June 22, 2025

Anthony Badea

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Research Interests

My research goal is to deepen our understanding of the fundamental forces of nature and early universe by studying systems produced by energetic particle collisions. I have made significant contributions through my work on the ATLAS experiment at the Large Hadron Collider and my research at the intersection of particle physics, nuclear physics, and computer science. My achievements include characterizing high multiplicity hadronic systems produced by electron-positron, proton-proton, and lead-lead collisions to probe underlying quantum dynamics and search for imprints of new particles. I have also made notable technology advances, including commissioning a new particle detector, and developing novel machine learning methods in software and hardware.

Appointments

Schmidt Research Fellow, Enrico Fermi Institute, University of Chicago	2023 - 2025

Education

Ph.D. Physics, Harvard University	2023
M.A. Physics, Harvard University	2020
B.S. Double Major Physics and Mathematics, MIT	2019

Publications

In Progress: A weakly-supervised search for multijet resonances in pp collisions at $\sqrt{s} = 13.6$ TeV with the ATLAS detector. The ATLAS Collaboration	2025
In Progress: In-Pixel integration of signal processing and AI/ML based data filtering for particle tracking detectors. Badea, Gingu, Parpillon et al.	2025
In Progress: Fully-corrected and unbinned measurement of thrust in e^+e^- collisions at 91 GeV with archived ALEPH data. Badea and Nachman et al.	2025
In Progress: Reinterpretation of searches for supersymmetry models with long-lived particles using the ATLAS experiment at the LHC. The ATLAS Collaboration	2025
Measurement of energy-energy correlator in e^+e^- collisions at 91 GeV with archived ALEPH data. Bossi et al, 2505.11828	2025

Observation of $t\bar{t}$ production in Pb+Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with the ATLAS detector. The ATLAS Collaboration, *PRL Editors' Suggestion*, 2411.10186, CERN Physics Briefing, ATLAS Physics Briefing, ATLAS Video Briefing, APS Physics Viewpoint, Nature Research Highlight	2024
Smart Pixels: In-pixel AI for on-sensor data filtering. Parpillon et al., *IEEE NSS MIC RSTD 2024*, 2406.14860	2024
The quest to discover supersymmetry at the ATLAS experiment. The ATLAS Collaboration, *submitted to Physics Reports*, 2403.02455	2024
The ATLAS Trigger System for LHC Run 3 and Trigger performance in 2022. The ATLAS Collaboration, *JINST*, 2401.06630	2024
A data-driven and model-agnostic approach to solving combinatorial assignment problems in searches for new physics. Badea and Berlingen, *PRD*, 2309.05728	2024
A search for R-parity-violating supersymmetry in final states containing many jets in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector. The ATLAS Collaboration, *JHEP*, 2401.16333, ATLAS Physics Briefing	2023
The ATLAS Experiment at the CERN LHC: A Description of the Detector Configuration for Run 3. The ATLAS Collaboration, *JINST*, 2305.16623	2023
The New Small Wheel Electronics. Iakovidis et al., *JINST*, 2303.12571	2023
Long-range near-side correlation in e^+e^- Collisions at $\sqrt{s} = 189 - 209$ GeV with ALEPH Archived Data. Chen et al., *PLB*, 2312.05084	2023
Jet energy spectrum and substructure in e^+e^- collisions at $\sqrt{s} = 91$ GeV with ALEPH archived data. Chen et al., *JHEP*, 2111.09914	2022
Solving Combinatorial Problems at Particle Colliders Using Machine Learning. Badea et al., *PRD*, 2201.02205	2022
Measurements of two-particle correlations in e^+e^- collisions at $\sqrt{s} = 91$ GeV with ALEPH archived data. Badea et al., *PRL*, 1906.00489	2019

Presentations

ATLAS Experiment Lecture Series (invited), Geneva, CH	2025
MIT LNS Seminar (invited), Boston, USA	2025
CERN Collider Cross Talk (invited), Geneva, CH	2024
ICHEP, Prague, CZ	2024
UChicago AI+Science Summer School, Chicago, USA	2024
UChicago DSI Research Day, Chicago, USA	2024
Moriond Electroweak, La Thuile, IT	2024
University of Tennessee (invited), Knoxville, USA	2024
Korea Institute For Advanced Study (invited), Virtual	2024
MuC Annual Meeting, Geneva, CH	2024
6^{th} CERN Machine Learning Workshop, Geneva, CH	2024
Schmidt Future Workshop, Lake Geneva, USA	2023

5th ATLAS Machine Learning Workshop, Virtual	2021
ICHEP, Virtual	2020
Snowmass Computational Frontier (invited), Virtual	2020
4th FCC Physics Workshop (invited), Virtual	2020
BOOST, Virtual	2020
JETSCAPE, College Station, USA	2019
ICHEP, Seoul, KR	2018
Quark Matter, Venice, IT	2018

Honors

Breakthrough Prize in Fundamental Physics to LHC Collaborations	2025
Singapore Global Young Scientist Summit Attendee	2025
94th Enrico Fermi Institute Arthur H. Compton Lectures	2024
Harvard Certificate of Distinction in Teaching	2020
MIT Malcom Cotton Brown Outstanding Senior Experimentalist	2019
MIT News Cover	2019
Rhodes Scholarship Finalist	2019

Professional Activities

Co-organizer for UChicago AI+Science Hackathon [1, 2]	2024 - 2025
Co-organizer for UChicago AI+Science Summer School [1]	2024 - 2025
Physical Review D Referee	2024
Schmidt Sciences Article – Machine Learning Optimized Experiment Design	2024
Harvard Teaching Assistant for Elementary Particle Physics	2020
Harvard Science Article – The Quark Soup	2019

Funding

UChicago Research Computing Center Allocation (110k CPU hours)	2024 - 2025
UChicago AI and Science Research Initiative Grant ($15k and GPU time)	2024 - 2025
UChicago Schmidt AI in Science Postdoctoral Fellowship ($95k/year)	2023 - 2025
Stanford Science Fellowship (declined) ($93k/year)	2023
Harvard Frederick Sheldon Traveling Fellowship ($40k)	2021 - 2022
Harvard Graduate Prize Fellowship (Full Ph.D. funding)	2019 - 2023
MIT Undergraduate Research Opportunities Program Grant ($15k/year)	2016 - 2019

References

Professor John Huth, Harvard University, huth@g.harvard.edu, PhD Advisor
Professor Matthias Schott, University of Bonn, mschott@uni-bonn.de, Collaborator
Professor Ann Syfrla, University of Geneva, anna.sfyrla@unige.ch, Collaborator
Professor Ed Blucher, University of Chicago, blucher@hep.uchicago.edu, Fellowship Mentor
Microelectronics Division Head Farah Fahim, Fermilab, farah@fnal.gov, Collaborator
Senior ASIC Engineer Ben Parpillon, Fermilab, bparpill@fnal.gov, Collaborator

Professor Iwona Grabowska-Bold, AGH Krakow, iwona.grabowska@cern.ch, Collaborator
Professor Theodoros Alexopoulos, NTU Athens, theoalex@central.ntua.gr, Collaborator
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Professor Yen-Jie Lee, MIT, yenjie@mit.edu, Bachelors Advisor