

<p><b>Personal information</b></p> <p>Surname(s) / First name(s)  Address(es)  Telephone(s)  Email(s)  Date of birth</p>	<p><b>Cooper, Patrick James</b></p> <p>1310 LaClair St, Pittsburgh, PA 15218</p> <p>+1 (929)-431-7650</p> <p>patrick.cooper8771@gmail.com</p> <p>April 30, 1987 (Pittsburgh, Pennsylvania)</p>
<p><b>Education</b></p> <p>New York University  <small>Sept 2010 - Dec 2015  New York City, USA</small></p> <p>University of Pittsburgh  <small>Sept 2005 - June 2010  Pittsburgh, Pennsylvania</small></p> <p>University of Oxford  <small>Sept 2008 - June 2009  Oxford, England</small></p>	<p><b>M.S., Ph.D.</b> in Theoretical Physics</p> <ul style="list-style-type: none"> <li>Research Topics: Effective String Theory, Supersymmetry, Integrability of p-branon scattering, Confinement and the Gribov ambiguity</li> <li>GPA - 3.911</li> </ul> <p><b>B.Sc</b> in Mathematics and Physics</p> <ul style="list-style-type: none"> <li>Completed additional honors component for degree in Physics</li> <li>Completed additional honors component for degree in Mathematics</li> <li>GPA - 3.95</li> </ul> <ul style="list-style-type: none"> <li>Studied the equivalent of Oxford's second year physics program, as well as courses in mathematics, philosophy and literature.</li> </ul>
<p><b>Research &amp; Projects</b></p> <p>University of Pittsburgh  <small>Fall 2016</small></p> <p>New York University  <small>Spring 2016-Fall 2016</small></p> <p>New York University  <small>Fall 2015</small></p> <p>New York University  <small>Fall 2015</small></p> <p>New York University  <small>September 2013 - September 2014</small></p>	<p><b>Quantum and Classical Theory Entangled</b></p> <p>Professor George Sparling and I coadvise a team of 5 advanced undergraduate mathematics students, where we're currently working on two projects: one is a numerical investigation of the Penrose limit of various spacetimes where a quantum duality emerges; the other, trying to further the work of those searching for spacetime structure within the mutual information structure of quantum mechanics.</p> <p><b>The Instantaneous Dynamics of Yang Mills Theory</b></p> <p>This article uses non-perturbative techniques (The Instantaneous Schwinger-Dyson equations) to gain insight about confinement using the Gribov-Zwanziger action in Coulomb gauge. (<i>manuscript in preparation</i>)</p> <p><b>Origin of Confining Force</b></p> <p>We show how restricting the measure of the path integral of Yang-Mills theory to the "Gribov Region" enhances the long range color-Coulomb potential, thought to be responsible for the phenomenon of confinement. (P. Cooper and D. Zwanziger, Phys. Rev. <b>D93</b>, 105024 (2016), 1512.05725)</p> <p><b>The Gribov Ambiguity at Finite Temperature</b></p> <p>This research shows the consistency of the Maggiore-Schaden shift with the temporal periodicity condition of finite-temperature field theory and suggests the connection between the Gribov mass and the magnetic mass of the spatial gluons in finite-temperature QCD. (P. Cooper and D. Zwanziger, Phys. Rev. <b>D93</b>, 105026 (2016), 1512.08858)</p> <p><b>Searching For Integrability on the Flux Tube</b></p> <p>A study of the complete landscape of integrable theories whose light degrees of freedom are Goldstone particles of spontaneously broken superspace symmetries. (P. Cooper, S. Dubovsky, V. Gorbenko, A. Mohsen, and S. Storace, JHEP <b>04</b>, 127 (2015), 1411.0703)</p>

New York University

April 2013 - September 2013

New York University

October 2012 - August 2013

### **Superluminality on the worldsheet of an effective string.**

Examination of a novel theory with macroscopically acausal but UV-complete and Lorentz Invariant scattering of p-brane excitations using the thermodynamic Bethe Ansatz. This provides a non-trivial example of a 'wrong sign', yet UV-healthy theory. (P. Cooper, S. Dubovsky, and A. Mohsen, Phys. Rev. **D89**, 084044 (2014), 1312.2021)

### **Reintroducing reparameterization invariance into effective string theories**

I prove an isomorphism between effective string theories derived from a derivative expansion of geometric invariants, and those that follow from a CCWZ coset construction of spontaneously broken spacetime symmetries. (P. Cooper, Phys. Rev. **D88**, 025047 (2013), 1303.0743)

## **Teaching**

Duquesne University

Fall 2016 - Spring 2017  
Pittsburgh, PA

The University University of  
Pittsburgh

Fall 2016 - Spring 2017  
Pittsburgh, PA

New York University

Spring 2016  
New York University

Cooper Union

Spring 2013  
Cooper Union for the Advancement of Science and Art

New York University

October 2011 - May 2016  
New York University

University of Pittsburgh

April 2006, April 2010  
University of Pittsburgh

The Logan School for Creative  
Learning

July 2015  
Denver, USA

### **Adjunct Professor (Physics Department)**

- Astronomy (X2 Fall and Spring)

### **Visiting Professor (Mathematics Department)**

- Calculus for Scientists and Engineers (X2 Classes)
- Algebra
- Differential Equations (X2 Classes)
- Numerical Linear Algebra

### **Adjunct Professor (Physics Department)**

- General Relativity for undergraduates interested in pursuing graduate school.

