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Dacheng Xu

徐 大 成

Education

2022–now **Doctor of Philosophy in Physics**, *Columbia University*
Dissertation: Search for Solar ^{8}B and pp Neutrinos with XENONnT
Advisor: Prof. Elena Aprile

2018–2022 **Bachelor of Engineering (Major: Engineering Physics)**, *Tsinghua University*
Dissertation: Probing Coherent Elastic Neutrino–Nucleus Scattering from Reactor Neutrinos with LXeTPC and HPGe Detectors
Advisor: Prof. Fei Gao & Prof. Litao Yang

Selected Research Experience

XENONnT Dark Matter Project

2025–now **Krypton Background Measurement System**
Develop a system to measure the krypton background in xenon at ppq-level sensitivity
- Commission a cold-trap system to isolate Krypton from xenon for residual-gas-analyzer-based measurement
- Improve sensitivity to solar pp neutrinos and heavy WIMP searche

2022–2026 **Solar ^{8}B CEνNS and Light Dark Matter Search**
Signal–background modeling and statistical inference for solar neutrino and light dark matter searche
- First indication of solar ^{8}B neutrino CEνNS and light dark matter search in the presence of "neutrino fog"
- Corresponding author of two PRL publications and main contributor to one more

2024–2026 **Analysis Coordinator of XENONnT**
Coordinated analysis efforts with focus on real-data provisioning and analysis software infrastructure
- Coordinated analysis activities across multiple working groups, ensuring efficient communication
- Ensured timely delivery and reliability of collaboration-wide analyses

2024 **Convener of Computing and Analysis Tools Group**
Led development of computing and analysis software infrastructure
- Developed and maintained HTC/HPC processing pipeline with 5 PB IO
- Designed a data-reprocessing workflow with improved stability adopted for latest XENONnT analyses

2023–2024 **Toy-MC Inference Framework**
Developed the open-source statistical inference framework for toy-MC based confidence interval constructions
- Designed a scalable, modular framework for large-scale toy-MC inference integrated with HPC workflows
- Adopted by multiple analyses (heavy WIMP, solar ^{8}B and pp neutrinos, etc.) and external collaborations

2022–2023 **GPU-based LXe Response Simulation and Inference**
Developed a open-source simulation and Bayesian inference framework for liquid xenon detector response
- Rewrote CUDA (C++) framework into JAX (Python) for improved usability and maintainability
- Enabled Bayesian inference with MCMC, widely used in dark matter and neutrino analyses in XENONnT

Jinping Neutrino Experiment (JNE)

2019–2021 **PMT Waveform Analysis for Neutrino Detection**
Developed waveform analysis methods to reconstruct photon timing and charge for MeV-neutrino measurements
- Improved time and charge resolution, enabling robust downstream analyses
- Applied statistical learning methods to enhance the charge resolution in low-occupancy regimes

Gamma-Ray Integrated Detectors (GRID)

2018–2022 **CubeSat Gamma-ray Transient Events Analysis**
Developed a data processing pipeline for CubeSat-based gamma-ray bursts (GRBs) monitoring
- Enabled the detection of over 40 GRBs as of 2025
- Built simulation framework for light curve and localization algorithm development

Selected Honors and Awards

2022.03 **Grand Prize of the 17th "Challenge Cup" Competition**, *Ministry of Education, etc.*
Student Extracurricular Academic and Technological Works Competition
Project: GRID-02 satellite payload calibration and scientific results

2021.12 & 2019.12 **Dongchang He Prize**, *Tsinghua University*
Highest award for undergraduate of the Department of Engineering Physics, achieved twice

2020.12 **NAOC Fellowship**, *National Astronomy Observatory of China, Chinese Academy of Sciences*
Three winners per year in Tsinghua University, for students in the field of astronomy nationwide

2020.12 **BOEING Scholarship**, *Tsinghua University*
Excellent Comprehensive Scholarship of Tsinghua University

Talks

Conferences

2025.06 **Talk: A measurement of the Solar Boron-8 Neutrino Fog with XENONnT**, *Rio de Janeiro, Brazil*
Magnificent CEvNS 2025

2025.06 **Talk: Data processing in XENONnT dark matter project**, *Madison, Wisconsin (online)*
Throughput Computing 2025

2024.10 **Talk: First Measurement of Solar ^{8}B Neutrinos via Coherent Elastic Neutrino-Nucleus Scattering with XENONnT**, *Blois, France*
Blois 2024: 35th Rencontres de Blois on "Particle Physics and Cosmology"

