Austin Baty

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Curriculum Vitæ

Education and Research Experience

University of Illinois Chicago
Assistant Professor — *2023 -*
UIC High Energy Nuclear Physics Group (CMS, ePIC Collaborations)

Rice University
Research Scientist — *2023*
Rice Academy Postdoctoral Fellow — Advisor: Prof. Wei Li — *2019-2023*
Rice Relativistic Heavy Ion Group (CMS, H1 Collaborations)

Massachusetts Institute of Technology
Ph.D. in Physics — *2013-2019*
Research Assistant — Advisor: Prof. Gunther Roland
MIT Relativistic Heavy Ion Group (CMS Collaboration)

Texas A&M University
B.S. in Physics and Mathematics, Summa Cum Laude, University Honors — *2009-2013*
Research Assistant — Advisor: Prof. Peter McIntyre — *2012-2013*
Texas A&M Accelerator Research Lab

Awards and Honors

2022 Global Young Scientist Summit (GYSS) attendee — *2022*
CMS Collaboration Award — *2020*
Given "for his development work on the heavy ion track reconstruction and research activity aiming to evolve the tracker data storage scheme."
Best talk award at 2019 USA LHC Users' Association meeting — *2019*
Rice University Academy Postdoctoral Fellowship — *2019*
MIT School of Science Fellowship — *2013-2016*
Texas A&M Best Undergraduate STEM thesis — *2013*

Research Highlights

- Analyzer for precision experimental extraction of the speed of sound in the quark-gluon-plasma, using a novel method of examining head-on ultracentral heavy ion collisions.
- Analyzer for measurement observing QGP-like effects in single jets from pp collisions. Observes deviations from models which suggest new connections between nuclear and high-energy physics. Published as a PRL Editors' Suggestion.
- Main analyzer of a precision Z boson measurement in PbPb collisions, published in PRL. Proposes a method to remove modeling uncertainties and biases in LHC measurements.
- Main analyzer of the CMS Collaboration's 2015 charged particle nuclear modification factor paper. It has been cited over 300 times and had a figure featured in the CERN Courier.
- Author on a paper searching for collectivity in e^+e^- collisions using archived 30-year-old data from LEP. Provides a strong argument for open-data and data archival initiatives.
- Award-winning contributions to the CMS tracking detector, including leadership of the heavy ion tracking group for 7 years and a nearly 10x increase in heavy ion DAQ rate compared to 2012.

Leadership Positions

LPCC Heavy Ion Working Group Convener *2023 -*

This working group provides a forum for the Heavy Ion community to discuss priority topics. As a convener I organize public forums and topics of discussion.

ePIC Collaboration Council representative for UIC *2023 -*

I represent UIC's interests in high-level meetings used to dictate the organization and operation of the Collaboration.

Project Manager - CMS MTD ETL Nuclear Physics Consortium *2023*

I coordinated a group of 5 institutions (KU, MIT, ORNL, Rice, UIC) during the construction of this $18.4M timing detector that will be installed in CMS. I am responsible for the project being executed on-time and on-budget.

CMS Heavy Ion Heavy Flavor and Spectra group leader *2022 -*

Responsibilities include arranging meetings and providing analysis advice, reviewing new analyses to maintain quality, and arranging priorities for new data collection.

CMS Raw' Data Format Task Force Leader *2020 - 2023*

The group investigated new data formats to optimize event throughput. Leadership involved managing different skill sets, and communication to ensure proper integration. Ultimately resulted in a 35% increase in number of events gathered for the LHC Run 3.

CMS Heavy Ion Tracking Contact *2016 - 2022*

I coordinated 5-10 people working on tracking software. Responsibilities include mentoring students, organization, troubleshooting, and facilitating collaboration with other groups.

Others Skills and Certifications

Certified Associate in Project Management (CAPM) *2023*

A globally recognized credential from the Project Management Institute indicating training in professional project management. Skills tested include project leadership, ability to control the cost, schedule, and scope of large projects, and the ability to manage various stakeholder interests.

CMS Certified Language Editor *2018 -*

Indicates strong technical writing skills, and proficiency with LaTeX. I edit articles for the collaboration before they are submitted to a journal.

Scientific service work

Reviewer for DoE Graduate Student Research (SCGSR) Program *2024 -*

Reviewer for Physical Review C *2022 -*

Advocate for Congressional funding of physics *2020 - 2021*

I am a member of the contingent from the US LHC Users' Association that advocates for NSF and DoE funding. I set up meetings with members of Congress to update them about our scientific mission and remind them of the importance of their continued support.

