Ayan Paul

Research Associate Professor @ The Institute for Experiential AI
PI, Neural Dynamics Group, Northeastern University, Boston MA, USA.
apaul2@alumni.nd.edu | www.desy.de/~apaul | talismanbrandi | ayan--paul | Google Scholar

Research Areas of the Neural Dynamics Group

- ***Machine Learning:*** Interpretable Machine Learning, Coalition Game Theory in Machine Learning, Reinforcement Learning
- ***Neural Networks:*** Large language models for Genetics, High-Precision Regressors, GNN and Transformers for Transcriptomics
- ***Transcriptomics:*** Alternative splicing, RNA binding protein function, ML models for splicing, immune cell biology
- ***Proteomics:*** Protein structure and function prediction, enzyme engineering for waste degradation, directed evolution of proteins
- ***Mathematical Epidemiology:*** Population Behavioral Dynamics, Agent Based Models, Transmission Dynamics, Multi-Layer Network Analysis
- ***Flavour Physics:*** CP violation, Semileptonic and leptonic decays, hadronic decays, tests of lepton flavour universality and BSM
- ***Higgs and EW Physics:*** Effective Field Theories, Higgs productions and decays, BSM and future colliders, axions
- ***ML for Nuclear Physics:*** Prediction of nuclear properties, tuning and control systems for fragment separators

Academic appointments

The Institute for Experiential AI, Northeastern University *Boston, USA*
& Brigham and Women's Hospital, Harvard Medical School

Research Associate Professor *October 2025 – Present*
Research Scientist *July 2023 - September 2025*
Research Fellow (Electrical & Computer Engineering) *April 2022 - June 2023*
Sponsored Staff (CDNM, BWH) *February 2023 - Present*

– Mentoring MS and PhD students, postdocs and research scientists.
– Managing funding of over $1M and delivering research products to public and private sector stakeholders.
– Research Directions:
  - Deep Learning for genomics, transcriptomics and protein function prediction and design.
  - Machine Learning for drug discovery and synergistic drug response prediction.
  - Deep Learning for high precision predictions in particle physics and nuclear physics.
  - Knowledge aggregation and reasoning over scientific knowledge graphs using LLMs.
  - Reinforcement Learning for policy optimization during epidemic outbreaks.
  - Subtyping of diseases (COPD, SCLC) through multi-modal data integration and analysis.
  - Multi-omics for personalized immunotherapy and immune cell engineering.

Deutsches Elektronen-Synchrotron (DESY, Hamburg) *Hamburg, Germany*

Fellow *November 2017 - April 2022*

Delegated as ***Senior Scientist*** to the Humboldt Universität zu Berlin.

Istituto Nazionale di Fisica Nucleare, Sezione di Roma I *Roma, Italy*

Postdoctoral Fellow *Sep 2012 - Oct 2017*

ERC Grant "NPFlavour".

University of Notre Dame du Lac *Notre Dame IN, USA*

Graduate Assistant (Teaching & Research) *August 2005 - December 2011*

Employed full-time by the Department of Physics.

Non-academic appointments

KarmaV [karmav.com] *USA & Singapore*

Co-Founder & Chief Scientific Officer (Consulting) *October 2020 - PRESENT*

– Intelligent automation for establishing Fair Equality of Opportunity in recruitment.
– Debiasing data and Algorithmic Affirmative Action through hiring to meet corporate DE&I goals

Covis Inc. – a DESY Spin-off [covishealth.com] *USA & Germany*

Co-Founder & Chief Scientific Officer (Consulting) *April 2020 - June 2022*

Harnessing the power of Machine Learning and scientific research for global disease risk management.

Education

University of Notre Dame du Lac, Department of Physics *Notre Dame, Indiana*

PhD in Physics *2007 - 2012*

Title of dissertation: ***Charm Beyond the Standard Model***
PhD Advisor: ***Prof. Ikaros I. Bigi***

University of Notre Dame du Lac, Department of Physics *Notre Dame, Indiana*

MS in Physics *2005 - 2007*

S. N. Bose National Center for Basic Sciences *Calcutta, India*
M.Sc. in Physics *2003 - 2005*
Presidency College, University of Calcutta *Calcutta, India*
B.Sc. in Physics *1999 - 2002*

Grants & Awards

2025 **NIH R01 – Pending ($4,178,827)**, NIH. MPI. Project: "Precision Immunotherapy: Bridging Functional and Molecular Insights to Optimize NK and CAR-NK Cell-Based Therapies with AI-Guided Profiling" (Duration: 5 year) *Boston, USA*

2025 **NIH R01 Supplement – Pending ($240,000, subaward)**, NIH. PI. Project: "Supplement for: COPD GWAS Functional Variant Identification in Airway Epithelial Cells using Deep Learning Splicing Models" (Duration: 1 year) *Boston, USA*

2024 **NIH R01 – Awarded ($575,558, subaward, 30% credit)**, NIH. Co-PI. "COPD GWAS Functional Variant Identification in Airway Epithelial Cells using Deep Learning Splicing Models" (Duration: 4 years) *Boston, USA*

2025 **Artificial Intelligence and Machine Learning Applied to Nuclear Science and Technology – Declined ($2,000,000)**, Department of Energy. PI. Project: "Precision and efficiency upgrades for the Advanced Rare Isotope Separator at the Facility for Rare Isotope Beams using Machine Learning" (Duration: 2 year) *Boston, USA*

2025 **Artificial Intelligence and Machine Learning Applied to Nuclear Science and Technology – Declined ($568,600, subaward)**, Department of Energy. PI. Project: "Precision Determination and Validation of Low-Energy Properties of Nuclei Using Machine Learning" (Duration: 2 year) *Boston, USA*

2024 **NIH R01 – Awarded ($120,000, subaward)**, NIH. PI. "Using Integrative Genomics To Identify and Characterize Emphysema-Associated eQTL" (Duration: 1 year) *Boston, USA*

2024 **Corporate Sponsored Research – Awarded ($1,769,000)**, Breaking Inc. PI. Project: "Optimization of Enzymes for Plastic Degradation Using Machine Learning" (Duration: 2 year) *Boston, USA*