2024.07 **Talk: Search for Coherent Elastic Scattering of Solar ^{8}B Neutrinos in the XENONnT**, *Shandong University, China*
The 14th Conference of High Energy Physics Branch of Chinese Physical Society

2021.08 **Poster: Accurate and Robust PMT Waveform Analysis**, *Shandong University, China (online)*
The 13th Conference of High Energy Physics Branch of Chinese Physical Society

2021.06 **Poster: Optimized PMT Waveform Analysis**, *The University of Minnesota, US (online)*
The 28th International Workshop on Weak Interactions and Neutrinos (WIN2021)

2020.08 **Talk: PMT waveform analysis in neutrino experiments**, *Lawrence Berkeley National Laboratory, US (online)*
Dark-matter and Neutrino Computation Explored (DANCE) Machine Learning Workshop 2020

Seminars

2025.04 **Venturing into the Neutrino Fog with XENONnT**, *SLAC National Accelerator Laboratory, California*

2024.09 **A measurement of solar neutrino with XENONnT experiment**, *Stony Brook University, New York*

2024.09 **First Measurement of Solar ^{8}B Neutrinos via Coherent Elastic Neutrino-Nucleus Scattering with XENONnT**, *Brookhaven National Laboratory, New York*, Particle Physics Seminars at BNL

Mentoring

2025 **Khushi Vandra**, *Columbia University*, NSF Research Experiences for Undergraduates (REU)
S1 pulse shape discrimination in liquid xenon detectors

Teaching

2024 **Lecturer for XENONnT Computing Tutorial Series**, *Online*
Biweekly tutorial sessions on HTC/HPC computing in XENONnT context

2022–2025 **Teaching Assistant**, *Columbia University*, Six Semesters
Intermediate Laboratory Work
Weekly lab sessions at E. K. A. advanced physics lab, covering topics in optics, quantum and particle physics

Internships

2024.07 & 2026.01 **Visiting Researcher**, *Laboratori Nazionali del Gran Sasso*, Assergi, Italy
Operation and calibration shift for XENONnT

2021 **Undergraduate Researcher**, *Columbia University*, Summer Undergraduate Research
Data analysis on the XENON detector, including several signal selection criteria
Supervisor: Prof. Elena Aprile

Outreach Activities

2021–now **Open-source Projects Maintainer**, *Columbia University*
Promoted open and accessible use of XENONnT analysis tools across collaborations

References

Elena Aprile, *Centennial Professor of Physics*, Columbia University
Ph.D. advisor & XENON Spokesperson, Email: age@astro.columbia.edu

Fei Gao, *Associate Professor of Physics*, Tsinghua University
B.Eng. advisor, Email: feigao@mail.tsinghua.edu.cn

For a complete publications list, please refer to my INSPIRE profile.

Selected Publications

[1] Elena Aprile et al. WIMP Dark Matter Search Using a 3.1 Tonne-Year Exposure of the XENONnT Experiment. *Phys. Rev. Lett.*, 135:221003, 2025.

[2] E. Aprile et al. First Search for Light Dark Matter in the Neutrino Fog with XENONnT. *Phys. Rev. Lett.*, 134(11):111802, 2025.

[3] Elena Aprile et al. First Indication of Solar ^{8}B Neutrinos via Coherent Elastic Neutrino-Nucleus Scattering with XENONnT. *Phys. Rev. Lett.*, 133(19):191002, 2024. **Corresponding Author**.

[4] Chang Cai et al. Reactor neutrino liquid xenon coherent elastic scattering experiment. *Phys. Rev. D*, 110(7):072011, 2024.

[5] E. Aprile et al. The XENONnT dark matter experiment. *Eur. Phys. J. C*, 84(8):784, 2024.

[6] E. Aprile et al. First Dark Matter Search with Nuclear Recoils from the XENONnT Experiment. *Phys. Rev. Lett.*, 131(4):041003, 2023.

[7] E. Aprile et al. Search for New Physics in Electronic Recoil Data from XENONnT. *Phys. Rev. Lett.*, 129(16):161805, 2022.

[8] Dacheng Xu et al. Towards the ultimate PMT waveform analysis for neutrino and dark matter experiments. *JINST*, 17(06):P06040, 2022. **First Author**.

[9] Jiaxing Wen et al. GRID: a student project to monitor the transient gamma-ray sky in the multi-messenger astronomy era. *Exper. Astron.*, 48(1):77–95, 2019.