

Abhisek Datta

PERSONAL DATA	Assistant Professor University of Notre Dame E-mail: adatta2@nd.edu	Office: 405 Nieuwland Science Hall Notre Dame, IN 46556, USA Phone: +1 607-280-7963
RESEARCH INTERESTS	Experimental particle physics at high energy colliders, with my interests ranging from development and operation of particle detectors to state-of-the-art data analysis techniques to understand the properties of the Higgs boson as well as to search for new physics.	
PROFESSIONAL POSITIONS	Assistant Professor , Department of Physics and Astronomy University of Notre Dame, USA	2025 – Present
	Postdoctoral Scholar , Department of Physics and Astronomy University of California, Los Angeles (UCLA), USA	2020 – 2025
EDUCATION	Ph.D. in Physics Cornell University, USA Thesis Title: Higgs Production in Association with a Top Quark-Antiquark Pair and Decaying into a Bottom Quark-Antiquark Pair at the CMS Experiment	2020
	Master of Science in Physics Cornell University, USA	2018
	Bachelor and Master of Science (Honors) in Physics Indian Institute of Technology (IIT) Kharagpur, India Gold medalist for securing 1 st rank among 1250 students across all majors	2015
OTHER APPOINTMENTS HELD	Level-3 Coordinator , USCMS Endcap Muon Management CMS Collaboration, CERN, Switzerland	2025 – Present
	Level-2 Coordinator , GEM Electronics Group CMS Collaboration, CERN, Switzerland	2022 – Present
	Level-3 Coordinator , Pixel Commissioning and Calibrations Group CMS Collaboration, CERN, Switzerland	2018 – 2020
PUBLICATIONS	Co-author of 738 papers published by the CMS Collaboration since 2018. The following selected publications include significant personal contributions. Selected CMS Publications: The CMS Collaboration, Hayrapetyan, A et al., “Measurement of the $t\bar{t}H$ and tH production rates in the $H \rightarrow b\bar{b}$ decay channel with 138 fb ⁻¹ of proton-proton collision data at $\sqrt{s} = 13$ TeV”, J. High Energ. Phys. 2025, 97 (2025), https://doi.org/10.1007/JHEP02(2025)097 Abhisek Datta, on behalf of the CMS Collaboration, “Development of readout electronics for the CMS ME0 muon detector”, Nuclear Instruments and Methods in Physics Research Section A: Ac-	

celerators, Spectrometers, Detectors and Associated Equipment, Volume 1047, **2023**, 167872, ISSN 0168-9002, <https://doi.org/10.1016/j.nima.2022.167872>

The CMS Tracker Collaboration, “The CMS Phase-1 pixel detector upgrade”, W. Adam et al., **2021** JINST 16 P02027, <https://doi.org/10.1088/1748-0221/16/02/p02027>

The CMS Collaboration, “Combined Higgs boson production and decay measurements with up to 137 fb^{-1} of proton-proton collision data at $\sqrt{s} = 13 \text{ TeV}$ ”, CMS PAS HIG-19-005 (**2020**), <https://cds.cern.ch/record/2706103>

The CMS Collaboration, “Measurement of $t\bar{t}H$ production in the $H \rightarrow b\bar{b}$ decay channel in 41.5 fb^{-1} of proton-proton collision data at $\sqrt{s} = 13 \text{ TeV}$ ”, CMS PAS HIG-18-030 (**2019**), <https://cds.cern.ch/record/2675023>

The CMS Collaboration, Sirunyan, A.M. et al., “Search for $t\bar{t}H$ production in the $H \rightarrow b\bar{b}$ decay channel with leptonic $t\bar{t}$ decays in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, J. High Energ. Phys. 2019, 26 (**2019**), [https://doi.org/10.1007/JHEP03\(2019\)026](https://doi.org/10.1007/JHEP03(2019)026)

The CMS Collaboration, Sirunyan, A.M. et al., “Observation of $t\bar{t}H$ production” Phys. Rev. Lett. 120, 231801 (**2018**), <https://doi.org/10.1103/PhysRevLett.120.231801>

Other Publications:

Abhisek Datta, Anwesh Mazumdar, Umang Gupta, Saskia Hekker, “Automated determination of g-mode period spacing of red-giant stars”, Monthly Notices of the Royal Astronomical Society, Volume 447, Issue 2, 21 February **2015**, Pages 1935-1950, <https://doi.org/10.1093/mnras/stu2499>

V. Silva Aguirre, G. Ruchti, S. Hekker, S. Cassisi, J. Christensen-Dalsgaard, A. Datta, A. Jendrieck, J. Jessen -Hansen, A. Mazumdar, B. Mosser, D. Stello, P. Beck, J. De Ridder, “Old puzzle, new insights: a lithium rich giant quietly burning helium in its core”, **2014** ApJL 784 L16, <https://doi.org/10.1088/2041-8205/784/1/L16>

