

# Kevin J. Kelly

## Curriculum Vitae

### PERSONAL DETAILS

---

*Location* CERN Department of Theoretical Physics  
*Address* Office 4/1-016  
*Phone* +1 (248) 635-4238  
*E-mail* kjkelly [at] cern.ch

### EMPLOYMENT

---

**Fellow** 2021-Present  
*CERN (Department of Theoretical Physics)*

**Postdoctoral Research Associate** 2018-2021  
*Fermi National Accelerator Laboratory (Theory Group)*

### EDUCATION

---

**PhD Physics** 2013-2018  
*Northwestern University, Advisor: Prof. André de Gouvêa*

**BSc. Physics, Mathematics** 2009-2013  
*University of Notre Dame, Summa Cum Laude. Advisor: Prof. Michael Hildreth*

### COMMUNITY SERVICE

---

#### Journal Referee

*Physical Review Letters, Physical Review D, Journal of High Energy Physics*

#### Snowmass 2021

*Snowmass Early Career Convener: BSM with Neutrinos (NF03) & Neutrino Theory (TF11).*

*White-paper contribution on self-interacting neutrinos forthcoming.*

*Mini-Workshop on Neutrino Theory: Co-Organized.*

#### Neutrino University 2021

*Speaker: "Beyond the Standard Model Physics with Neutrinos," Virtual, July 2021*

#### Neutrino University 2019

*Lecture series organizer, Fermilab, June-August 2019*

#### Fermilab Undergraduate Lecture Series

*Summer 2020, speaker: "Introduction to Particle Physics"*

#### Fermilab Saturday Morning Physics

*2019-2020 sessions: lectures on special relativity*

#### Fermilab Office of Education and Public Engagement

*Various outreach events: Superheroes in STEM, Ask-A-Scientist, etc.*

#### KICP Lifelong Learning Institute

*Outreach talks, October 2019*

#### Hidden Sector Fixed Target Experiments at Fermilab Symposium

*Organizer, Fermilab, September 2019*

#### Physics Opportunities at the Near DUNE Detector Hall (PONDD) 2018

*Organizer, Fermilab, December 2018*

#### Physics & Astronomy Graduate Student Council

*Northwestern University – Secretary (2016), Teaching Assistant Committee Head (2016-2017)*

**Society of Physics Students**

*University of Notre Dame - Vice President (2012-2013)*

## **TEACHING EXPERIENCE**

---

|   |                      |
|---|----------------------|
| <b>PHYS 135-1 Substitute Lecturer</b><br><i>Classical Mechanics, Northwestern University</i>            | <b>Oct.-Dec. '17</b> |
| <b>PHYS 412-2 Guest Lecturer</b><br><i>Graduate Quantum Mechanics, Northwestern University</i>          | <b>Mar. 2016</b>     |
| <b>PHYS 135-3 Teaching Assistant</b><br><i>Modern Physics, Prof. Zosia Krusberg</i>                     | <b>Spring 2018</b>   |
| <b>PHYS 135-1 Teaching Assistant</b><br><i>Classical Mechanics, Prof. Zosia Krusberg</i>                | <b>Fall 2017</b>     |
| <b>PHYS 135-3 Teaching Assistant</b><br><i>Modern Physics, Prof. Deborah Brown</i>                      | <b>Spring 2017</b>   |
| <b>PHYS 135-2 Teaching Assistant</b><br><i>Electricity &amp; Magnetism, Prof. Deborah Brown</i>         | <b>Winter 2017</b>   |
| <b>ASTRON 120 Teaching Assistant</b><br><i>Highlights of Astronomy, Prof. David Meyer</i>               | <b>Fall 2016</b>     |
| <b>ASTRON 220 Teaching Assistant</b><br><i>Introduction to Astrophysics, Prof. David Meyer</i>          | <b>Spring 2016</b>   |
| <b>PHYS 135-2 Teaching Assistant</b><br><i>Electricity &amp; Magnetism, Prof. Deborah Brown</i>         | <b>Winter 2016</b>   |
| <b>PHYS 135-1 Teaching Assistant</b><br><i>Classical Mechanics, Prof. Deborah Brown</i>                 | <b>Fall 2015</b>     |
| <b>PHYS 136-1,2,3 Laboratory Assistant</b><br><i>General Physics Laboratories, Prof. Arthur Schmidt</i> | <b>Summer 2015</b>   |
| <b>ASTRON 111 Teaching Assistant</b><br><i>Introduction to Astrobiology, Prof. David Meyer</i>          | <b>Spring 2015</b>   |
| <b>ASTRON 101 Teaching Assistant</b><br><i>Modern Cosmology, Prof. Michael Smutko</i>                   | <b>Winter 2015</b>   |
| <b>ASTRON 120 Teaching Assistant</b><br><i>Highlights of Astronomy, Prof. David Meyer</i>               | <b>Fall 2014</b>     |