### **Adjunct Professor (Engineering Department)**

- General Relativity for advanced engineering undergraduates.

### **Adjunct Professor (Teaching Assistant)**

- Teaching assistant for Physics I under Kyle Cranmer
- Teaching assistant for Physics I under David Grier
- Teaching assistant for Physics II under Andrew MacFadyen
- Teaching assistant for General Physics I under Burton Budick (X2)
- Teaching assistant for General Physics II under Andre Adler
- Lab instructor for Intermediate Physics Lab under Andy Haas
- Teaching Assistant for Quantum Mechanics II for Aditi Mitra
- Teaching Assistant for General Relativity (graduate level) for Andrei Gruzinov
- Teaching Assistant for Dynamics (graduate level) for John Lowenstein
- Lab instructor for the Advanced Physics Lab (graduate level) for Andy Haas

### **Various Positions**

- Grader for several courses ranging from Calculus I through Differential equations
- Worked as a tutor at the Mathematics Assistance Center for 3 years teaching the full undergraduate mathematics curriculum.
- Undergraduate teaching assistant for the physics department, teaching the full undergraduate physics curriculum.
- Worked for the Academic Resource Center (ARC) teaching various topics in mathematics, physics, economics and other sciences.

### **Logan Camp**

- Designed and led two, week-long summer camps on Physics and Robotics for children between the ages of 7 and 12 at Logan Camp.

## Private Tutoring

- Conducted regular private tutoring sessions about a broad range of topics for the last 10 years, especially but not limited to STEM from primary level arithmetic to post-graduate physics and mathematics.

## Outreach and Conferences

### Outreach

Fall 2016  
Duquesne University

### START-Play Hackers

I'm helping run a club at Duquesne with professor Regina Harbourn in the physical therapy department where we alter children's toys to make them more accessible to children with disabilities. Since 'playing' in physical space is shown to be a crucial element of cognitive development, this club is meant to ensure that children with fine motor skill disabilities don't become cognitively disabled as well.

### Adopt-A-Physicist

I volunteered to run a forum over a several week span for students of Norwin High-school answering questions about being a physicist and more generally, an adult.

### Pittsburgh Learning Commons

Founder and executive director of a non-profit aimed at running informal after school and summer educational experiences with a focus on project and skills based learning in the Pittsburgh area.

Fall 2016  
Duquesne University

Summer 2016-Current  
Pittsburgh, PA

### TopHonors

I volunteered as "games leader" weekly for an after school math assistance program through the non-profit TopHonors.

### US Science and Engineering Festival

I headed the theory team for the ATLAS detector at the LHC at the national STEM festival in Washington D.C. There I explained various topics on the frontiers of physics to thousands of participants of all age groups.

Spring 2015-Summer 2016  
New York, NY

Spring 2014  
Washington, D.C.

### Invited Talks for the Society for Physics Students (SPS)

The Society for Physics Students at NYU often reaches out to me to give talks on various advanced topics to precocious undergraduates. I've given several talks on topics ranging from technical aspects of quantum field theory, to more civic endeavors about the ethical responsibility of a scientist.

2014-Present  
New York, USA

### Little, Brown Books for Young Readers

I'm the science editor for the Space Taxi series, a series of science novels for kids.

Spring 2012-present  
New York, NY

### Invited talk at the NYC Atheist Society

I gave a public talk about the theoretical motivation and implications of the Higgs Boson discovery at the Large Hadron Collider.

Winter 2014  
New York, NY

### Invited Talks for the Society for Physics Students (SPS)

The Society for Physics Students at NYU often reaches out to me to give talks on various advanced topics to precocious undergraduates. I've given several talks on topics ranging from technical aspects of quantum field theory, to more civic endeavors about the ethical responsibility of a scientist.

2014-Present  
New York, USA

### Invited Talk at the Center for Cosmology and Particle Physics (CCPP)

I gave the CCPP "Brown Bag" talk to all the graduate students, post docs and faculty working for the CCPP. My talk was about gauge theories from a more geometrical perspective, leading up to a discussion about the current state of the Gribov ambiguity, pitched at the level of a first year graduate student.

Fall 2015  
New York University