang-Mills, Trento, Italy.  
Presented *Scattering Amplitudes and Positive Grassmannian*.
- 07/2012 **String 2012**, Munich, Germany.
- 03/2012 **Amplitudes 2012**, DESY, Hamburg.  
Presented *Non-planar leading singularities in  $N=4$  SYM*.
- 12/2011 **Invited seminar** at Charles University in Prague.
- 11/2011 **Amplitudes 2011**, University of Michigan, Ann Arbor.  
Presented *Scattering amplitudes as volumes of local polytopes*.
- 09/2011 **Exact results in Gauge/Gravity dualities**, Perimeter Institute, Canada.  
Presented *Scattering amplitudes as volumes of polytopes*.
- 01/2011 **Invited seminar** at Humboldt University, Berlin, Germany.
- 01/2011 **Invited seminar** at Albert Einstein Institute, Potsdam, Germany.
- 06/2010 **Cargese summer school**, Corsica, France.
- 06/2010 **Quarks 2010**, Kolomna, Russia.  
Presented *Grassmannians and  $N=4$ : Dual Theory for the S-matrix*.
- 05/2010 **Amplitudes 2010**, London, England.
- 03/2010 **XI Hadron Physics**, Maresias, Brazil.  
Presented poster *Resonance Chiral Theory and high energy constraints at NLO in  $1/N_c$* .
- 08/2009 **Congress on Mathematical Physics**, Prague, Czech Republic.
- 07/2009 **Chiral Dynamics 09**, Bern, Switzerland.  
Presented poster *Resonance chiral theory and short distance constraints at NLO in  $1/N_c$* .
- 02/2009 **Workshop Effective field theories**, from pion to upsilon, Valencia, Spain.

- Presented *Problems with renormalization of effective field theories for spin one particles*.
- 11/2008 **Princeton research symposium**, Princeton, NJ.  
Presented poster *Effective field theories for strong interactions*.
- 07/2008 **14th International QCD Conference**, Montpellier, France.  
Presented *Renormalization of vector resonance propagators in Resonance chiral theory*.
- 01/2008 **Winter School of Geometry and Physics**, Srni, Czech Republic.
- 11/2007 **EuroFlavour 07**, Orsay, France.  
Presented *Ghosts in Resonance chiral theory*.
- 09/2007 **Hadron Structure 07**, Modra, Slovakia.  
Presented *Renormalization of vector propagators in RChT*.
- 08/2007 **10th International Conference on Differential Geometry**, Olomouc, Czech Rep.
- 06/2007 **Petrov summer school** and seminar on theoretical physics, Kazan, Russia.  
Presented *First order formalism for spin one fields*
- 05/2007 **Frascati spring school**, Frascati, Italy.  
Presented *First order formalism in Resonance chiral theory*
- 07/2006 **ZUOZ summer school**, Zuoz, Switzerland.

## Lecturing at schools

- 07/2017 **Lecturer** at Amplitudes 2017 Summer School, Edinburgh, UK.  
Lectures on: *Grassmannian Geometry of Scattering Amplitudes* (4 lectures).
- 05/2017 **Lecturer** at Summer School on Particle Physics, ICTP, Trieste, Italy.  
Lectures on: *Theory Developments on Amplitudes* (3 lectures).
- 10/2016 **Lecturer** at School Amplitudes in Beijing, China.  
Lectures on: *Geometry pictures for scattering amplitudes* (3 lectures).
- 01/2016 **Lecturer** at Asian Winter School, Okinawa, Japan.  
Lectures on: *Scattering Amplitudes* (4 lectures).
- 01/2014 **Lecturer** at Winter school in Geometry and Physics, Srni, Czech Republic.  
Lectures on: *Geometry pictures for scattering amplitudes* (3 lectures).

## Teaching experience

- 2018 Spring **Superstring theory and D-branes**, PHY250 at UC Davis.
- 2018 Winter **Physics 9B**, PHY9B at UC Davis.
- 2017 Winter **Topic course on string theory**, PHY250 at UC Davis.
- 2017 Winter **Physics 9B**, PHY9B at UC Davis.
- 2016 Winter **Topic course on scattering amplitudes**, PHY250 at UC Davis.
- 2013 Spring **General Physics II**, PHY104 at Princeton.
- 2012 Fall **Introduction to the Quantum Theory**, PHY305 at Princeton.
- 2012 Spring **Quantum Mechanics**, PHY208 at Princeton.
- 2011 Fall **Future Physics**, PHY115 at Princeton.
- 2011 Spring **Relativistic Quantum Theory II.**, PHY 510 at Princeton.

2010 Fall	<b>Quantum Mechanics</b> , PHY 505 at Princeton.
2010 Fall	<b>Electricity and Magnetism</b> , PHY 501 at Princeton.
2009 Fall	<b>General Physics</b> , PHY 103 at Princeton.
2008 Spring	<b>Electroweak Interactions II.</b> at Charles University in Prague.
2007 Fall	<b>Experiments IV</b> at Charles University in Prague.
2003-2007	Lecturer at preparation camp for International Physics Olympiad, Czech Republic.

## Organizer of conferences and workshops

- International conference *Amplitudes 2019*, Dublin, July 2019.
- International conference *Amplitudes 2018*, SLAC, June 2018.
- QMAP Amplitudes Summer School, UC Davis, June 2018.
- Workshop *QCD meets gravity*, UCLA, December 2017.
- KITP program on scattering amplitudes, Santa Barbara, April-June 2017.
- MITP program on scattering amplitudes, Mainz, February 2017.
- Conference *Recent Developments in Fields, Strings, Gravity*, UC Davis, December 2016.
- Workshop *QCD meets Gravity*, UCLA, December 2016.
- Second Workshop *Amplitudes in California*, UCLA, October 2016.
- First Workshop *Amplitudes in California*, UC Davis, June 2016.
- Workshop *Amplitudes in Asia*, Taiwan, November, 2015.
- Aspen summer program *From Scattering Amplitudes to Conformal Bootstrap*, July 2015.
- Workshop *Grassmannian Geometry of Scattering Amplitudes*, Caltech, December 2014.
- Workshop *Amplitudes at Caltech*, February 2014.

## PhD students advised

1. Cameron Langer (UC Davis), *will graduate in 2020*.
2. Enrico Herrmann (Caltech, with Mark Wise, 2017), postdoc at SLAC.
3. Chia-Hsien Shen (Caltech, with Cliff Cheung, 2017), postdoc at UCLA.

## Professional Activities

- Referee of JHEP, Physical Review D, Physical Review Letters, Nuclear Physics B.
- Reviewer for European Research Council (ERC), National Science Foundation (NSF).
- Editor for the special issue of Advances in High Energy physics on "Amplitudes in Gauge Theories and String Theories".
- Member of American Physical Society.
- 2005-2009: Member of Central committee of Physics Olympiad of the Czech Republic.
- 2005-2008: Member of Academic Senate, Charles University in Prague.