

Keping Xie

Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260
xiekeping@pitt.edu, +1(469)758-7010

Education and training

- **Postdoctoral researcher**, 09/2019 – present
Pittsburgh Particle Physics, Astrophysics, and Cosmology Center (PITT PACC),
Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260
Supervisors: Ayres Freitas and Tao Han
- **Ph.D. in Physics**, 08/2014 – 08/2019
Department of Physics, Southern Methodist University, Dallas, TX 75275
Advisors: Pavel Nadolsky and Roberto Vega
- **B.S. in Physics**, 09/2010 – 07/2014
State Key Laboratory of Nuclear Physics and Technology, School of Physics,
Peking University, Beijing 100871, China
Advisor: Han-Qing Zheng

Research Interests

I work on the high-energy phenomenology, which bridges the theoretical and experimental particle physics. My efforts mainly focus on the precision and resummation calculations. As a member of the CTEQ-TEA (CT) collaboration, I participate in the development of a new generation of QCD parton distribution functions (PDFs), [CT18](#), and the QED corrections ([CT18qed](#)), which are widely used for physics exploration at the hadron colliders. Recently, I dedicate to the electroweak (EW) factorization, which involves the EW gauge bosons (W/Z) as partons to resum large EW logarithms as PDFs for initial-state radiations (ISR) and fragmentation functions (FFs) for final-state radiations (FSR). I also work on heavy flavor physics, which requires a composite scheme to match the high energy regime, where the heavy-flavor particle can be excited as an active massless parton, to the low energy regime, in which heavy flavors can be only dynamically created through light flavors. I am also interested in high-order calculations, small- x and q_T resummations, light exotic Higgs bosons, and effective field theory.

Public Tools

- I am one of authors of the [S-ACOT-MPS](#) package, *i.e.*, the Simplified Aivazis-Collins-Olness-Tung scheme with Massive Phase Space. It is designed to deal with the heavy-flavor hadroproduction, especially at the Large Hadron Collider (LHC).
- I develop and maintain the SARAH model files for the Supersymmetric Georgi-Machacek ([SGM](#)) Model, a decoupling limit of the Supersymmetric Custodial Triplet Model (SCTM), which gives a weakly coupled origin for the GM model at the electroweak scale.

Professional activities and service

- **Organizing committee**, [11th PIKIMO](#), Pittsburgh, PA, 2021; Phenomenology Symposium, Pittsburgh, PA, [2021](#), [2020](#); [LHC Run III Workshop](#), Pittsburgh, PA, 2021; [Muon Collider Physics](#), Pittsburgh, PA, 2020; [LoopFest XIX](#), Pittsburgh PA, 2020
- **Convener** for Phenomenology Symposium, Pittsburgh, PA, [2019](#); APS April Meeting, Denver, CO, [2019](#)
- **Referee** for *International Journal of Modern Physics A*, *Journal of High Energy Physics*, *Chinese Physics C*, *Physical Review D*
- **Leader** for Snowmass Early Career in Energy Frontier
- **Member** of the CTEQ-TEA collaboration and American Physical Society (APS)
- **Visitor**, Fermilab, 09/2017 – 01/2019, Michigan State University, 04/2018, 12/2016, 09/2016
- **Research Assistant**, Southern Methodist University, 08/2015 – 08/2019
Student Employee of the Year Nominee 2019, Lightner-Sams Graduate Fellowship 2018
- **Teaching Assistant**, Southern Methodist University, 08/2014 – 07/2015
Outstanding Teaching Assistant Award 2015

Recent presentations

Invited seminars and talks at conferences and workshops

1. **The photon content of proton in the CT18 global analysis**
Seminar at Institute of Nuclear Physics, Polish Academy of Sciences (IFJ PAN), Krakow, Poland, 11/2021
2. **Precision Test of the Muon-Higgs Coupling at a High-energy Muon Collider**
Talk at Lepton Colliders session, SUSY 2021, ITP-CAS, Beijing, China, 08/2021
3. **The partonic picture at high-energy lepton colliders**
Seminar at Tsung-Dao Lee Institute & School of Physics and Astronomy, Shanghai Jiao Tong University, Shanghai, China, 06/2021
4. **Quark and gluon contents of a lepton at high energies**
Muon Collider Physics and Detector Workshop, International Muon Collider Collaboration, 06/2021
5. **Electroweak Parton Distribution Functions**
Winter 2021 topical meeting on VBS: VBS at Snowmass, VBSCan Action, 01/2021
6. **Standard Model physics at high-energy muon colliders**
PITT PACC Workop: Muon Collider Physics, University of Pittsburgh, PA, 12/2020
7. **Light Exotic Higgs Bosons at the LHC**
Seminar at Department of Physics, Southern Methodist University, Dallas, TX, 03/2019
8. **Light Exotic Higgs Bosons at the LHC**
Seminar at Theoretical Physics Department, Fermilab, Batavia, IL, 11/2018