## **HONORS AND AWARDS**

---

### **Fermilab**

*Lab Directed R&D (LDRD) Award Co-Investigator: "Accelerator-based Dark Matter Initiatives at Fermilab"*

### **Northwestern University**

*Weinberg College Outstanding Graduate Student Teacher Award (2015-2016), Physical Sciences*

*Fermilab Neutrino Physics Center (NPC) Scholar, Fall 2017*

### **University of Notre Dame**

*Outstanding Physics Major Award, Notre Dame Department of Physics (Spring 2013)*

*George Kolettis Award in Mathematics (Spring 2013)*

## PUBLICATIONS

---

For a complete and up-to-date listing of publications, see my [InspireHEP profile \(link\)](#).

Note that publications as a member of the DUNE collaboration have been omitted from this list, but are available on my InspireHEP profile.

39. **DUNE atmospheric neutrinos: Earth Tomography**  
Kevin J. Kelly, Pedro A.N. Machado, Iván Martínez-Soler, Yuber F. Pérez-González.  
Submitted for publication. [arXiv:2110.00003](#)
38. **Characterizing Heavy Neutral Fermions via their Decays**  
André de Gouvêa, Patrick J. Fox, Boris Kayser, Kevin J. Kelly.  
Submitted for publication. [arXiv:2109.10358](#)
37. **New constraints on tau-coupled Heavy Neutral Leptons with masses  $m_N = 280 - 970$  MeV**  
The ArgoNeuT Collaboration, including Kevin J. Kelly.  
Phys. Rev. **Lett.** **127** (2021) no. 12, 121801. [arXiv:2106.13684](#)
36. **The MicroBooNE Experiment, the NuMI Absorber, and Heavy Neutral Leptons**  
Kevin J. Kelly, Pedro A.N. Machado.  
Phys. Rev. **D104** (2021) no. 5, 055015. [arXiv:2106.06548](#)
35. **Millicharged Particles from the Heavens: Single- and Multiple-Scattering Signatures**  
Carlos A. Argüelles Delgado, Kevin J. Kelly, Victor Muñoz.  
Submitted for publication. [arXiv:2104.13924](#)
34. **Light, Long-Lived  $B - L$  Gauge and Higgs Bosons at the DUNE Near Detector**  
P.S. Bhupal Dev, Bhaskar Dutta, Kevin J. Kelly, Rabindra N. Mohapatra, Yongchao Zhang.  
**JHEP** 07 (2021) 166. [arXiv:2104.07681](#).
33. **Three-Body Decays of Heavy Dirac and Majorana Fermions**  
André de Gouvêa, Patrick J. Fox, Boris Kayser, Kevin J. Kelly.  
Phys. Rev. **D104** (2021) no. 1, 015038. [arXiv:2104.05719](#)
32. **LEvEL: Low-Energy Neutrino Experiment at the LHC**  
Kevin J. Kelly, Pedro A.N. Machado, Alberto Marchionni, Yuber F. Pérez-González.  
**JHEP** 08 (2021) 87. [arXiv:2103.00009](#).
31. **Heavy Axion Opportunities at the DUNE Near Detector**  
Kevin J. Kelly, Soubhik Kumar, Zhen Liu.  
Phys. Rev. **D103** (2021) no. 9, 095002. [arXiv:2011.05995](#).
30. **Intimate Relationship Between Sterile Neutrino Dark Matter and  $\Delta N_{\text{eff}}$**   
Kevin J. Kelly, Manibrata Sen, Yue Zhang.  
Phys. Rev. **Lett.** **127** (2021) no. 4, 041101. [arXiv:2011.02487](#).
29. **Current and Future Neutrino Oscillation Constraints on Leptonic Unitarity**  
Sebastian A. R. Ellis, Kevin J. Kelly, Shirley Weishi Li.  
**JHEP** 12 (2020) 068. [arXiv:2008.01088](#).
28. **Back to (Mass-)Square(d) One: The Neutrino Mass Ordering in Light of Recent Data**  
Kevin J. Kelly, Pedro A. N. Machado, Stephen J. Parke, Yuber F. Pérez-González, Renata Zukanovich Funchal.  
Phys. Rev. **D103** (2021) no. 1, 013004. [arXiv:2007.08526](#).
27. **Origin of Sterile Neutrino Dark Matter via Vector Secret Neutrino Interactions**  
Kevin J. Kelly, Manibrata Sen, Walter Tangarife, Yue Zhang.  
Phys. Rev. **D101** (2020) no. 11, 115031. [arXiv:2005.03681](#).