Conference Session Chair

'4th Workshop on QCD Collectivity at the Smallest Scales' Qingdao, China. *2024*
'Opportunities of OO and pO collisions at the LHC' workshop at CERN. *2021*

Mentoring

Postdoctoral advisor

Prottoy Das: *2024 -*

PhD advisor

Jeetendra Gupta: *2024 -*
Vipul Pant: *2024 -*
Zheng Huang: *2023 -*
Shirsendu Nanda: *2023 -*
Nicholas Barnett: *2023 -*

Undergraduate research advisor

Raven Lee: Summer intern with CMS SPRINT/PURSUE program *2024*
Kyle Sabo: UIC Honors student *2024 - 2025*

Mentoring as a postdoc

Parker Gardner: Rice graduate student *2020 - 2023*

Mentoring as a graduate student

Anthony Badea: MIT undergraduate student *2018 - 2019*

UIC Service Work

Doctoral Preliminary Exam Committee Member

I have served on the following students' committees:
Shirsendu Nanda - 5/9/2024
Ricardo Escobar - 3/29/2024
Gavin Wilks - 12/19/2023
Clayton Bennett - 12/4/2023
Ziyue Zhang - 9/22/2023

UIC Physics Department Undergraduate Mentoring Committee: Aug. 2024 -
UIC Honors College Faculty Fellow: Aug. 2024 -
Physics Department Commencement Marshall: 5/5/2024
UIC Undergraduate Research Forum Judge: 4/15/2024
LAS Faculty Meeting Quorum member: 3/14/2023

Publications

As a member of the CMS Collaboration, I am a listed author on over 800 publications. A full list can be found at inspireHEP. Items here are ones I made notable contributions to. Being primary author indicates I was one of the main analyzers on the analysis, while secondary author indicates I provided support in the form of corrections, cross-checks, software, etc.. Paper editing contributions usually involved significant editing/rewrites of the paper.

As a primary author

Sept. 2024 The CMS Collaboration. *Observation of enhanced long-range elliptic anisotropies inside high-multiplicity jets in pp collisions at* $\sqrt{s} = 13$ *TeV.* PRL 133 (2024) 142301 (editors' suggestion).

June 2024 The CMS Collaboration. *Extracting the speed of sound in quark-gluon plasma created in ultrarelativistic lead-lead collisions at the LHC.* Rep. Prog. Phys. 87 (2024) 077801.

June 2024 The CMS Collaboration. *Observation of the multiplicity dependence* $\sigma_{\Psi(2S)}/\sigma_{J/\Psi}$ *of in pPb collisions at 8.16 TeV.* CMS PAS HIN-24-001.

May 2024 The CMS Collaboration. *Overview of high-density QCD studies with the CMS experiment at the LHC.* Submitted to Physics Reports.

Sept. 2023 The CMS Collaboration. *Pseudorapidity distributions of charged hadrons in PbPb collisions at* $\sqrt{s_{NN}} = 5.36$ *TeV.* Submitted to PLB

July 2023 Baty, A., Gardner, P., and Li, W. *Novel observables for exploring QCD collective evolution and quantum entanglement within individual jets.* Phys. Rev. C 107, 064908.

Aug. 2021 The CMS Collaboration. *Constraints on the Initial State of Pb-Pb Collisions via Measurements of Z-Boson Yields and Azimuthal Anisotropy at* $\sqrt{s_{NN}} = 5.02$ *TeV.* PRL 127 (2021) 102002.

Dec. 2020 The H1 Collaboration. *Search for collectivity in e-p collisions with H1.* Conference Note.

Nov. 2019 Badea, A., et al. *Measurements of two-particle correlations in* e^+e^- *collisions at 91 GeV with ALEPH archived data.* PRL 123 (2019) 212002.

June 2019 Baty, A. *Study of Parton Energy Loss in Heavy Ion Collisions using Charged Particle Spectra Measured with CMS.* Doctoral thesis.

Aug. 2018 The CMS Collaboration. *Charged-particle nuclear modification factors in XeXe collisions at* $\sqrt{s_{NN}} = 5.44$ *TeV.* JHEP 10 (2018) 138.

April 2017 The CMS Collaboration. *Charged-particle nuclear modification factors in PbPb and pPb collisions at* $\sqrt{s_{NN}} = 5.02$ *TeV.* JHEP 1704 (2017) 039.

Jan. 2016 The CMS Collaboration. *Measurement of transverse momentum relative to dijet systems in PbPb and pp collisions at* $\sqrt{s_{NN}} = 2.76$ *TeV.* JHEP 01 (2016) 006.