2024 **NIH UG3/UH3 – Declined ($2,720,000, subaward, 25% credit)**, NIH. Co-PI. "Multimodal probabilistic methods for individualized penetrance and expressivity estimates for multi-organ genetic disorders" (Duration: 5 years) *Boston, USA*

2024 **Mathematical Modeling of Policy Options for Evolving Public Health Challenges – Declined ($997,484)**, NSF. PI. Project: ''MPOPHC: Optimizing Epidemic Response Models Through Social Behavior and Policy Feedback Integration" (Duration: 3 year) *Boston, USA*

2024 **Incorporating Human Behavior in Epidemiological Models – Declined ($997,484)**, NSF. PI. Project: " IHBEM: Modeling Strategies to Mitigate Socioeconomic Disruptions during Epidemics with Social-Behavior Aware AI" *Boston, USA*

2023 **Enabling Discovery through GEnomics – Declined ($2,285,942)**, NSF. Co-PI. Project: "EDGE CMT: Detailed mapping of the role of RNA binding proteins in splicing: from RNA sequences to tissue and disease phenotypes" *Boston, USA*

2020 **Corona Crisis and Beyond – Awarded (119,200€)**, Volkswagen Stiftung. PI. Project: "Talisman: Intelligent Algorithms for COVID-19 mitigation casting virtual safety nets to protect and empower the society" (Duration: 21 months, Project overheads borne by DESY) *Berlin, Germany*

2020 **DESY Strategy Fund for COVID-19 – Awarded (100,000€)**, DESY, PI. Project: "CoVis: empowering health decisions, delivered by intelligent algorithms to contain COVID-19" (Duration: 16 months) – Leading to a DESY Spin-off (Technology Transfer): Covis Inc. *Hamburg, Germany*

2012 **GPS Conference 2012 Sponsorships**, Graduate School, University of Notre Dame du Lac *Notre Dame, IN USA*

2012 **Research and Dissertation Award**, Dept. of Physics, University of Notre Dame du Lac *Notre Dame, IN USA*

2011 **Notebaert Prof. Dev. Fund (II)**, Graduate School, University of Notre Dame du Lac *Notre Dame, IN USA*

2011 **Notebaert Prof. Dev. Fund (I)**, Graduate School, University of Notre Dame du Lac *Notre Dame, IN USA*

2011 **Joseph F. Downes Memorial Award**, Graduate School, University of Notre Dame du Lac *Notre Dame, IN USA*

2010 **W. & L. Stavropoulos Fellowship**, Graduate School, University of Notre Dame du Lac *Notre Dame, IN USA*

2010 **Kaneb Outstanding Graduate Teaching Assistant Award**, University of Notre Dame du Lac *Notre Dame, IN USA*

2009 **Reilly Fellowship**, Graduate School, University of Notre Dame du Lac *Notre Dame, IN USA*

2005 **CSIR Junior Research Fellowship**, (HRDG, Govt. of India) *Calcutta, India*

2005 **University Lecturership**, National Eligibility Test (UGC–CSIR, Govt. of India) *Calcutta, India*

2003 – 2005 **Research Fellowship**, S. N. Bose National Center for Basic Sciences *Calcutta, India*

Publications

Publications and Prerpints: 50 [citations: over 5000, h-index: 31]

Notable journals published in: Nature Reviews Physics, Journal of High Energy Physics, Physical Review D, Scientific Reports, European Physical Journal C, Journal of the Royal Society: Interface, Journal of Physics: Complexity.

Note: *Authors are listed alphabetically arranged by their last name in Particle Physics and Socioeconomics papers with rare exceptions.*

Computational Biology:

1. J. Estevam, R. White, M. Finocchiaro, S. Karthyk, S. M. Thakur, A. Paul and T. Konry, *An Integrative Function-to-Omics and Alternative Splicing Platform to Enrich Cytotoxic NK cells for Cancer Immunotherapeutics*. Submitted to Science Advances for peer-review.
2. J. Estevam, R. White, M. Finocchiaro, S. Karthyk, A. Paul and T. Konry, *Integration of Tumor-Killing Mechanisms with Transcriptional Profiles of Anti-Tumor Bispecific Antibodies using a Single-Cell Function-to-Omics Approach*. Submitted to Science Advances for peer-review.

Machine Learning and Computational Physics:

1. N. Sanda, B. Gyori, V. Quaranta, A. Ganguly, and A. Paul, *eGoT: Enhamced Graph-of-Thoughts for Improved Knowledge Retrieval*. Submitted to EACL 2026 for review. [patent pending]
2. S. Gupta, S. Biggs, M. Laber, Z. Shafi, R. Walters, and A. Paul, *DeepWeightFlow: Re-Basined Flow Matching for Generating Neural Network Weights*. Submitted to ICLR 2026 for review.
3. I. Bentley, J. Tedder, M. Gebran, A. Paul, *Further Exploration of Precise Binding Energies from Physics Informed Machine Learning and the Development of a Practical Ensemble Model*. Phys. Rev. **C 112**, 014324. DOI:10.1103/brx1-pnq9.
4. I. Bentley, J. Tedder, M. Gebran, A. Paul, *High Precision Binding Energies from Physics Informed Machine Learning*. Phys. Rev. **C 111**, 034305. DOI:10.1103/PhysRevC.111.034305.
5. A. Patra, S. Sengupta, A. Paul, S. Chakraborty, *Inferring to cooperate: Evolutionary games with Bayesian inferential strategies*. New J. Phys. **26**, 063003 (2024). DOI:10.1088/1367-2630/ad4e5e.
6. F. Bishara, A. Paul, J. Dy, *High-Precision Regressors for Particle Physics*. Sci Rep **14**, 5294 (2024). DOI:10.1038/s41598-024-52941-4.
7. F. Bishara, A. Paul, J. Dy, *Skip Connections for High Precision Regressors*. Machine Learning and the Physical Sciences, Workshop at the 36th conference on Neural Information Processing Systems **(NeurIPS 2022)**.
8. L. Alasfar, R. Gröber, C. Grojean, A. Paul and Z. Qian, *Machine learning the trilinear and light-quark Yukawa couplings from Higgs pair kinematic shapes*. JHEP**11** (2022) 045. [arXiv:2207.04157].
9. C. Grojean, A. Paul, Z. Qian and I. Strümke, *Lessons on interpretable machine learning from particle physics*. Nat Rev Phys 4, 284–286 (2022). DOI:10.1038/s42254-022-00456-0.
10. C. Grojean, A. Paul and Z. Qian, *Resurrecting $b\bar{b}h$ with kinematic shapes*. JHEP**04** (2021) 139. [arXiv:2011.13945].
11. S. S. AbdusSalam et al., *Simple and statistically sound strategies for analysing physical theories*, Rept. Prog. Phys. **85** (2022) 052201. [arXiv:2012.09874].
12. J. de Blas et. al., `HEPfit`: *a Code for the Combination of Indirect and Direct Constraints on High Energy Physics Models*. Eur. Phys. J. **C80** (2020) no.5, 456. [arXiv:1910.14012].

