Keping Xie

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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 presetations

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 Worksop: 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 Sematic 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," *JHEP* **12** (2021) 162, 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 datain 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

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