Other talks

1. **Precision Test of the Muon-Higgs Coupling at a High-energy Muon Collider**
Higgs 2021, Stony Brook University, NY, 10/2021
2. **Photon PDF and Impact from heavy flavors in the CT18 global analysis**
The European Physical Society Conference on High Energy Physics, University of Hamburg and DESY, Germany, 07/2021
3. **Nonperturbative contributions to the photon PDF uncertainty in the CT18 global analysis**
19th International Conference on Hadron Spectroscopy and Structure, Mexico City, Mexico, 07/2021
4. **The Photon PDF within the CT18 global analysis**
2021 Meeting of the Division of Particles and Fields of the American Physical Society, Florida State University, Tallahassee, FL, 07/2021
5. **The Photon PDF within the CT18 global analysis**
DIS 2021, Stony Brook University, NY, 04/2021
6. **A next-to-leading order method general-mass method for heavy-flavor production at the LHC**
DIS 2021, Stony Brook University, NY, 04/2021
7. **New CTEQ Global Analysis of QCD with High Precision Data from the LHC**
HEP Group Meeting, University of Pittsburgh, PA, 11/2020
8. **BSM Physics at the Electron Ion Collider: Searching for Heavy Neutral Leptons**
Snowmass RF04 meeting, Virtual, 10/2020
9. **Small-x PDFs in the CTEQ-TEA global QCD analysis**
Snowmass EF06 meeting, Virtual, 07/2020
10. **The Electroweak PDFs (I): the general considerations**
Phenomenology 2020 Symposium, University of Pittsburgh, PA, 05/2020
11. **New CTEQ Global Analysis with High Precision Data from the LHC**
8th PIKIMO Meeting, University of Cincinnati, OH, 11/2019
12. **Light Fermiphobic Higgs Bosons in the Supersymmetric Georgi-Machacek Model**
HEP Group Meeting, University of Pittsburgh, PA, 09/2019
13. **Heavy flavor production at hadron colliders**
QCD@LHC 2019, State University of New York at Buffalo, NY, 07/2019
14. **Light Exotic Higgs Bosons in the Supersymmetric Georgi-Machacek Model**
SUSY 2019, Texas A&M University - Corpus Christi, TX, 05/2019
15. **Heavy flavor production at hadron colliders**
Phenomenology 2019 Symposium (Travel Award), University of Pittsburgh, PA, 05/2019

16. **New CTEQ global analysis of quantum chromodynamics with high precision data from the LHC**
APS April Meeting, Denver, CO, 04/2019
17. **Next-to-leading order general-mass scheme for heavy-quark production at the LHC**
CTEQ Workshop, Jefferson Lab, Newport News, VA, 11/2018
18. **Light (and darkness) from a light hidden Higgs**
6th PIKIO Meeting, University of Notre Dame, IN, 10/2018
19. **The Supersymmetric Georgi-Machacek Model**
Phenomenology 2018 Symposium, University of Pittsburgh, PA, 05/2018
20. **Type II seesaw mechanism and leptogenesis**
Journal Club, Fermilab, Batavia, IL, 04/2018
21. **Fast NLO computations with APPLgrid in PDF fitting**
HEP Group Meeting, Michigan State University, East Lansing, MI, 09/2016
22. **A hint of a new heavy particle at the LHC: *What do we see? What can it be?***
Research Day Poster Session (Dean's Award), Southern Methodist University, Dallas, TX 02/2016
23. **Heavy-quark mass treatment for deep inelastic scattering at N3LO level**
Fall 2015 Texas Section of APS Meeting (Travel Award), Baylor University, Waco, TX, 10/2015

Publications

The latest list of my publications, including citations, can be viewed in the data base of [INSPIRE HEP](#), [Google Scholar](#), and [Semantic Scholar](#).