June 2015 The CMS Collaboration. *Jet Fragmentation Function in pPb Collisions at* $\sqrt{s_{NN}} = 5.02$ *TeV and pp Collisions at* $\sqrt{s} = 2.76$ *and 7 TeV.* CMS PAS HIN-15-004.

Sept. 2013 Sooby E. et al. *Candidate molten salt investigation for an accelerator driven subcritical core.* Journal of Nuclear Materials (2013) 440(1), 298–303.

June 2013 Baty, A. *Molecular Dynamics Simulation of the Transport Properties of Molten Transuranic Chloride Salts.* Undergraduate research thesis.

As a secondary author

Sept. 2024 The CMS Collaboration *Search for jet quenching signatures using transverse momentum balance in high-multiplicity pPb collisions at the CMS detector.* CMS PAS HIN-23-010.

Sept. 2024 Chen, Y.-C., et al. *Long-range near-side correlation in e^+e^- collisions at 183–209 GeV with ALEPH archived data.* PLB 856 (2024) 138957.

March 2023 Arslandok M., et al. *Hot QCD White Paper.* arXiv:2303.17254.

March 2023 Achenbach P., et al. *The Present and Future of QCD.* As submitted to the 2023 NSAC Long Range Planning committee.

June 2022 Chen, Y., et al. *Jet energy spectrum and substructure in e^+e^- collisions at 91.2 GeV with ALEPH Archived Data.* JHEP 06 (2022) 008.

June 2021 The CMS Collaboration. *First measurement of large area jet transverse momentum spectra in heavy-ion collisions.* JHEP 05 (2021) 284.

May 2021 The CMS Collaboration. *Measurement of b jet shapes in proton-proton collisions at $\sqrt{s}$=5.02 TeV.* JHEP 05 (2021) 054.

April 2019 The CMS Collaboration. *Jet shapes of isolated photon-tagged jets in PbPb and pp collisions at $\sqrt{s_{NN}}$=5.02 TeV.* PRL 122 (2019) 152001.

Dec. 2018 The CMS Collaboration. *Observation of medium-induced modifications of jet fragmentation in Pb-Pb collisions at $\sqrt{s_{NN}}$=5.02 TeV using isolated photon-tagged jets.* PRL 121 (2018) 242301.

April 2018 The CMS Collaboration. *Pseudorapidity distributions of charged hadrons in proton-lead collisions at $\sqrt{s_{NN}}$=5.02 and 8.16 TeV.* JHEP 01 (2018) 045.

March 2016 The CMS Collaboration. *Correlations between jets and charged particles in PbPb and pp collisions at $\sqrt{s_{NN}}$ = 2.76 TeV.* JHEP 02 (2016) 156

As the collaboration's paper editor

Oct. 2022 The CMS Collaboration. *Correlations between azimuthal anisotropy and mean transverse momentum in pp, pPb, and peripheral PbPb collisions.* Submitted to PRL.

Sept. 2024 The CMS Collaboration. *Search for medium-induced jet axis decorrelations with inclusive jets from PbPb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV.* CMS PAS HIN-24-010.

Sept. 2024 The CMS Collaboration. *The Bjorken-x evolution of gluon fields probed via incoherent J/Ψ photoproduction in ultraperipheral PbPb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV.* CMS PAS HIN-23-009.

Dec. 2023 The CMS Collaboration. *Probing small Bjorken−x nuclear gluonic structure via coherent J/Ψ photoproduction in ultraperipheral PbPb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV.* PRL 131, (2023) 262301.

Oct. 2023 The CMS Collaboration. *Measurements of the azimuthal anisotropy of charmonia in PbPb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV.* JHEP 10 (2023) 115.

Mar. 2023 The CMS Collaboration. *Multiplicity dependence of charm baryon and meson production in pPb collisions at 8.16 TeV.* CMS-PAS-HIN-21-016.

July 2022 The CMS Collaboration. *Probing charm quark dynamics via multiparticle azimuthal correlations in 5.02 TeV PbPb collisions.* PRL 129, (2022) 022001 .

Sept. 2021 The CMS Collaboration. *Observation of forward neutron multiplicity dependence of dimuon acoplanarity in ultraperipheral PbPb collisions at* $\sqrt{s_{NN}}$*= 5.02 TeV.* PRL 127, (2021) 122001.

July 2020 The CMS Collaboration. *Measurement of quark- and gluon-like jet fractions using jet charge in PbPb and pp collisions at 5.02 TeV.* JHEP 07 (2020) 115.