AWARDS AND FELLOWSHIPS

Co-recipient of the 2025 Breakthrough Prize in Fundamental Physics as a member of the CMS Collaboration	2025
CMS Award for leadership roles in design, construction, and integration of the electronics for the new ME0 GEM muon detectors and its associated software and as L2 Coordinator for GEM electronics	2023
Distinguished Graduate Teaching Assistant Award in General Physics - I course at Cornell University	2015
Hartman Memorial Teaching Award from the Physics Department at Cornell University	2015
Prime Minister of India Gold Medal for securing the 1 st rank among 1250 students across all majors at IIT Kharagpur	2015
WISE (Working Internships in Science and Engineering) Fellowship by the German Academic Exchange Service (DAAD) for summer internship	2013
Best Presentation Award at the Visiting Students Research Programme (VSRP) at TIFR	2012
Summer Research Fellowship in Physics by the Indian Academy of Sciences (IAS)	2012

	Represented India and won the Best Question Award at the 5th Asian Science Camp hosted at KAIST, South Korea	2011
	NIUS-PHYSICS (National Initiative on Undergraduate Science) Fellowship	2011
	Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship by the Govt. of India	2010
	NTSE (National Talent Search Examination) Scholarship by NCERT, Govt. of India	2008
LIST OF TALKS AND POSTERS	“Search for $HH \rightarrow b\bar{b}WW^*$” CMS Week Physics Plenary, CERN, Switzerland	Feb 2026
	“ME0 Electronics” ME0 Manufacturing Progress Review (MPR), CERN, Switzerland	Nov 2025
	“Improvements to the Higgs Boson Self-Interaction Measurement in the $HH \rightarrow b\bar{b}WW^*$ Channel” US CMS Annual Meeting, Rice University, USA	May 2025
	“ATLAS and CMS non-resonant HH searches in the 2b2l/2b2V final states” Higgs Pairs Workshop 2025, La Biodola, Italy	May 2025
	“From Top Quarks to Self-Coupling: Is the Higgs Boson Extrovert or Introvert” Colloquium, University of Nebraska-Lincoln, USA	Feb 2025
	Colloquium, University of Notre Dame, USA	Jan 2025
	“CMS Status Report” US LHC Users Association Annual Meeting, SLAC, USA	Dec 2024
	“Status of ME0 Production and Testing” CMS Phase-II Upgrades Group (P2UG) Review, CERN, Switzerland	Nov 2024
	“New Triggers with Lower Lepton-p_T for HH and Other Analyses” : Poster “Muon GEM/CSC Backend Upgrade for LS-3: Status and Planning” US CMS Annual Meeting, Princeton University, USA	Jun 2024
	“Measurements of Higgs Boson Properties with the CMS Experiment at the Large Hadron Collider” Seminar, Cornell University, USA	Feb 2024
	Seminar, California Institute of Technology, USA	Jan 2024
	Colloquium, Texas A&M University, USA	Jan 2024
	“$t\bar{t}H$ and tH Production with $H \rightarrow b\bar{b}$ at the CMS Experiment” Higgs 2023 Conference, Institute of High Energy Physics (IHEP), China	Nov 2023
	Topic of the Week Seminar, LHC Physics Center, Fermilab, USA	Nov 2023
	Seminar, University of Wisconsin-Madison, USA	Nov 2023
	Seminar, University of California, Los Angeles (UCLA), USA	Oct 2023
	Seminar, Tata Institute of Fundamental Research (TIFR), India	Sep 2023
	“Status of GEM GE2/1 and ME0 Upgrade Projects” US CMS Annual Meeting, Carnegie Mellon University, USA	Jun 2023

“ME0 On-Chamber Electronics Design and Interfaces” ME0 Electronics Systems Review (ESR), CERN, Switzerland	May 2023
“ME0: The New Far Forward Muon Detector in CMS” US CMS Annual Meeting, University of Wisconsin-Madison, USA	Jun 2022
“Development of Readout Electronics for the CMS ME0 Muon Detector” : Poster 15th Pisa Meeting on Advanced Detectors, La Biodola, Italy	May 2022
“Measurement of $t\bar{t}H$ production in the $H \rightarrow b\bar{b}$ decay channel at CMS” APS Meeting of the Division of Particles and Fields, Northeastern University, USA	Jul 2019
“Overcoming DCDC Converter Challenges: Impact on Operation of the CMS Pixel Detector” : Poster EIROforum School on Instrumentation, ESTEC, Netherlands	May 2019
“Pixel Operation, Commissioning and Calibration Plans in 2019/LS2” CMS Week, CERN, Switzerland	Dec 2018
“Pixel Detector Status Report” Tracker Week, CERN, Switzerland	Jul 2018