- [1] M. Guzzi, K. Xie, T.-J. Hou, P. Nadolsky, C. Schmidt, M. Yan, and C. P. Yuan, "CTEQ-TEA group updates: Photon PDF and Impact from heavy flavors in the CT18 global analysis," in *European Physical Society Conference on High Energy Physics 2021*. 10, 2021. [arXiv:2110.11495 \[hep-ph\]](#).
- [2] L. A. Anchordoqui *et al.*, "The Forward Physics Facility: Sites, Experiments, and Physics Potential," [arXiv:2109.10905 \[hep-ph\]](#).
- [3] M. Guzzi *et al.*, "NNLO constraints on proton PDFs from the SeaQuest and STAR experiments and other developments in the CTEQ-TEA global analysis," in *28th International Workshop on Deep Inelastic Scattering and Related Subjects*. 8, 2021. [arXiv:2108.06596 \[hep-ph\]](#).
- [4] T. Han, W. Kilian, N. Kreher, Y. Ma, J. Reuter, T. Striegl, and K. Xie, "Precision Test of the Muon-Higgs Coupling at a High-energy Muon Collider," [arXiv:2108.05362 \[hep-ph\]](#).
- [5] K. Xie, J. M. Campbell, and P. M. Nadolsky, "A general-mass scheme for prompt charm production at hadron colliders," in *28th International Workshop on Deep Inelastic Scattering and Related Subjects*. 8, 2021. [arXiv:2108.03741 \[hep-ph\]](#).

- [6] M. Guzzi, P. Nadolsky, and K. Xie, “Impact of heavy-quark production measurements in the CT18 global QCD analysis of PDFs,” in *28th International Workshop on Deep Inelastic Scattering and Related Subjects*. 8, 2021. [arXiv:2108.01791 \[hep-ph\]](#).
- [7] K. Xie, T. J. Hobbs, T.-J. Hou, C. Schmidt, M. Yan, and C. P. Yuan, “The photon content of the proton in the CT18 global analysis,” in *28th International Workshop on Deep Inelastic Scattering and Related Subjects*. 7, 2021. [arXiv:2107.13580 \[hep-ph\]](#).
- [8] K. Xie, T. J. Hobbs, T.-J. Hou, C. Schmidt, M. Yan, and C.-P. Yuan, “The photon PDF within the CT18 global analysis,” [arXiv:2106.10299 \[hep-ph\]](#).
- [9] D. Buarque *et al.*, “Vector Boson Scattering Processes: Status and Prospects,” [arXiv:2106.01393 \[hep-ph\]](#).
- [10] T. Han, Y. Ma, and K. Xie, “Quark and Gluon Contents of a Lepton at High Energies,” [arXiv:2103.09844 \[hep-ph\]](#).
- [11] S. Klein *et al.*, “New opportunities at the photon energy frontier,” in *2022 Snowmass Summer Study*. 9, 2020. [arXiv:2009.03838 \[hep-ph\]](#).
- [12] T. Han, Y. Ma, and K. Xie, “High energy leptonic collisions and electroweak parton distribution functions,” *Phys. Rev. D* **103** no. 3, (2021) L031301, [arXiv:2007.14300 \[hep-ph\]](#).
- [13] T.-J. Hou *et al.*, “New CTEQ global analysis of quantum chromodynamics with high-precision data from the LHC,” *Phys. Rev. D* **103** no. 1, (2021) 014013, [arXiv:1912.10053 \[hep-ph\]](#).
- [14] T.-J. Hou *et al.*, “LHC and DIS experimental data in the CT18(Z) global QCD analysis,” *PoS DIS2019* (2019) 021, [arXiv:1909.00001 \[hep-ph\]](#).
- [15] T.-J. Hou *et al.*, “Progress in the CTEQ-TEA NNLO global QCD analysis,” [arXiv:1908.11394 \[hep-ph\]](#).
- [16] C.-P. Yuan *et al.*, “New CTEQ global analysis with high precision data from the LHC,” *PoS DIS2019* (2019) 001, [arXiv:1908.11238 \[hep-ph\]](#).
- [17] O. Amat *et al.*, “Impact of LHC top-quark pair measurements to CTEQ-TEA PDF analysis,” *PoS DIS2019* (2019) 017, [arXiv:1908.06441 \[hep-ph\]](#).
- [18] K. Xie, *Massive elementary particles in the Standard Model and its supersymmetric triplet Higgs extension*. PhD thesis, [Southern Methodist U.](#), 2019.
- [19] M. Guzzi, T.-J. Hou, S. Dulat, J. Gao, J. Huston, P. Nadolsky, C. Schmidt, J. Winter, K. Xie, and C.-P. Yuan, “CTEQ-TEA parton distribution functions with intrinsic charm,” *EPJ Web Conf.* **192** (2018) 00003, [arXiv:1810.00264 \[hep-ph\]](#).
- [20] R. Vega, R. Vega-Morales, and K. Xie, “Light (and darkness) from a light hidden Higgs,” *JHEP* **06** (2018) 137, [arXiv:1805.01970 \[hep-ph\]](#).
- [21] K. Xie, J. Campbell, and P. Nadolsky, “Next-to-leading order general-mass scheme for heavy-quark production at the LHC,” *SMU-HEP-18-03* (2018).
- [22] R. Vega, R. Vega-Morales, and K. Xie, “The Supersymmetric Georgi-Machacek Model,” *JHEP* **03** (2018) 168, [arXiv:1711.05329 \[hep-ph\]](#).