Flavour Physics:

1. M. Ciuchini, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *Constraints on Lepton Universality Violation from Rare B Decays decays*, Submitted to PRD for review. arXiv:2212.10516.
2. M. Ciuchini, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *Charming penguins and lepton universality violation in $b \to s\ell^+\ell^-$ decays*, Eur. Phys. J **83** (2023) 1, 64. [arXiv:2110.10126].
3. M. Ciuchini, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *Lessons from the $B^{0,+} \to K^{*0,+}\mu^+\mu^-$ angular analysis*, Phys. Rev. D **103** (2021) 1, 015030. [arXiv:2011.01212].
4. L. Alasfar, A. Azatov, J. de Blas, A. Paul, M. Valli, *B anomalies under the lens of electroweak precision*, JHEP**12** (2020) 116. [arXiv:2007.04400].
5. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *New Physics in $b \to s\ell^+\ell^-$ confronts new data on Lepton Universality*, Eur. Phys. J. **C79** (2019) no.8, 719. [arXiv:1903.09632].
6. F. Buccella, A. Paul and P. Santorelli, *$SU(3)_F$ breaking through FSI phases and CP asymmetries in $D \to PP$ decays*, Phys. Rev. **D 99** (2019) no.11, 113001. [arXiv:1902.05564].
7. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *Hadronic uncertainties in the $B \to K^*\ell^+\ell^-$ decays*, Proceedings of the International Conference on B-Physics at Frontier Machines, BEAUTY 2018. PoS **BEAUTY2018** (2018) 044. [arXiv:1809.03789].
8. Belle II Collaboration (E. Kou (ed.) et. al.), *The Belle II Physics Book*, PTEP 2019 (2019) 12, 123C01. [arXiv:1808.10567].
9. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *On Hadronic uncertainties polluting the New Physics hunt in $b \to s$ transitions*, Proceedings of the 7^{th} Workshop on Theory, Phenomenology and Experiments in Flavour Physics: The Future of BSM Physics. Nucl. Part. Phys. Proc. **303-305** (2018) 8-13. [*inspirehep link*].
10. M. Ciuchini, M. Fedele, E. Franco, S. Mishima, A. Paul, L. Silvestrini and M. Valli, *Knowns and Unknowns in the Predictions for $B \to K^*\ell^+\ell^-$*, Proceedings of the 6^{th} Workshop on Theory, Phenomenology and Experiments in Flavour Physics: Interplay of Flavour Physics with electroweak symmetry breaking. Nucl. Part. Phys. Proc. **285-286** (2017) 45-49. [*inspirehep link*].

11. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *On Flavourful Easter eggs for New Physics hunger and Lepton Flavour Universality violation*, Eur. Phys. J. **C77** (2017) no.10, 688. [arXiv:1704.05447].
12. G. Casarosa, A. Di Canto and A. Paul, *Phenomenological and Experimental Developments in Charm Physics: The WG7 Report from CKM 2016*, PoS **CKM2016** (2017) 020. [arXiv:1704.00041].
13. M. Ciuchini, M. Fedele, E. Franco, S. Mishima, A. Paul, L. Silvestrini and M. Valli, $B \to K^* \ell^+ \ell^-$ *in the Standard Model: Elaborations and Interpretations*, PoS **ICHEP2016** (2016) 584. [arXiv:1611.04338].
14. A. Paul and D. Straub, *Constraints on new physics from radiative* B *decays*, JHEP**04** (2017) 027. [arXiv:1608.02556.]
15. M. Ciuchini, M. Fedele, E. Franco, S. Mishima, A. Paul, L. Silvestrini and M. Valli, $B \to K^* \ell^+ \ell^-$ *decays at large recoil in the Standard Model: a theoretical reappraisal*. JHEP**06** (2016) 116. [arXiv:1512.07157].
16. A. Paul, *Lessons from charm dynamics.* Proceedings of **XII IFAE**, Cittadella Universitaria di Monserrato, Cagliari. 3rd - 5th April 2013. Il Nuo. Cim. **C 37** N. 1. [arXiv:1308.5886].
17. A. Paul, A. de La Puente and I. I. Bigi, *Manifestations of Warped Extra Dimension in Rare Charm Decays and Asymmetries*. Phys. Rev. **D 90** (2014) 014035. [arXiv:1212.4849].
18. I. I. Bigi and A. Paul, *On CP Asymmetries in Two-, Three- and Four-Body* D *Decays*. JHEP**03** (2012) 021. [arXiv:1110.2862].
19. I. I. Bigi, A. Paul and S. Recksiegel, *Theoretical Conclusions from CDF Analyses of CP Violation in* $D^0 \to \pi^+\pi^-, K^+K^-$ *and Future Tasks*. JHEP**06** (2011) 089. [arXiv:1103.5785].
20. A. Paul, I. I. Bigi and S. Recksiegel, *On* $D \to X_u l^+ l^-$ *within the Standard Model and Frameworks like the littlelest Higgs model with T Parity*. Phys. Rev. **D 83** (2011) 114006. [arXiv:1101.6053].
21. A. Paul, I. I. Bigi and S. Recksiegel, $D^0 \to \gamma\gamma$ *and* $D^0 \to \mu^+\mu^-$ *rates on an unlikely impact of the littlest Higgs model with T parity*. Phys. Rev. **D 82** (2010) 094006. [arXiv:1008:3141].