RESEARCH IN PARTICLE PHYSICS	CMS (Compact Muon Solenoid) Experiment at the LHC (Large Hadron Collider), CERN (European Council for Nuclear Research) Member since 2015
	University of Notre Dame, USA 2025 – Present

Search for non-resonant HH Production in the $HH \rightarrow b\bar{b}WW^*$ Decay Channel at CMS

- One of the most sensitive channels to search for HH production in order to probe the Higgs boson self-interaction strength as a test for the Standard Model.
- Exploring different machine learning techniques to improve the sensitivity of this search.
- Currently analyzing the data collected in Run 3 of the LHC with these new analysis strategies, with preliminary studies showing promising results.

Construction & Commissioning of the ME0 Gas Electron Multiplier (GEM) Detector

- As the coordinator of the GEM Electronics group (50 members), supervising the R&D, production, testing, and operation of the electronic readout system for new muon GEM detectors at CMS (including ME0), as part of the upgrade for the High Luminosity (HL) LHC.
- Involved in the construction of six-layer ME0 detector stacks integrated with electronics, at CERN, which will be installed in the CMS endcap.
- Working with engineers to finalize the back-end FPGA firmware for the readout system of ME0, including an algorithm for muon track finding to be used in the CMS Level-1 trigger.

University of California, Los Angeles (UCLA), USA	2020 – 2025
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Search for non-resonant HH Production in the $HH \rightarrow b\bar{b}WW^*$ Decay Channel at CMS

- Designed new trigger algorithms for Run 3 (currently taking data) by combining cuts on kinematic properties of leptons and jets to lower thresholds on lepton momentum and increase signal acceptance and thus improve the sensitivity.
- Developed new analysis strategies using deep neural networks to improve the sensitivity of this measurement in Run 3.

Measurement of $t\bar{t}H$ and tH Production Rates in the $H \rightarrow b\bar{b}$ Decay Channel at CMS using Full Run-2 Data

- One of the most sensitive channels for probing the Top-Higgs Yukawa coupling. Published results using data from full Run 2 (2016-2018) of the LHC, which included several improvements in the background modeling and analysis strategies as compared to previous measurements performed.
- Performed measurements of both the overall $t\bar{t}H$ production rate and in intervals of the Higgs boson transverse momentum. Also set constraints on the tH production rate and the strength and structure of the Top-Higgs coupling.

Design of the Readout System for the ME0

- Responsible for the design, testing, and production of the ME0 optohybrid (OH) electronic board at UCLA. The OH collects data from the front-end electronics over electrical links and converts it into optical signals for transmission to the back-end data acquisition system.
- Set up quality control test-stands (at UCLA and CERN) and developed software for validating the OH and other readout electronics individually, and also when integrated with GEM detectors.
- Completed the production and testing of around 1000 OH boards to be used in CMS.

Muon Track Finding in ME0 for CMS Level-1 Trigger

- Developed the algorithm for muon track finding in ME0, to be used as inputs to the hardware-based (Level-1) trigger system in CMS.
- Optimized the algorithm using simulation by studying its performance in the presence of expected background at HL-LHC.

Cornell University, USA

2015 – 2020

Measurement of $t\bar{t}H$ Production Rate in the $H \rightarrow b\bar{b}$ Decay Channel at CMS using Partial Run-2 Data

- Published results using data from 2016 and 2017, which showed the first evidence for $t\bar{t}H(H \rightarrow b\bar{b})$ at CMS (2016 + 2017 data), compatible with Standard Model predictions. The results using 2016 data, combined with other Higgs decay channels, led to the first observation of $t\bar{t}H$ at CMS.
- Developed new single electron triggers to increase the signal efficiency for 2017 and 2018 data.
- Performed background estimation studies for the major irreducible background to $t\bar{t}H(H \rightarrow b\bar{b})$ from $t\bar{t} + b\bar{b}$ production.

Development and Monitoring of Triggers for Higgs and Top Quark Analyses at CMS

- Developed single electron plus jet/ H_T cross-triggers for measurement of $t\bar{t}H$, Single- t and $t\bar{t}$ production, to increase signal efficiency at lower electron p_T .
- Used by several Higgs and Top analyses for 2017 and 2018 data. Performance plots for these triggers are now public. Measured scale factors for these triggers to match their efficiency in simulation to data for the full Run-2 data period.