- [23] M. Guzzi, T.-J. Hou, S. Dulat, J. Gao, J. W. Huston, P. Nadolsky, C. Schmidt, J. Winter, K. Xie, and C.-P. Yuan, “CTEQ-TEA parton distributions functions with intrinsic charm,” *PoS DIS2017* (2018) 030.
- [24] T.-J. Hou, S. Dulat, J. Gao, M. Guzzi, J. Huston, P. Nadolsky, C. Schmidt, J. Winter, K. Xie, and C.-P. Yuan, “CT14 Intrinsic Charm Parton Distribution Functions from CTEQ-TEA Global Analysis,” *JHEP* **02** (2018) 059, [arXiv:1707.00657 \[hep-ph\]](#).
- [25] T.-J. Hou *et al.*, “CT14 Monte-Carlo parton distributions with positivity and asymmetric uncertainties,” *PoS DIS2016* (2016) 034.
- [26] T.-J. Hou *et al.*, “Reconstruction of Monte Carlo replicas from Hessian parton distributions,” *JHEP* **03** (2017) 099, [arXiv:1607.06066 \[hep-ph\]](#).
- [27] P. Nadolsky and K. Xie, “Resummed background for heavy diphoton resonances,” *SMU-HEP-16-08* (2016) .
- [28] J. R. Andersen *et al.*, “Les Houches 2015: Physics at TeV Colliders Standard Model Working Group Report,” in *9th Les Houches Workshop on Physics at TeV Colliders*. 5, 2016. [arXiv:1605.04692 \[hep-ph\]](#).
- [29] B. Wang, P. Nadolsky, and K. Xie, “Heavy-quark mass treatment for deep inelastic scattering at N3LO level,” *SMU-HEP-16-01* (2016) .
- [30] T. Cheng *et al.*, “Pre-CDR: Monte Carlo Tools for future collider projects,” *SppC Pre-CDR* (2014) .
- [31] K. Xie, W. Ke, W. Liang, X. Fu, C. Jiao, J. Pei, and F. Xu, “Collective rotations of fission isomers in actinide nuclei,” *Sci. China Phys. Mech. Astron.* **57** (2014) 189–193.

References

- **John Campbell**
Theoretical Physics Department
Fermi National Accelerator Laboratory
Batavia, IL 60510
Email: johnmc@fnal.gov
- **Ayres Freitas**
Department of Physics and Astronomy
University of Pittsburgh
Pittsburgh, PA, 15260
Email: afreitas@pitt.edu
- **Jun Gao**
School of Physics and Astronomy
Shanghai Jiao Tong University
Shanghai, China 200240
Email: jung49@sjtu.edu.cn
- **Tao Han**
Department of Physics and Astronomy
University of Pittsburgh
Pittsburgh, PA, 15260
Email: than@pitt.edu
- **Pavel Nadolsky** (PhD Advisor)
Department of Physics
Southern Methodist University
Dallas, TX 75275-0181
Email: nadolsky@smu.edu
- **Roberto Vega** (PhD Advisor)
Department of Physics
Southern Methodist University
Dallas, TX 75275-0181
Email: rvega@smu.edu
- **Roberto Vega-Morales**
Department of Physics
University of Granada
Granada, Spain
Email: rvegamorales@gmail.com
- **C.-P. Yuan**
Department of Physics and Astronomy
Michigan State University
East Lansing, MI 48824-2320
Email: yuan@pa.msu.edu