Higgs and Electroweak Physics:

1. A. Paul and M. Valli, *Violation of custodial symmetry from W-boson mass measurements*, Phys. Rev. **D 106** (2022) 013008. [arXiv:2204.05267].
2. Q. Bonnefoy, L. Di Luzio, C. Grojean, A. Paul and A. N. Rossia, *Comments on gauge anomalies at dimension-six in the Standard Model Effective Field Theory*, JHEP**05** (2021) 153 [arXiv:2012.07740].
3. Q. Bonnefoy, L. Di Luzio, C. Grojean, A. Paul, A. N. Rossia, *The Anomalous Case of Axion EFTs and Massive Chiral Gauge Fields*, JHEP**07** (2021) 189. [arXiv:2011.10025].
4. J. De Blas, G. Durieux, C. Grojean, J. Gu and A. Paul, *On the future of Higgs, electroweak and diboson measurements at lepton colliders*. JHEP**12** (2019) 117. [arXiv:1907.04311].
5. J. de Blas et. al., *CLIC Potential for New Physics*. CERN Yellow Rep. Monogr. Vol. 3 (2018). [arXiv:1812.02093].
6. S. Gori, C. Grojean, A. Juste, A. Paul, *Heavy Higgs Searches: Flavor Matters*. JHEP**01** (2018) 108. [arXiv:1710.03752].
7. A. Azatov, C. Grojean, A. Paul and E. Salvioni, *Resolving gluon fusion loops at current and future hadron colliders*. JHEP**09** (2016) 123. [arXiv:1608.00977].
8. A. Azatov, C. Grojean, A. Paul and E. Salvioni, *Taming the off-shell Higgs boson*. J. Exp. Theor. Phys. 120 (2015). [arXiv:1406.6338].
9. A. Azatov and A. Paul, *Probing Higgs couplings with high* p_T *Higgs production*. JHEP**01** (2014) 014. [arXiv:1309.5273].

Mathematical Epidemiology & Computational Socioeconomics:

1. T. Banerjee, A. Paul, V. Srikanth and I. Strümke, *Causal connections between socioeconomic disparities and COVID-19 in the USA*, Sci. Rep. **11**, 18891 (2022). DOI:10.1038/s41598-022-18725-4.
2. A. Paul, J. K. Bhattacharjee, A. Pal, S. Chakroborty, *Emergence of Universality in the transmission dynamics of COVID-19*, Sci. Rep. **11**, 18891 (2021). DOI:10.1038/s41598-021-98302-3.
3. A. Paul, P Englert and M. Varga, *Socio-economic disparities and COVID-19 in the USA*, J. Phys. Complex. **2** (2021) no. 3, 035017. DOI:10.1088/2632-072X/ac0fc7.
4. J. Bell et al., *Beyond COVID-19: Network science and sustainable exit strategies*, J. Phys. Complex. **2** (2020) no. 2, 021001. DOI:10.1088/2632-072X/abcbea.
5. H. Kim and A. Paul, *Automated Contact Tracing: a game of big numbers in the time of COVID-19*, J. R. Soc. Interface **18** (2021) no. 175, 20200954. DOI:10.1098/rsif.2020.0954.

Book Chapters:

1. A. Paul, *Crafting Data-driven Strategies to disentangle socioeconomic disparities from disease spread*. To be published by Springer Nature (2022). Edited by: S. Pachauri, A. Pachauri and K. Mittal.

Mentoring

Research Scientists

2023 – Present **Arzu Tuğçe Güler**, Research Scientist, AI+ Life Sciences, The Institute for Experiential AI, Northeastern University.

2024 – Present **Kelly Brock**, Senior Research Scientist, AI + Life Sciences, The Institute for Experiential AI, Northeastern University.

2025 – Present **Hyunju Kim**, Principal Research Scientist, Bouvé College of Health Sciences & The Institute for Experiential AI, Northeastern University.

Students and postdoctoral fellows

Current (Fully-funded research staff in the Neural Dynamics Group)

2025 – Present **Daniel Zeiberg**, *Machine Learning for Protein Function & Directed Evolution*, Postdoctoral Fellow

2025 – Present **Janmejay Vyas**, *Machine Learning for Personalized Immunotherapy*, Graduate Student

2025 – Present **Niraj Chaudhari**, *Generative models for function-specific Protein Design*, Graduate Student

2025 – Present **Nihar Sanda**, *LLM-augmented Knowledge Graphs for Biomedical Applications*, Graduate Student

2025 – Present **Aathira Pillai**, *Machine Learning for Drug Synergy*, Graduate Student

2025 – Present **Malathi Gadupudi**, *Cognitive and Physical Fitness with Machine Learning*, Graduate Student

2025 – Present **Jahnavi Umesh**, *Foundation models for EEG signal processing*, Graduate Student

2024 – Present **Harish Akula**, *Reinforcement Learning for Epidemiology*, Graduate Student

2024 – Present **Priyanka Gujar**, *Graphlet Representations of Protein Structure*, Graduate Student

2024 – Present **Saumya Gupta**, *Transformers & Masked Language Models for Splicing Quantification*, Graduate Student

2024 – Present **Sowmya Muthlaya**, *RNA Binding Proteins and their Effects on Splicing*, Bioinformatician

2024 – Present **Sanika Thakur**, *Splicing Patterns in Small-Cell Lung Cancer*, Bioinformatician

2024 – Present **Matthew Runyan**, *Machine Learning Models for Variant Effects in Splicing*, Bioinformatician

2024 – Present **Shalini Karthyk**, *Single-cell Multiomics and Splicing*, Bioinformatician

2025 – Present **Sofia Castaldi**, *Networked Critical Infrastructure under Compound Extremes*, Applied Mathematics Research Associate

2024 – Present **Scott Biggs**, *Diffusion Models for Neural Network Parameter Prediction*, ML Research Associate

Past

2024 – 2025 **Vitali Bahatyrevich**, *Analyzing long-read sequencing in epithelial cells*, Bioinformatician

2025 **Tanuj Thakkar**, *Nonsense mediated decays in epithilial cells*, Graduate Student

2025 **Muskan Jain**, *Machine Learning for splicing variants*, Graduate Student

2025 **Meghana Dropathi**, *RNA methylation in immune cells*, Graduate Student

2025 **Anudeep Ragata**, *Machine Learning for splicing in human tissues*, Graduate Student

2015 **Claudio Fabiani**, *The decays of $B_{s,d}$ in the Standard Model*, MS Student, Università di Roma La Sapienza.