Outreach and Public Relations Articles

Feb. 2024 The CMS Collaboration. *Hearing the sound of quark-gluon plasma.* CERN homepage News Release, February 16, 2024.

Jan. 2024 The CMS Collaboration. *A Big Bang from a Quantum Quark?* CMS News Release, January 22, 2024.

Jan. 2024 The CMS Collaboration. *QGP production studied at record energies.* CERN Courier Jan/Feb Issue, (2024) p16.

Seminars and Colloquia

July 2024 Seminar — *High-energy nuclear physics and heavy ion collisions with CMS.* July 3, 2024. CMS PURSUE/SPRINT Program Seminar, Fermilab, Chicago, Il..

May 2024 Seminar — *Speed of sound in quark-gluon plasma.* May 16, 2024. Collider cross talk seminar, CERN Department of Theoretical Physics, Geneva, Switzerland.

May 2024 Colloquium — *Emergence in trillion-degree matter and other high-density systems.* May 6, 2024. Enrico Fermi Institute Colloquium, University of Chicago, Chicago, Illinois.

April 2024 Colloquium — *UIC at the LHC and EIC: The Present and Future of Nuclear Physics.* April 10, 2024. UIC Faculty Colloquium, Chicago, Illinois.

Jan. 2023 Seminar — *Jets and trillion-degree matter: studying QCD at multiple scales.* Jan. 26, 2023. Yale University Nuclear, Particle, and Astrophysics seminar, New Haven, Connecticut.

July 2023 Seminar — *Observation of enhanced long-range elliptic anisotropies inside high-multiplicity jets in pp collisions at the LHC.* July 18, 2023. LHC Seminar, LHC Physics Center at CERN (LPCC), Geneva, Switzerland.

April 2023 Colloquium — *Jets and trillion-degree matter: studying the emergence of QCD phenomena.* April 5, 2023. University of Illinois Chicago Physics Colloquium, Chicago, Illinois.

Feb. 2022 Colloquium — *Trillion Degree Matter: Probing the emergence of the quark-gluon plasma.* Feb. 3, 2022. Vanderbilt University Department of Physics and Astronomy Colloquium, Nashville, Tennessee.

Feb. 2022 Seminar — *Trillion Degree Matter: Probing the emergence of the quark-gluon plasma.* Feb. 1, 2022. Rice University Nuclear and Particle Physics Seminar, Houston, Texas.

Oct. 2019 Seminar — *Searching for collectivity in small systems using e^+e^- data from ALEPH*, October 1, 2019. LBL Heavy Ion Tea Seminar, Berkeley National Lab, Berkeley, California.

Feb. 2019 Seminar — *Exploring charged particle production in the quark-gluon plasma: from e^+e^- to PbPb*, Feb. 7, 2019. CU Boulder, Boulder, Colorado.

Conference Presentations

Talks at larger conferences and high profile talks are indicated by bold font.

Sept. 2024 Parallel — *Observation of the multiplicity dependence of $\sigma_{\psi(2S)}/\sigma_{J/\psi}$ in pPb collisions and implications for comover effects.* September 25, 2024. Hard Probes 2024, Nagasaki, Japan.

Aug. 2024 Workshop — ***Final state interactions in heavy ion collisions with CMS and at the EIC.* August 21, 2024. Heavy Ion Physics in the EIC Era Workshop, Institute for Nuclear Theory, Seattle, Wa..**

June 2024 Workshop — ***Collectivity in jets: Experiment.* June 25, 2024. 4th International Workshop on QCD Collectivity at the Smallest Scales, Qingdao, China.**

June 2024 Parallel — *Measurement of the multiplicity dependence of charm hadron production in pPb collisions with CMS.* June 4, 2024. 21st International Conference on Strangeness in Quark Matter, Strasbourg, France.

June 2024 Parallel — *Long range correlations in high-multiplicity e^+e^- collisions using archived ALEPH data at 91-209 GeV.* June 4, 2024. 21st International Conference on Strangeness in Quark Matter, Strasbourg, France.

Nov. 2023 Workshop — *Extracting the speed of sound in the strongly interacting matter in ultrarelativistic nuclear collisions.* Nov. 21, 2023. 14th International Workshop on Multiple Parton Interactions at the LHC, Manchester, UK.

Sept. 2023 Plenary ***Overview of Recent CMS Results.*** **Sept. 4, 2023. Quark Matter 2023, Houston, Texas.**

June 2023 Parallel *Status of DOE-NP ETL Project.* June 1, 2023. US CMS Annual Collaboration Meeting, Carnegie Mellon University, Pittsburgh, Pennsylvania.

