

# CURRICULUM VITAE

Kaan Şimşek

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## Education

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**Northwestern University**, Evanston, Illinois, USA

Physics, Ph.D. candidate, Aug 2020 – Present

Advisor: Francis John Petriello

**Middle East Technical University**, Ankara, Turkey

Physics, M.Sc., Feb 2017 – Jul 2019

Dissertation: *Exploring extra dimensions through rare processes*

Advisor: İsmail Turan

Coadvisor: İsmet Yurduşen (Hacettepe University)

**Middle East Technical University**, Ankara, Turkey

Physics, B.Sc. (double major), Sep 2012 – Feb 2017

Dissertation: *Exploring universal extra dimensions*

Advisor: İsmail Turan

**Middle East Technical University**, Ankara, Turkey

Civil engineering, B.Sc., Sep 2009 – Feb 2016

Dissertation: *Redesign of METU pedestrian bridge*

Advisor: Alp Caner

## Academic employment

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**Northwestern University**, Evanston, Illinois, USA

Graduate student, teaching assistant, research assistant

September 2020 – Present

**Argonne National Laboratory**, Lemont, Illinois, USA

Visiting student

January 2023 – July 2023

**University of Rochester**, Rochester, New York, USA

Teaching assistant

August 2019 – August 2020

**Middle East Technical University**, Ankara, Turkey

Teaching assistant

October 2017 – August 2019

**Middle East Technical University**, Ankara, Turkey

Student assistant

October 2016 – June 2017

## Research interest

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My main field of study is theoretical particle physics. I am profoundly interested in phenomenological studies. My research interests include theories with extra dimensions, top physics, rare processes, physics beyond the Standard Model, hadron phenomenology, QCD and electroweak precision studies, collider physics, and effective field theories.

## Teaching experience

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During my graduate years at Northwestern University, I assisted the following courses:

- Undergraduate level

Physics 125-1	<b>General Physics ISP</b> (2021-1) <i>Graded homework and exam papers; prepared discussion problems; led discussion sessions</i>
Physics 130-3	<b>College Physics</b> (2021-3) <i>Graded quiz papers; prepared discussion problems; led discussion sessions</i>
Physics 135-2, 3	<b>General Physics</b> (2021-4) <i>Graded quiz and exam papers; prepared discussion problems; led discussion sessions</i>
Physics 136-2	<b>General Physics Laboratory</b> (2024-1) <i>Led lab sessions; graded lab reports</i>
Physics 126-2	<b>Physics for ISP Laboratory: Electricity &amp; Magnetism</b> (2024-2) <i>Led lab sessions; graded lab reports</i>

- Graduate level

Physics 411-1	<b>Methods of Theoretical Physics</b> (2021-1; 2022-1; 2023-1) <i>Graded homework and exam papers</i>
Physics 412-1, 2, 3	<b>Quantum Mechanics</b> (2022-1, 3; 2023-1, 2, 3) <i>Graded homework and exam papers; led discussion sessions; prepared 100+ pages of supplemental material; compiled computational resources</i>
Physics 416-0	<b>Introduction to Statistical Mechanics</b> (2021-2) <i>Graded homework papers</i>

During my graduate year at the University of Rochester, I assisted the following courses:

- Undergraduate level

Physics 113, 114	<b>General Physics I, II</b> (Laboratory) (2019-1, 3) <i>Prepared lab manual; led lab sessions; graded lab report</i>
Physics 121, 122	<b>Mechanics, Electromagnetism</b> (Laboratory) (2019-1, 3) <i>Prepared lab manual; led lab sessions; graded lab reports</i>
Physics 142	<b>Electricity &amp; Magnetism</b> (Laboratory) (2019-1) <i>Led lab sessions; graded lab reports</i>
Physics 123	<b>Waves &amp; Modern Physics</b> (2019-2) <i>Led lab sessions; graded lab reports and homework and exam papers; led discussion sessions</i>

During my undergraduate and graduate years at Middle East Technical University, I assisted the following courses:

- Undergraduate level

Physics 105, 106	General Physics <a href="#">I</a> , <a href="#">II</a> (Laboratory) (2016-1, 2; 2017-1, 2, 3; 2018-1, 2) <i>Led lab sessions; graded lab reports and quizzes</i>
Physics 207	<a href="#">Concepts of Modern Physics</a> (2017-1) <i>Graded quiz papers</i>
Physics 407, 408	Particle Physics <a href="#">I</a> , <a href="#">II</a> (2017-1, 2; 2018-2) <i>Graded homework papers; led theoretical discussion sessions; prepared quiz and homework problems; delivered lectures; taught shell scripting, Mathematica, FeynArts, FormCalc, Package X, LanHEP, and CalcHEP</i>