2014 – 2017 **Marco Fedele**, *Study of the $B \to K^{(*)}\ell^+\ell^-$ decays in the Standard Model and Beyond*, PhD Student, Università di Roma La Sapienza.

COVID-19 Working Group funded by DESY Strategy Fund and Volkswagen Foundation

Megan Bromley, PhD Student, School of Earth and Space Exploration, Arizona State University, USA.

Philipp Englert, PhD Candidate, DESY, Hamburg, Germany.

Maryl Harris, Research Technician, Monell Chemical Senses Center, USA.

Swanand Khanapurkar, PhD Student, Department of Physics, Arizona State University, USA.

Nicholas Tran, MS Student, Department of Computer Science, Arizona State University, USA.

Vishak Srikanth, High School Student, Basis Independent Silicon Valley, San Jose CA, USA.

Teaching

Teaching at University of Notre Dame du Lac

2006 – 2011 **Instructor** for *Scientific Computing* for REU Summer Students

Designed and taught a scientific programming course in FORTRAN to student with no or little prior exposure to coding. The objective of the course was to enable them to be able to code for research projects in nuclear physics, condensed matter physics, statistical mechanics, particle physics, astronomy, astrophysics, cosmology, etc.

2005 - 2011 **Teaching Assistant** for undergraduate and graduate courses. (Kaneb Outstanding Graduate TA Award recipient)

Undergraduate Courses:

– *Introductory Physics for Engineers*: Tutorials, help Sessions, and grading (2 semesters)

– *Introductory Physics for Pre-Meds*: Tutorials, help Sessions, and grading (4 semesters + 2 summers)

– *Introductory Physics Laboratory for Engineers*: Laboratory Assistant (2 semesters)

– *Introductory Physics Laboratory for Pre-Meds*: Laboratory Assistant (4 semesters)

Graduate Courses:
– *Special and General Relativity*: Substitute teaching, tutorials, help sessions, and grading (2 semesters)
– *Classical Mechanics*: Tutorials, help sessions, and grading (2 semesters)
– *Quantum Field Theory I*: Help sessions and grading (2 semesters)
– *Particle Physics*: Help sessions and grading (1 semesters)
– *Atomic Physics*: Help sessions and grading (1 semesters)
– *Statistical Mechanics*: Help sessions and grading (1 semesters)
– *Quantum Mechanics*: Grading (2 semesters)

2006 – 2010 **Tutor** for the Academic Services for Student Athletes for ***Physics*** and ***Mathematics***
Taught student athletes one-on-one for introductory, intermediate and advanced courses in Physics and introductory and intermediate courses in mathematics. Taught a student with special needs for two semesters which included tailoring teaching strategies, testing strategies being able to adapt to his learning needs.

Postgraduation teaching experience

2014 Lectures on *CP Violation*: Substitute instructor for a graduate course on particle physics at Universita di Roma La Sapienza

2018 Lectures on *Symmetries in particle physics*: Substitute instructor for a graduate course on particle physics at Humboldt Univesität zu Berlin

September 2019 **Berlin QFT Master Class**, Electroweak Symmetry Breaking.: Designed and instructed undergraduate students on electroweak symmetry breaking in particle physics as a part of a summer course for undergraduate students to get familiar with particle physics.

March 2020 **DESY Workshop Seminars**, *Interpretable Machine Learning:* Designed and conducted a short seminar series on interpretable machine learning for graduate students and early-career postdocs with no or little prior exposure to machine learning.

Academic and Outreach Activities

2024	**Interviewer for three faculty search**, Bouvé College of Health Sciences, Northeastern University	*Boston MA, USA*
Present	**Editor**, Frontiers in Public Health – Special Issues	
Present	**Associate Editor**, Nature Scientific Reports	
Present	**Contributor**, SustainableHEP: Initiative for making HEP environmentally sustainable.	*Planet Earth*
Present	**Member**, KI Community, Interface for AI experts and users.	*Berlin, Germany*
Present	**Co-Founder**, Diversity@DESY-Theory, Promoting Diversity and Inclusion in Academia.	*Hamburg, Germany*
Present	**Guest Editor**, "Symmetries in Particle Physics" – special edition for Symmetry	
2013 – Present	**Referee for peer reviewed journals**, JHEP, Nucl. Phys. B, EPJ C, Scientific Reports, Scipost, Frontiers in Public Health, Public Health Reviews	
July 2023	**Session Lead**, Mid-Atlantic Splicing Conference 2023	*New River Gorge, USA*
September 2022	**Organizer**, Sustainable HEP - 2nd edition: Conference on Sustainability and Social Justice in High Energy Physics, Cosmology and Astroparticle Physics	*CERN, Switzerland*
September 2019	**DESY Theory Workshop 2019**, Chair for the Particle Phenomenology sessions	*Hamburg, Germany.*
2016	**CKM 2016**, Convener of WG7 – Charm Physics	*Mumbai, India.*
2012-2016	**Content Editor**, Global editions of Physics textbooks for Pearson Education.	*Pearson India*
2012	**GPS Conference 2012**, Founding Organizer	*Notre Dame IN, USA.*
2011-2012	**Graduate Physics Society**, Member of Founding Committee	*Notre Dame IN, USA.*
2010-2012	**Science Outreach**, Judge for several science fairs for junior and middle school students	*Notre Dame IN, USA.*
2007-2008	**Graduate Student Union**, Representative for the Physics Department	*Notre Dame IN, USA.*
2003-2005	**Institute Sports Committee**, Sports equipments acquisition and auditing at S N Bose National Center for Basic Sciences	*Kolkata, India.*