26. **Leptonic Unitarity Triangles**  
Sebastian A.R. Ellis, Kevin J. Kelly, Shirley Weishi Li.  
Phys. Rev. **D102** (2020) no. 11, 115027. arXiv:[2004.13719](#).
25. **Searches for Decays of New Particles in the DUNE Multi-Purpose Near Detector**  
Jeffrey M. Berryman, André de Gouvêa, Patrick J. Fox, Boris J. Kayser, Kevin J. Kelly, Jennifer L. Raaf.  
**JHEP** 02 (2020) 174. arXiv:[1912.07622](#).
24. **Prospects of Measuring Oscillated Decay-at-Rest Neutrinos at Long Baselines**  
Roni Harnik, Kevin J. Kelly, Pedro A.N. Machado.  
Phys. Rev. **D101** (2020) no. 3, 033008. arXiv:[1911.05088](#).
23. **White Paper on New Opportunities at the Next-Generation Neutrino Experiments (Part 1: BSM Neutrino Physics and Dark Matter)**  
C.A. Argüelles et. al. (incl. Kevin J. Kelly)  
arXiv:[1907.08311](#).
22. **Neutrino Non-Standard Interactions: A Status Report**  
P.S. Bhupal Dev, K.S. Babu, Peter B. Denton, Pedro A.N. Machado et. al. (incl. Kevin J. Kelly)  
SciPost Phys. Proc. 2 (2019) 001. arXiv:[1907.00991](#).
21. **Constraining the Self-Interacting Neutrino Interpretation of the Hubble Tension**  
Nikita Blinov, Kevin J. Kelly, Gordan Z. Krnjaic, Samuel D. McDermott.  
Phys. Rev. **Lett.** **123** (2019) no. 19, 191102. arXiv:[1905.02727](#).
20. **Physics with Beam Tau-Neutrino Appearance at DUNE**  
André de Gouvêa, Kevin J. Kelly, G.V. Stenico, Pedro Pasquini.  
Phys. Rev. **D100** (2019) no. 1, 016004. arXiv:[1904.07265](#).
19. **Sub-GeV Atmospheric Neutrinos and CP-Violation in DUNE**  
Kevin J. Kelly, Pedro A.N. Machado, Iván Martínez-Soler, Stephen J. Parke, Yuber F Perez-Gonzalez.  
Phys. Rev. **Lett.** **123** (2019) no. 8, 081801. arXiv:[1904.02751](#).
18. **Hunting On- and Off-Axis for Light Dark Matter with DUNE-PRISM**  
Valentina De Romeri, Kevin J. Kelly, Pedro A.N. Machado.  
Phys. Rev. **D100** (2019) no. 9, 095010. arXiv:[1903.10505](#).
17. **Mono-Neutrino at DUNE: New Signals From Neutrinophilic Thermal Dark Matter**  
Kevin J. Kelly, Yue Zhang.  
Phys. Rev. **D99** (2019) no. 5, 055034. arXiv:[1901.01259](#).
16. **Proton Fixed-Target Scintillation Experiment to Search for Minicharged Particles**  
Kevin J. Kelly, Yu-Dai Tsai.  
Phys. Rev. **D100** (2019) no. 1, 015043. arXiv:[1812.03998](#).
15. **Dark Tridents at Off-Axis Liquid Argon Neutrino Detectors**  
André de Gouvêa, Patrick J. Fox, Roni Harnik, Kevin J. Kelly, Yue Zhang.  
**JHEP** 1901 (2019) 001. arXiv:[1809.06388](#).
14. **Multimessenger Astronomy and New Neutrino Physics**  
Kevin J. Kelly, Pedro A.N. Machado.  
**JCAP** 1810 (2018) no.10, 048. arXiv:[1808.02889](#).
13. **Shining light on the mass scale and nature of neutrinos with  $e\gamma \rightarrow e\nu\bar{\nu}$**   
Jeffrey M. Berryman, André de Gouvêa, Kevin J. Kelly, Michael Schmitt.  
Phys. Rev. **D98** (2018) no.1, 016009. arXiv:[1805.10294](#).
12. **Matter Density Profile Shape Effects at DUNE**  
Kevin J. Kelly, Stephen J. Parke.  
Phys. Rev. **D98** (2018) no.1, 015025. arXiv:[1802.06784](#).