- Graduate level

Physics 507, 508	Quantum Mechanics <a href="#">I</a> , <a href="#">II</a> (2017-1, 2; 2018-1, 2) <i>Graded homework and exam papers; led discussion sessions; prepared homework and exam problems; delivered lectures</i>
Physics 545, 546	Particle Physics <a href="#">I</a> , <a href="#">II</a> (2018-1, 2) <i>Graded homework and exam papers; prepared recitation hours and exam problems; delivered lectures</i>

## Publications

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- 12 *Transverse spin asymmetries and the electron Yukawa coupling at an FCC-ee*  
R. Boughezal, F. Petriello, K. Şimşek  
[Phys. Rev. D \*\*110\*\* \(2024\) 075026](#) | [arXiv: 2407.12975](#) | [INSPIRE-HEP: 2808919](#)
- 11 *SMEFT analysis with LHeC, FCC-eh, and EIC DIS pseudodata*  
C. Bissolotti, R. Boughezal, K. Şimşek  
[arXiv: 2307.09459](#) | [INSPIRE-HEP: 2678210](#)
- 10 *SMEFT probes in future precision DIS experiments*  
C. Bissolotti, R. Boughezal, K. Şimşek  
[Phys. Rev. D \*\*108\*\* \(2023\) 075007](#) | [arXiv: 2306.05564](#) | [INSPIRE-HEP: 2667587](#)
- 9 *Neutral-current electroweak physics and SMEFT studies at the EIC*  
R. Boughezal, A. Emmert, T. Kutz, S. Mantry, M. Nycz, F. Petriello, K. Şimşek, D. Wiegand, X. Zheng  
[Phys. Rev. D \*\*106\*\* \(2022\) 016006](#) | [arXiv: 2204.07557](#) | [INSPIRE-HEP: 2067965](#)
- 8 *Snowmass 2021 White Paper: Electron Ion Collider for high energy physics*  
R. Abdul Khalek *et al.*  
[arXiv: 2203.13199](#) | [INSPIRE-HEP: 2057945](#)
- 7 *Strong coupling constants of charmed and bottom mesons with light vector mesons in QCD sum rules*  
T. M. Aliev, K. Şimşek  
[Phys. Rev. D \*\*104\*\* \(2021\) 074034](#) | [arXiv: 2107.02735](#) | [INSPIRE-HEP: 1877690](#)
- 6 *Strong  $B_{QQ'}^* B_{QQ'} V$  vertices and the radiative decays of  $B_{QQ}^* \rightarrow B_{QQ} \gamma$  in the light-cone sum rules*  
T. M. Aliev, T. Barakat, K. Şimşek  
[Eur. Phys. J. A \*\*57\*\* \(2021\) 160](#) | [arXiv: 2101.10264](#) | [INSPIRE-HEP: 1842668](#)
- 5 *Strong vertices of doubly heavy spin-3/2 baryon to spin-1/2 baryon with light mesons in light-cone QCD sum rules*  
T. M. Aliev, K. Şimşek  
[Phys. Rev. D \*\*103\*\* \(2021\) 054044](#) | [arXiv: 2011.07150](#) | [INSPIRE-HEP: 1830522](#)

- 4 *Gravitational form-factors of the  $\rho$ ,  $\pi$ , and  $K$  mesons in QCD sum rules*  
T. M. Aliev, T. Barakat, K. Şimşek  
[Phys. Rev. D \*\*103\*\* \(2021\) 054001](#) | [arXiv: 2008.04385, 2009.07926](#) | [INSPIRE-HEP: 1817654](#)
- 3 *Strong coupling constants of doubly heavy baryons with vector mesons in QCD*  
T. M. Aliev, K. Şimşek  
[Eur. Phys. J. C \*\*80\*\* \(2020\) 976](#) | [arXiv: 2009.03464](#) | [INSPIRE-HEP: 1815748](#)
- 2 *Determination of the strong vertices of doubly heavy baryons with pseudoscalar mesons in QCD*  
H. I. Alrebdi, T. M. Aliev, K. Şimşek  
[Phys. Rev. D \*\*102\*\* \(2020\) 074007](#) | [arXiv: 2008.05098](#) | [INSPIRE-HEP: 1811409](#)
- 1  *$N^*(1535) \rightarrow N$  transition form-factors due to the axial current*  
T. M. Aliev, T. Barakat, K. Şimşek  
[Phys. Rev. D \*\*100\*\* \(2019\) 054030](#) | [arXiv: 1907.08017](#) | [INSPIRE-HEP: 1744448](#)