Computational Skills and Experience

Programming Languages	FORTRAN, C, C++ (Primary language for `HEPfit`), Python, Perl, shell scripting, JavaScript and R
Parallel Computing	MPI and OpenMP (Used in `HEPfit` and `BAT`)
HEP Tools	MadGraph, FormCalc, FeynRules, FeynCalc, FeynArts, FeynHiggs, LoopTools, MCFM and several other public codes used in HEP
Libraries & Packages	ROOT, GSL, BOOST, BAT (Used in `HEPfit`), TensorFlow, XGBoost, scikit-learn, scipy ecosystem, etc.
Functional Programming	Mathematica, MatLab and form

Analytic Methods	Bayesian Analysis, Markov Chain Monte Carlo, Statistical Inference, Multivariate Methods, Neural Networks (DNN/LSTM/GRU/GNN/Transformers) and Machine Learning (BDT/SVM/RF).
Code Moderation	Moderator for the core of the `HEPfit` code (statistical framework and the user interface.)
Flavour@`HEPfit`	Implemented flavour observables from all flavour sectors in `HEPfit`
Complex Networks	Network construction and analysis of the authors' collaboration network of all publications in Physical Review C from 2000 to 2006 with an aim to enhance inter-disciplinary and inter-institutional collaborations and for use in reports and proposals submitted to national funding agencies. (Project funded by JINA in 2007)

My contributions to `HEPfit` and other codes: https://github.com/talismanbrandi.

Presentations

Keynote & Panels (2)

10^{th} June 2025	**2025 Annual Symposium on Risks and Opportunities of AI in Pharmaceutical Medicine**, "Responsible AI in Medical Research"	*Portland ME, USA.*
11^{th} March 2025	**2025 Sustainability Innovations Week**, "AI & Sustainability – The Future of Climate Innovation"	*Boston MA, USA.*

Plenary talks (9)

19^{th} May 2023	**34^{th} Rencontres de Blois**, "Machine Learning and Artificial Intelligence for Physics"	*Blois, France.*
19^{th} January 2021	**Quantum Universe Day**, "Interpretable Machine Learning and Cooperative Game Theory meet Particle Physics analyses"	*Hamburg, Germany.*
28^{th} May 2020	**COVID-19 Beyond Center Workshop**, "The Curious Case of Automated Contact Tracing"	*Tempe, USA.*
18^{th} May 2020	**CHARM 2020**, "Flavour Symmetries and CP violation in Charm"	*Mexico City, Mexico.*
28^{th} April 2020	**Quantum Universe Workshop**, "COVID-19 and a Theorist's Dilemma"	*Hamburg, Germany.*
2^{nd} December 2016	**CKM 2016**, "A Summary on Charm Dynamics from WG7"	*Mumbai, India.*
6^{th} September 2016	**CHARM 2016**, "Theoretical aspects on NP search in rare and (semi-)leptonic decays"	*Bologna, Italy.*
4^{th} April 2013	**XII IFAE, Cittadella Universitaria di Monserrato**, "A Higgs and the World of Flavour"	*Cagliari, Italy.*
16^{th} January 2013	**XX DAE-BRNS HEP Symposium**, "For When the Bells toll..."	*Santiniketan, India.*

Invited talks (21)

8^{th} June 2025	**Systems Biology of Human Disease**, "Charting the regulation of Alternative Splicing using Machine Learning in two human diseases, COPD and SCLC"	*Berlin, Germany.*
12^{th} Dec 2025	**Solid Waste Association of North America**, "The Real-World Impact of AI adoption: a Chapter on Waste Management"	*Boston, USA.*
7^{th} December 2022	**Herrenhausen Conference**, "Talisman: Intelligent Algorithms for COVID-19 mitigation."	*Hannover, Germany.*
24^{th} November 2021	**CKM 2021**, "CP Violation in Charm: A New Beginning"	*Melbourne, Australia.*
23^{rd} November 2021	**Physics at the Terascale**, "Interpretable Machine Learning @ Future Colliders"	*Hamburg, Germany.*
8^{th} September 2021	**Living in the Pandemic Age**, "Data-driven approaches from physics, game theory and machine learning for mapping disease transmission"	*Tempe, USA.*
5^{th} September 2021	**PANIC 2021**, "Nailing Higgs Couplings at Future Colliders"	*Lisboa, Portugal.*
29^{th} April 2021	**AI Community Meetup**, "Interpretable Machine Intelligence using Coalition Game Theory"	*Berlin, Germany.*
24^{th} March 2021	**DASHH Hamburg COVID-19 Series**, "On Transmission Dynamics of COVID-19: A Physicist's Perspective"	*Hamburg, Germany.*
4^{th} December 2020	**Round Table on Machine Learning @ DESY 2020**, "Machine Intelligence @ DESY Theory"	*Hamburg, Germany.*
2^{nd} November 2020	**TOOLS 2020**, "HEPfit: The Bayesian MCMC for HEP"	*Lyon, France.*
28^{th} October 2020	**AI Community Meetup**, "Machine Intelligence and COVID-19"	*Berlin, Germany.*
23^{rd} July 2018	**Higgs Hunting 2018**, "Flavour Physics meets Heavy Higgs Searches"	*Orsay-Paris, France.*
24^{th} May 2018	**HXSWG Offshell Meetings: BSM/EFT studies**, "Looking Inside Gluon Fusion Loops"	*Geneva, Switzerland.*
9^{th} November 2017	**LHCb Implications 2017**, "CP violation in charm: from Rags to Riches"	*Geneva, Switzerland.*
30^{th} May 2017	**Beyond the LHCb Phase-1 Upgrade**, "The On-Shell Story"	*Isola d'Elba, Italy.*
23^{rd} May 2016	**$4^{\mathbf{th}}$ B2TiP Workshop**, "Prospects of estimating hadronic uncertainties in $B \to K^*\gamma$"	*Pittsburgh, USA.*
9^{th} March 2016	**Towards the Theory of Flavour**, "Musings on the Future of Beauty and Charm Dynamics"	*Munich, Germany.*
29^{th} October 2015	**$3^{\mathbf{rd}}$ B2TiP Workshop**, "An Introduction to `HEPfit`"	*Tsukuba, Japan.*
27^{th} April 2015	**$2^{\mathbf{nd}}$ B2TiP Workshop**, "Tutorial on SusyFit"	*Krakow, Poland.*