11. **Lepton-Number-Charged Scalars and Neutrino Beamstrahlung**  
Jeffrey M. Berryman, André de Gouvêa, Kevin J. Kelly, Yue Zhang.  
Phys. Rev. **D97** (2018) no.7, 075030. arXiv:[1802.00009](#).
10. **Neutrino versus antineutrino oscillation parameters at DUNE and Hyper-Kamiokande experiments**  
André de Gouvêa, Kevin J. Kelly.  
Phys. Rev. **D96** (2017) no.9, 095018. arXiv:[1709.06090](#).
9. **Dark Matter and Neutrino Mass from the Smallest Non-Abelian Chiral Dark Sector**  
Jeffrey M. Berryman, André de Gouvêa, Kevin J. Kelly, Yue Zhang.  
Phys. Rev. **D96** (2017) no.7, 075010. arXiv:[1706.02722](#).
8. **Searches for new physics at the Hyper-Kamiokande experiment**  
Kevin J. Kelly.  
Phys. Rev. **D95** (2017) no.11, 115009. arXiv:[1703.00448](#).
7. **Lepton-number-violating searches for muon to positron conversion**  
Jeffrey M. Berryman, André de Gouvêa, Kevin J. Kelly, Andrew Kobach.  
Phys. Rev. **D95** (2017) no.11, 115010. arXiv:[1611.00032](#).
6. **False Signals of CP-Invariance Violation at DUNE**  
André de Gouvêa, Kevin J. Kelly.  
arXiv:[1605.09376](#).
5. **Imperfect mirror copies of the standard model**  
Jeffrey M. Berryman, André de Gouvêa, Daniel Hernández, Kevin J. Kelly.  
Phys. Rev. **D94** (2016) no.3, 035009. arXiv:[1605.03610](#).
4. **Large extra dimensions at the Deep Underground Neutrino Experiment**  
Jeffrey M. Berryman, André de Gouvêa, Kevin J. Kelly, O.L.G. Peres, Zahra Tabrizi.  
Phys. Rev. **D94** no.3, 033006. arXiv:[1603.00018](#).
3. **Non-standard neutrino interactions at DUNE**  
André de Gouvêa, Kevin J. Kelly.  
Nucl. Phys. **B908**, 318 (2016). arXiv:[1511.05562](#).
2. **Sterile neutrino at the Deep Underground Neutrino Experiment**  
Jeffrey M. Berryman, André de Gouvêa, Kevin J. Kelly, Andrew Kobach.  
Phys. Rev. **D92** (2015) no.7, 073012. arXiv:[1507.03986](#).
1. **CP-invariance violation at short-baseline experiments in 3+1 neutrino scenarios**  
André de Gouvêa, Kevin J. Kelly, Andrew Kobach.  
Phys. Rev. **D91** (2015) no.5, 053005. arXiv:[1412.1479](#).