Mar. 2023 Plenary ***Overview of Recent Experimental Electroweak Probes Results.*** **March 27, 2023. Hard Probes 2023, Aschaffenburg, Germany.**

Oct. 2022 Parallel *Constraints on the initial state of heavy ion collisions at the LHC using electroweak bosons.* Oct. 14, 2022. Fall Meeting of the Texas Section of the APS, Houston, Texas.

June 2022 Plenary ***Overview of recent heavy ion results.*** **June. 29, 2022. CMS Week, CERN, Switzerland.**

April 2022 Parallel ***Electroweak probes as tools for understanding initial state effects in heavy ions with CMS.*** **April. 7, 2022. Quark Matter 2022, Krakow, Poland.**

Aug. 2021 Parallel *Measurement of charged particle multiplicity distributions in DIS at HERA and its implication to entanglement entropy of partons.* Aug. 5, 2021. 14th Quark Confinement and the Hadron Spectrum Conference.

Jan. 2021 Parallel ***Measurement of initial stages via color neutral probes in pPb and PbPb.*** **Jan. 14, 2021. Initial Stages 2021.**

Oct. 2020 Parallel *New constraints of initial states in PbPb collisions with Z boson yields and azimuthal anisotropy at 5.02 TeV.* Oct. 29, 2020. APS Division of Nuclear Physics fall meeting (DNP 2020).

Oct. 2020 Parallel *Future opportunities for exploring collectivity using extra small systems.* Oct. 28, 2020. Snowmass EF07 meeting: High Density QCD in Small Collision Systems

June 2020 Parallel ***Probing initial and final state effects with Z bosons in PbPb and Drell-Yan in pPb with the CMS detector*****, June 3rd, 2020. Hard Probes 2020.**

Nov. 2019 Workshop *Electroweak Boson production in Heavy-Ion Collisions from CMS*, November 11th, 2019. A Workshop on Heavy Flavor and Dilepton Production in Relativistic Heavy-Ion Collisions (HeFe2019), University of Science and Technology of China, Hefei, China.

Nov. 2019 Parallel ***Collectivity of Heavy Flavor Hadrons in pp and pPb Collisions with the CMS Detector*****, November 5th, 2019. Quark Matter 2019, Wuhan, China.**

Oct. 2019 Parallel *Using charged particles to study jet quenching in heavy ion collisions with CMS*, October 17, 2019. US LHC Users Association Annual Meeting 2019, Rice University, Houston, Texas.

June 2019 Plenary ***Searches for the ridge in DIS and*** e^+e^-**, June. 27, 2019. Initial Stages 2019, Columbia University, New York City, New York.**

June 2019 Parallel *Studies of archived* e^+e^- *and HERA data*, June. 4, 2019. 2019 RHIC & AGS Annual Users' Meeting, Brookhaven National Lab, Brookhaven, New York.

Dec. 2018 Workshop *Measurements of two-particle correlations in* e^+e^- *collisions at 91 GeV with ALEPH archived data*, Dec. 11, 2018. 10th International Workshop on Multiple Parton Interactions at the LHC, Perugia, Italy.

Oct. 2018 Parallel ***Charged Particle Nuclear Modification Factors in pPb, PbPb, and XeXe Collisions with CMS*****, Oct. 2, 2018. Hard Probes 2018, Aix-Les-Bains, France.**

May 2018 Parallel ***Charged Particle Nuclear Modification Factors in pPb, PbPb, and XeXe Collisions with CMS*****, May 15, 2018. Quark Matter 2018, Venice, Italy.**

Sept. 2017 Parallel ***Boson+Jet Correlations and Boson-Tagged Jet Substructure in pp and PbPb collisions at 5.02 TeV with CMS*****, Sept 20, 2017. Initial Stages 2017, Krakow, Poland**

Sept. 2016 Parallel ***Charged particle nuclear modification factor in PbPb at 5.02 TeV with CMS*****, Sept 25, 2016. Hard Probes 2016, Wuhan, China**

July 2016 Workshop *Jet and Hadron R_{AA}*, July 27, 2016. 4th Heavy-Ion Jet Workshop, Paris, France

May 2016 Parallel ***Charged-particle production in PbPb and pp collisions at 5 TeV with CMS*****, May 24, 2016. Initial Stages 2016, Lisbon, Portugal**

Sept. 2015 Parallel ***Fragmentation patterns of jets in pPb collisions in CMS*****, September 28, 2015. Quark Matter 2015, Kobe, Japan**