27th April 2015 **2nd B2TiP Workshop**, "Diagrammatic approaches to understanding the SU(3) framework" *Krakow, Poland.*

25th February 2015 **New Physics at Belle II**, "An Introduction to SusyFit" *Karlsruhe, Germany.*

10th December 2014 **The landscape of Flavour Physics towards the high intensity era**, "The Charm of the Future" *Pisa, Italy.*

18th November 2011 **Workshop on Antiproton Physics at the Intensity Frontier**, "TAPAS and Charm Physics" *Fermilab, Batavia, USA*

Seminars (25)

1st November 2024 **Theory Lunch at Department of Systes Biology, Harvard Medical School**, "Charting alternative splicing: the rise of the machines" *Boston, USA.*

11th November 2021 **University of Bergen**, "A Particle Physics case for Interpretable Machine Learning and Cooperative Game Theory" *Bergen, Norway.*

26th March 2021 **Florida State University**, "Interpretable Machine Learning for Particle Physics Discoveries" *Tallahassee, FL USA.*

16th January 2020 **LPT, Orsay**, "Flavour Physics: A Precision Tool for Exploring Scale Separations" *Orsay, France.*

11th January 2019 **IACS**, "Looking Inside Gluon Fusion Loops for Effective Higgs Couplings" *Kolkata, India.*

15th August 2018 **Arizona State University**, "Higgs Dynamics with Effective Field Theories" *Tempe, USA.*

7th May 2018 **IFIC**, "Flavour@`HEPfit`" *Valencia, Spain.*

25th January 2018 **TIFR**, "Flavour Physics meets Heavy Higgs Searches" *Mumbai, India.*

10th July 2015 **CERN**, "$B \to K^* \mu^+ \mu^-$ decays in the Standard Model: a theoretical reappraisal" *Geneva, Switzerland.*

15th May 2013 **University of Edinburgh**, "The Industrial Revolution for Charm: From Sweatshops to Factories" *Edinburgh, UK.*

21st August 2012 **IMSc**, "Flavour in the Warped Extra Dimension" *Chennai, India.*

9th July 2012 **IMSc**, "Prospects of Charm" *Chennai, India.*

21st May 2012 **Università di Roma La Sapienza**, "Charm Beyond the Standard Model" *Roma, Italy.*

22nd December 2011 **University of Calcutta**, "Charm Dynamics: the Today and the Tomorrow" *Calcutta, India.*

21st December 2011 **University of Calcutta**, "Little Higgs Models; and with T Parity too...!!" *Calcutta, India.*

19th December 2011 **SINP**, "Yet another Era of Charm Physics" *Calcutta, India.*

1st December 2011 **TIFR**, "Charm: A Portal for ND" *Mumbai, India.*

15th November 2011 **University of Notre Dame du Lac**, "ND @ ND" *Notre Dame IN, USA.*

22nd March 2011 **Argonne National Laboratory**, "LHT and Charm: the Expected, the Unexpected and the Gamble" *Argonne IL, USA.*

17th February 2011 **Michigan State University**, "LHT and Charm: Hopes from a Pocket Pair of Twos" *East Lansing MI, USA.*

14th February 2011 **University of Illinois at Urbana Champaign**, "LHT and Charm: Gambling with a Hand that Others have Folded" *Urbana IL, USA.*

16th December 2010 **Fermilab**, "LHT and Charm: Gambling in Standard Model?s Backyard" *Batavia IL, USA.*

2nd November 2010 **University of Notre Dame du Lac**, "Not LHT but LHT-like... and beyond" *Notre Dame IN, USA.*

8th December 2009 **University of Notre Dame du Lac**, "LHT @ Work: Unleashing the Jack in the Box" *Notre Dame IN, USA.*

1st July 2005 **SINP**, "Simplicial Homology and its Application to Electrical and Electronic Circuits" *Calcutta, India.*

Contributed talks (19)

14th July 2024 **Intelligent Systems for Molecular Biology**, "Charting the role of RNA binding proteins in tissue-specific alternative splicing using machine explanations" *Montreal, Canada.*

29th June 2021 **Sustainable HEP 2021**, "Discussions on Diversity – an academic approach" *CERN, Switzerland.*

21st June 2021 **Networks 2021**, "Socio-economic disparities and COVID-19 in the USA" *Bloomington, USA.*

12th July 2019 **EPS 2019**, "EFT Fits for Higgs and EW @FCC-ee" *Ghent, Belgium.*

11th July 2019 **EPS 2019**, "Disentangling Higgs and EW Measurements at Future Lepton Colliders" *Ghent, Belgium.*

7th June 2019 **WIN 2019**, "Disentangling Higgs and EW Measurements at Future Lepton Colliders" *Bari, Italy.*

23rd May 2018 **Planck 2018**, "Flavour Physics meets Heavy Higgs Searches" *Bonn, Germany.*

28th November 2017 **Terascale Workshop**, "Flavour Physics meets Heavy Higgs Searches" *Hamburg, Germany.*

7th July 2017 **EPS 2017**, "$SU(3)_F$ Breaking through Final State Interactions and CP Asymmetries in $D \to PP$ Decays" *Venice, Italy.*

6th July 2017 **EPS 2017**, "Flavour Physics meets Heavy Higgs Searches" *Venice, Italy.*

6th August 2016 **ICHEP 2016**, "$b \to s$ transitions in the Standard Model and Beyond" *Chicago IL, USA.*

4th August 2016 **ICHEP 2016**, "Higgs productions in the gluon fusion channel: a complete EFT analysis" *Chicago IL, USA.*

17th June 2016 **LHCP 2016**, "Test of the Standard Model and the Search for New Physics Using UTfit" *Lund, Sweden.*

25th August 2015 **SUSY 2015**, "A critical examination of the $SU(3)$ framework in the hadronic decays of D" *Tahoe City CA, USA.*

25th August 2015 **SUSY 2015**, "An Introduction to `HEPfit`" *Tahoe City CA, USA.*