## **SEMINARS & COLLOQUIA**

---

### **Fermilab Joint Experimental-Theoretical Physics Seminar (Wine & Cheese)**

*October 2021*

“ArgoNeuT’s Search for Heavy Neutral Leptons,” presented together with Patrick Green

### **Texas A&M University Physics & Astronomy Colloquium**

*Remote, April 2021*

“Neutrinos and Dark Matter on a Collision Course”

### **Johns Hopkins University/University of Maryland Joint Seminar**

*Remote, February 2021*

### **University of Michigan LCTP Seminar**

*Remote, January 2021*

**Ohio State University CCAPP Seminar**

*Remote, December 2020*

“Self-Interacting Neutrinos, from the Lab to the Cosmos”

**Fermilab Neutrino Seminar**

*Remote, December 2020*

**BSM PANDEMIC Seminar**

*Remote, November 2020*

“Neutrino Oscillations: Where we are, where we’re going”

**University of Pittsburgh High-Energy Physics Seminar**

*Remote, November 2020*

**University of Wisconsin High-Energy/Cosmology Seminar**

*Remote, November 2020*

**University of Minnesota High Energy Physics Seminar**

*Remote, October 2020*

“Heavy Neutrinos and Where to Find Them”

**Korea Institute for Advanced Study High Energy Physics Seminar**

*Remote, July 2020*

“Self-Interacting Neutrinos, The Hubble Tension, and Sterile Neutrino Dark Matter”

**SLAC Elementary Particle Physics Seminar**

*Remote, June 2020*

“Leptonic Unitarity from Neutrino Oscillations: Current & Future Status”

**Brookhaven National Lab High Energy Theory Seminar**

*Remote, May 2020*

“Dark Sector Decays in the DUNE Multipurpose Near Detector”

**Lawrence Berkeley National Lab Particle Physics Seminar**

*Berkeley, CA, December 2019*

**Texas A&M Mitchell Institute High Energy Seminar**

*College Station, TX, December 2019*

“New Physics Searches at the DUNE Near Detector”

**Argonne National Lab Theory Seminar**

*Argonne, IL, April 2019*

**Fermilab Theory Seminar**

*Batavia, IL, March 2019*

**Fermilab Neutrino Seminar Series**

*Batavia, IL, January 2018*

“How much does matter matter at DUNE?”

**Northwestern University**

*Evanston, IL, November 2017*

“Independent Determination of Oscillation Parameters for Neutrinos and Antineutrinos”

**University of Illinois at Chicago High Energy Physics Seminar**

*Chicago, IL, November 2017*

“Chiral Gauge Theories for Dark Sector Construction”

**Indiana University High Energy Physics Seminar**

*Bloomington, IN, March 2017*

**University of Notre Dame High Energy Physics Seminar**

*Notre Dame, IN, January 2017*

**Argonne National Lab Theory Seminar**

*Argonne, IL, January 2017*

**Fermilab Theory Seminar**

*Batavia, IL, September 2016*

“New Physics Searches at DUNE”

## Northwestern University

Evanston, IL, 2014-2016

“CP Violation from a Fourth Neutrino?”

“Sterile Neutrinos at DUNE”

“Non-Standard Neutrino Interactions”

## CONFERENCE PRESENTATIONS

---

### **NuTau2021 (Workshop on Tau Neutrinos from GeV to EeV 2021)**

Remote conference, September-October 2021. Speaker: “Learning from Tau Neutrino Appearance at Long Baselines”

### **TAUP 2021 (Topics in Astroparticle and Underground Physics)**

Remote conference, August-September 2021. Speaker: “Heavy Dirac/Majorana Fermion Decays,” recording available at [this link](#).