## Seminars and talks

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- 11 **SMEFT probes in future precision DIS experiments**  
*New Perspectives 2023*, Fermilab, talk, June 27, 2023.
- 10 **Precision electroweak measurements and SMEFT studies at the EIC**  
*Phenomenology 2023 Symposium*, University of Pittsburgh, talk, May 9, 2023.
- 9 **Beyond-the-Standard-Model searches at the Large Hadron-electron Collider and the Electron-Ion Collider**  
*Physics and Astronomy Early Career Research Seminars*, Northwestern University, invited talk, April 19, 2023.
- 8 **Precision electroweak measurements and beyond the Standard Model searches at the Electron-Ion Collider**  
*DIS2023: XXX International Workshop on DIS and Related Subjects*, Michigan State University, invited talk, March 30, 2023.
- 7 **SMEFT projections at the EIC and LHeC to NLO QCD**  
*Candidacy talk*, Northwestern University, talk, December 2, 2022.
- 6 **SMEFT projections of neutral-current PVDIS asymmetries at the EIC**  
*EIC Early Career Workshop 2022*, CFNS Stony Brook University and remote, invited talk, July 25, 2022.
- 5 **SMEFT projections using EIC PVDIS asymmetries**  
*INT Workshop: Parity-Violation and other Electroweak Physics at JLab 12 GeV and Beyond*, remote, invited talk, June 27, 2022.
- 4 **Neutral-current SMEFT studies at the EIC**  
*CFNS Workshop: High-Luminosity EIC (EIC Phase II)*, remote, invited talk, June 21, 2022.
- 3 **Neutral-Current SMEFT Studies at the EIC**  
*HEP Seminars*, Northwestern University, seminar, April 18, 2022.
- 2 **Applications of MUED to Rare Top Quark Processes**  
*2020 GSRM Talks*, University of Rochester, talk, February 8, 2020.
- 1 **Universal Extra Dimensions**  
*Seminars*, Middle East Technical University, seminar, December 6, 2018.

## Conferences, workshops, and schools attended

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- 7 *New Perspectives 2023*, Fermilab, Batavia, Illinois, USA, June 26-27, 2023.
- 6 *Phenomenology 2023 Symposium*, University of Pittsburgh, Pittsburgh, Pennsylvania, USA, May 8-10, 2023.
- 5 *DIS2023: XXX International Workshop on DIS and Related Subjects*, Michigan State University, East Lansing, Michigan, USA, March 27-31, 2023.

- 4 EIC User Group Early Career Workshop 2022, CFNS Stony Brook University, New York, USA and remote, July 24-25, 2022.
- 3 2022 CTEQ Summer School on QCD and Electroweak Phenomenology, University of Pittsburgh, Pennsylvania, USA, July 6-16, 2022.
- 2 INT Workshop: Parity-Violation and other Electroweak Physics at JLab 12 GeV and Beyond, remote, June 27-July 1, 2022.
- 1 CFNS Workshop: High-Luminosity EIC (EIC Phase II), remote, June 21-24, 2022.

## Awards

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- 3 The most engaging and fun talk award  
New Perspectives 2023, Fermilab, Batavia, Illinois, USA  
June 27, 2023
- 2 Scholarship covering full tuition and monthly stipend  
Northwestern University, Evanston, Illinois, USA  
Aug 2020 – Present
- 1 Scholarship covering full tuition and monthly stipend  
University of Rochester, Rochester, New York, USA  
Aug 2019 – Jun 2020

## Computer skills

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- *Programming languages* Mathematica, Python, Fortran, R, C, MATLAB
- *HEP software* FeynArts, FormCalc, LoopTools, FeynCalc, Package X, LanHEP, CalcHEP, LHAPDF, MadGraph
- *Data science and machine learning* NumPy, pandas, matplotlib, autograd, PyTorch, TensorFlow, scikit-learn, unsupervised and supervised learning, neural networks, regression, classification, dimensional reduction, data visualization
- *Scientific computing* High-performance cluster computing, optimization methods, numerical simulations, Monte-Carlo methods
- *Tools and platforms* Git, Linux/Unix, Bash/Zsh, T<sub>E</sub>X, MS Office, Jupyter, Markdown, R Markdown, system administration
- *Other skills* Algorithm design, data wrangling, statistical modeling and analysis

## Hobbies

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I play the piano, guitar, and pretty much anything I can get my hands on. I also compose and produce music as an independent artist on Spotify. I am a licensed player of the Turkish Chess Federation. I am passionately into cycling, computers, collecting fountain pens, and learning new languages (human or computer).

## Languages

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 Native    Fluent    Beginner    Beginner    Beginner

## References

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**Hande Toffoli***Associate Professor,  
Chair Advisor*

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Middle East Technical University  
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Vice Chair*

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