Operation and Data Acquisition Software for the Phase-1 Pixel Detector in CMS

- Extensively involved in the operation of the CMS Pixel Detector during data taking in 2018 including several on-call expert shifts.
- Developed procedures to overcome challenges faced with DC-DC converters during powering and recovery of stuck components, which was critical in ensuring smooth data taking in 2018.
- As the Coordinator of the Pixel Commissioning and Calibrations group (10 members), supervised several projects to improve and optimize the calibration procedures and operation tools.
- Improved the data acquisition (DAQ) software, adapting to a new framework and added features to monitor DC-DC converters and other components.
- Maintained operational test setups for the pixel detector in clean rooms at CERN, used for testing operation tools and DAQ software before commissioning for the full detector.

CRESST Experiment for Direct Detection of WIMP Dark Matter

Max Planck Institute for Physics, Germany

2013

- Fabricated Transition Edge Sensors (TES), by making thin superconducting films by metal evaporation, sputtering, and photolithography processes, for testing new components. CRESST uses TES to detect phonon and light signals that can be produced by elastic scattering of WIMPs with the target nuclei. Also worked with ^3He – ^4He dilution refrigerators to test these sensors.

INO-ICAL Experiment for Neutrino Studies

Tata Institute of Fundamental Research (TIFR), India

2012

- Studied the variation in cosmic muon rate using an INO-ICAL prototype detector. Resistive Plate Chambers (RPC) are the active detector elements in INO-ICAL and a prototype RPC stack was used as a cosmic muon telescope. Used the data from this stack to find muon tracks and calculate the cosmic muon rate as seen by this prototype detector. Studied the variation in this rate between day and night, as well as over the course of several months.

**OTHER RESEARCH
ACTIVITIES****Femtosecond Pump Probe Experiments to Study Electron Dynamics in Gold Nanorods**

Indian Institute of Technology (IIT) Kharagpur, India

2014 – 2015

- Set up an ultrafast optical pump probe experiment using a femtosecond laser, designed to function both in degenerate and non-degenerate modes. 800 nm and 400 nm pump beams were used to selectively excite longitudinal and transverse surface plasmon resonance modes respectively in gold nanorods, while a 800 nm probe beam was used to study the transient transmission. This produced interesting results showing bleaching (due to stimulated emission) at 400 nm excitation while the 800 nm excitation resulted in excited state absorption in the gold nanorods.

AC Magnetoelectric Susceptibility Study of Multiferroics

Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

2014

- Studied the coupling between electric and magnetic degrees of freedom in emergent magnetoelectric materials like copper selenide and rare earth manganites. This involved orientation of the crystals using X-Ray Laue method to identify the crystallographic axes, DC magnetic susceptibility measurements, and AC magnetoelectric susceptibility measurements. This is a non-standard technique developed by this group and it was successfully used to precisely map the magnetic phase diagram for one of the magnetoelectrics under study.

Asteroseismology of Red Giant Stars

Homi Bhabha Centre for Science Education (HBCSE) – TIFR, India

2011 – 2014

- Developed a novel method (published in MNRAS) to determine the period spacing of gravity modes of oscillation in red giant stars from observed seismic data. Seismic oscillations create the pathway to study the interior structure of stars and the period spacing is instrumental in understanding the structure of their cores. This method was first tested on numerous stellar evolutionary models created using MESA (a stellar evolution code) and was then successfully applied to several real red giants observed by the NASA Kepler mission.

**TEACHING
EXPERIENCE**

Instructor, University of Notre Dame:

Engineering Physics II: Electricity and Magnetism

2025 – 2026

Facilitator at the CMS Data Analysis School (CMSDAS) 2023 at Fermilab

2023

Teaching Assistant, Cornell University:	
Mechanics and Heat	2017
Mechanics and Special Relativity	2016
General Physics - I and II	2015 – 2016
Member of the Academic Resource team at the 46th International Physics Olympiad hosted by TIFR, India	2015

EDUCATION AND SCIENCE OUTREACH	Provided academic and financial support for the education of two underprivileged students through middle school to college in a rural Indian village	2017 – 2023
	Team Leader of Prerana Voluntary organization started by students of IIT Kharagpur:	2012 – 2016
	• Provided merit-based scholarships to 50 underprivileged students from 20 primary and high schools in neighboring villages around IIT Kharagpur between 2012 and 2016 • Carried out teaching activities for 4 years for students from primary to high school in different rural villages	
	Awarded for being one of the Best Volunteers of the National Service Scheme in IIT Kharagpur for two consecutive years	2012

TECHNICAL SKILLS	Programming Languages: Python, C++, C, Bash (shell) Computing: ROOT, MATLAB, Mathematica, LabVIEW, Jupyter, Git, LaTeX, Linux Laboratory: Digital and Analog electronics and DAQ, Dilution Refrigeration, Detector Fabrication, Magnetic and Magnetoelectric Measurements, Laser Experiments
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