### **EPS-HEP 2021 (European Physical Society conference on high energy physics)**

Remote conference, July 2021. Speaker: “The DUNE Near Detector Complex as a Beam Dump Facility”

### **Forward Physics Facility Meeting #2**

Remote conference, May 2021. Speaker: “Low-energy LHC Neutrinos”

### **Pheno2021**

Remote conference, May 2021. Speaker: “Decays of Dirac/Majorana Fermions”

### **PIKIMO10**

Remote conference, April 2021. Speaker: “LEvEL: Low-Energy Neutrino Experiment at the LHC”

### **Dark Matter as a Portal to New Physics 2021**

Remote conference, February 2021. Invited speaker: “Searched for Dark Sectors in Neutrino Experiments”

### **Snowmass 2021 Artificial Neutrino Sources Meeting**

Remote conference, December 2020. Invited speaker: “New-Physics Searches at Beam Dump Experiments”

### **LEPLAr: Low-Energy Physics in Liquid Argon**

Remote conference, November 2020. Invited speaker: “MeV-Scale Features in BSM Searches”

### **PIKIMO9**

Remote conference, October 2020. Speaker: “Decays of Dirac and Majorana Heavy Neutral Leptons”

### **Snowmass 2021 Community Planning Meeting**

Invited speaker, parallel session on dark sector searches.

### **Snowmass 2021 Neutrino BSM Kick-off**

Invited speaker: “Dark Sectors at Neutrino Experiments”

### **New Perspectives 2020**

Remote conference, August 2020. Speaker: “Leptonic Unitarity: Current and Future”

### **PROSPECT Oscillation Workshop**

August 2020. Invited speaker: “Short-baseline/Long-baseline Oscillation Measurement Interplay: A Theorist’s Perspective”

### **Fermilab Users Meeting 2020**

Remote conference, August 2020. Plenary Speaker: “Neutrino Theory Post-Nu2020”

### **Neutrino2020**

Remote conference, June 2020. Poster Presented: “Searches for Dark Sector Mediators in the DUNE Multi-Purpose Near Detector.” Associated video available [here](#).

### **Neutrinos from the Lab to the Cosmos**

Institute for Nuclear Theory, University of Washington, January 2020. Speaker: “New Neutrino Physics at Long-Baseline Experiments” Discussion leader: “Neutrinos and the Hubble Tension”

### **Precision Investigations in the Neutrino Sector (PINS) 2019**

SLAC, July 2019. Speaker: “Sub-GeV Atmospheric Neutrinos and CP Violation”

### **SBND Collaboration Meeting 2019**

Ann Arbor, June 2019. Remote speaker: “Missing Transverse Momentum Signatures in SBND”

**Current Trends in Particle Theory (CTPT) 2019**

*Chicago, IL, June 2019*

**Fermilab New Perspectives Meeting 2019**

*Fermilab, 2019. Invited speaker: "Neutrino Theory in 10 Minutes"*

**New Directions in the Search for Light Dark Matter Particles**

*Fermilab, June 2019*

**NTN Workshop on Non-standard Neutrino Interactions**

*St. Louis, MO, May 2019. Speaker: "Light Dark Matter at DUNE"*

**DUNE Collaboration Meeting 2019**

*Fermilab, May 2019. Invited speaker: "Beyond the Standard Model Physics at the DUNE Near Detector"*

**LCTP Spring Neutrino Physics Symposium**

*Ann Arbor, MI, April 2019. Speaker: "Searches for Dark Matter with the DUNE Near Detector"*

**Discrete2018**

*Vienna, Austria, November 2018. Parallel session speaker: "Multimessenger Astronomy and New Neutrino Physics"*

**NuFact 2018**

*Blacksburg, VA, August 2018. Parallel session speaker: "Lepton-number-charged Scalars at DUNE"*

**Summer Institute for Neutrino Theory (SINT) 2017**

*Blacksburg, VA, July 2017*

**Pheno 2017**

*Pittsburgh, PA, May 2017. Parallel session speaker: "Lepton Number Violation and Muon-to-Positron Conversion"*

**Current Trends in Particle Theory (CTPT) 2017**

*Chicago, IL, March 2017. Poster presented: "Lepton Number Violation and Muon-to-Positron Conversion"*

**NuFact 2016**

*Quy Nhon, Vietnam, August 2016. Parallel session speaker: "New Physics Searches at DUNE"*

**Theoretical Advanced Summer Institute (TASI) 2016**

*Boulder, CO, June 2016*

**Nu@Fermilab**

*Batavia, IL, July 2015*