24th July 2015 **EPS 2015**, "A critical examination of the $SU(3)$ framework in the hadronic decays of D" *Vienna, Austria.*

23^{rd} July 2015	**EPS 2015**, "Questioning the anomalies in $B \to K^* \mu^+ \mu^-$ decays"	*Vienna, Austria.*
20^{th} May 2015	**CHARM 2015**, "Charm loop contributions in $B \to K^* \mu^+ \mu^-$ decays"	*Detroit MI, USA.*
19^{th} May 2015	**CHARM 2015**, "A case for $SU(3)$ in $D \to PP$ decays"	*Detroit MI, USA.*
28^{th} May 2014	**Planck 2014**, "Probing Higgs couplings with high p_T Higgs production"	*Paris, France.*

Workshops & Conferences

September 2023	**CAGI****, Workshop on Genome Interpretations	*Boston, USA*
July 2023	**Mid-Atlantic Splicing Conference**, Splicing and RNA Biology	*New River Gorge, USA*
October 2022	**Herrenhausen Conference**, AI and the future of societies.	*Hannover, Germany*
December 2021	**NeurIPS 2021**, Thirty-fifth Conference on Neural Information Processing Systems.	*Virtual*
September 2021	**Living in the Pandemic Age**, Designing effective strategies in light of lessons learned from COVID-19.	*Lisboa, Portugal.*
September 2021	**PANIC 2021**, Particles and Nuclei International Conference.	*Lisboa, Portugal.*
July 2021	**Networks 2021**, A Joint Sunbelt and NetSci Conference.	*Bloomington, USA.*
November 2020	**TOOLS 2020**, Tools for High Energy Physics and Cosmology.	*Lyon, France.*
May 2020	**Beyond COVID-19 Workshop**, Conference on COVID-19 Exit Strategies.	*Tempe, USA.*
May 2020	**Charm 2020**, Conference on Flavour Physics.	*Mexico City, Mexico.*
April 2020	**Quantum Universe Workshop**, Conference on Particle Physics and Cosmology.	*Hamburg, Germany.*
October 2019	**Implications of LHCb measurements and future prospects 2019**, Conference on Flavour Physics.	*Geneva, Switzerland.*
September 2019	**Quantum field theory meets gravity** , DESY Theory Workshop.	*Hamburg, Germany.*
July 2019	**EPS 2019**, Conference on High Energy Physics.	*Ghent, Belgium.*
June 2019	**WIN 2019**, International Workshop on Weak Interactions and Neutrino.	*Bari, Italy.*
May 2019	**BSM with Precision Flavour Experiments**, Workshop on BSM and Flavour physics.	*Munich, Germany.*
October 2018	**Implications of LHCb measurements and future prospects 2018**, Conference on Flavour Physics.	*Geneva, Switzerland.*
September 2018	**Beyond Standard Model: Where do we go from here?**, Conference on High Energy Physics.	*Firenze, Italy.*
July 2018	**Higgs Hunting 2018**, Conference on High Energy Physics.	*Orsay-Paris, France.*
April 2018	**Planck 2018**, Conference on High Energy Physics.	*Bonn, Germany.*
November 2017	**Terascale Workshop**, Helmholtz Alliance Annual Meeting	*Hamburg, Germany.*
October 2017	**Implications of LHCb measurements and future prospects 2017**, Conference on Flavour Physics.	*Geneva, Switzerland.*
July 2017	**EPS 2017**, Conference on High Energy Physics.	*Venice, Italy.*
May 2017	**Beyond the LHCb Phase-1 Upgrade**, Conference on Flavour Physics.	*Isola d?Elba, Italy.*
December 2016	**CKM 2016**, Conference on Flavour Physics.	*Mumbai, India.*
September 2016	**CHARM 2016**, Conference on Charm Physics.	*Bologna, Italy.*
August 2016	**ICHEP 2016**, Conference on High Energy Physics.	*Chicago IL, USA.*
June 2016	**LHCP 2016**, 4^{th} Annual Large Hadron Collider Physics Conference.	*Lund, Sweden.*
June 2016	**Flavour and Electroweak Symmetry Breaking**, Workshop on Flavour Physics.	*Anacapri, Italy.*
April 2016	**4^{th} B2TiP Workshop**, Belle Flavour Factory Workshop.	*Pittsburgh, USA.*
April 2016	**Higgs Tasting Workshop**, Workshop on Higgs Physics.	*Benasque, Spain.*
April 2016	**3^{rd} B2TiP Workshop**, Belle Flavour Factory Workshop.	*Tsukuba, Japan.*
March 2016	**Toward The Theory of Flavour**, Munich, Germany.	*Benasque, Spain.*
November 2015	**Implications of LHCb measurements and future prospects 2015**, Conference on Flavour Physics.	*Geneva, Switzerland.*
September 2015	**Gearing up for LHC13**, Workshop on physics at the LHC.	*Firenze, Italy.*
August 2015	**SUSY 2015**, Conference on High Energy Physics.	*Tahoe City CA, USA.*
July 2015	**EPS 2015**, Conference on High Energy Physics.	*Vienna, Austria.*
May 2015	**CHARM 2015**, Conference on Charm Physics.	*Detroit MI, USA.*
April 2015	**2^{nd} B2TiP Workshop**, Belle Flavour Factory Workshop.	*Cracovia, Poland.*
February 2015	**New Physics at Belle II**, Belle II meeting.	*Karlsruhe, Germany.*
December 2014	**The landscape of Flavour Physics towards the high intensity era**, Flavour Physics.	*Pisa, Italy.*
April 2013	**XII IFAE**, Conference on High Energy Physics.	*Cagliari, Italy.*
July 2011	**CTEQ Workshop 2011**, Summer School on QCD Analysis and Phenomenology	*Madison WI, USA.*
June 2011	**LHC – Fermilab HCP**, Sixth School on Hadron Collider Physics.	*Geneva, Switzerland.*
May 2011	**MadGraph Spring 2011**, Workshop for MadGraph and FeynRules developers.	*Batavia IL, USA.*
May 2011	**SLAC Summer Institute**, "Nu: Nature?s Mysterious Messengers"	*Menlo Park CA, USA.*