

# Ayan Paul

THEORETICAL AND COMPUTATIONAL PARTICLE PHYSICIST & DATA SCIENTIST

**Building the Future with Interpretable and Robust AI**

*Institut für Physik, Humboldt Universität zu Berlin, Notkestraße 15, 12489 Berlin, Germany.*

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## Skills

- **Data Analytics:** Proficient in data extraction and parsing, multivariate analysis, Markov Chain Monte Carlo methods and Bayesian inference.
- **Machine Learning:** Adept at BDT with XGBoost, SVM, KNN, clustering, feature engineering/importance analysis with scikit-learn.
- **Neural Networks:** 2+ years experience with TensorFlow: DNN for regression/classification, LSTM for time series prediction/signal classification.
- **Coding:** Over 10 years of experience in developing open-source codes with C/C++, Python and FORTRAN. Familiar with R, Julia and Matlab.
- **Parallel Computing:** Extensive experience in parallelizing codes with MPI and OpenMP and simulations on large computer clusters.
- **Innovation:** Over 12 years of experience with problem solving in physics, mathematics, statistics and coding for science.
- **Critical Thinking:** Highly trained in conceptualizing new ideas and building mathematical models for complex unexplored problems.
- **Leadership:** Mentor for several MS/PhD students and postdoctoral fellows. Co-organizer for several international conferences.
- **Team Worker:** Involved in working with large teams and collaborations for planning and implementation of projects.
- **Communications:** Recipient of teaching award and skilled in conveying scientific knowledge to non-experts. Native proficiency in English.

My contribution to open source codes: <https://github.com/talismanbrandi>.

## Professional Experience

### CoVis – a DESY Spin-Off

USA & Germany

CO-FOUNDER AND CHIEF SCIENTIFIC OFFICER

April 2020 - PRESENT

- Designed and implemented the backend algorithms for COVID-19 risk prediction using AI (LSTM/GRU) from prototyping to deployment.
- Defined research strategies and incorporated results from medical literature using Bayesian methods to combine emerging data.
- Designed data streams using SQL on AWS for regular updates and processing of data using ML algorithms.
- Leadership role in the formation of CoVis for building business strategies, raising pre-seed funds and defining core products and services.
- Winner of both formation and advanced round of MIT COVID-19 Challenge “Beat the Pandemic 1 & 2” hackathon.

### Deutsches Elektronen-Synchrotron (DESY) & Humboldt Universität zu Berlin

Hamburg & Berlin, Germany

FELLOW & SENIOR SCIENTIST

November 2017 - PRESENT

- Principal Investigator of a DESY Strategy Fund grant managing a team of 10 members for R&D.
- Planned and implemented Bayesian multivariate analyses using Markov Chain Monte Carlo routines for large global projects.
- Created innovative data visualizations using Perl, JavaScript and Python for future international colliders.
- Developed an Interpretable ML/AI framework for regression and signal-background classification for Higgs Physics in using DNN and BDT.

### Istituto Nazionale di Fisica Nucleare, Sezione di Roma I

Roma, Italy

POSTDOCTORAL FELLOW

September 2012 - October 2017

- Developed the open-source codes **HEPfit** and **BAT** in C++ for Bayesian inference using Markov Chain Monte Carlo.
- Reduced the runtime of **HEPfit** by a factor of 50 – 200 using MPI and software caching.
- Implemented statistical model selection with non-linear multi-parametric models on experimental data.
- Gained experience in process automation on large computer clusters using shell scripting.

### University of Notre Dame du Lac

Notre Dame IN, USA

RESEARCH ASSISTANT

August 2005 - May 2012

- Formulated theoretical models using current data to predict possible future experimental measurements at CERN.
- Constructed and analyzed a collaboration network using Graph Theory and textual analysis for a nationally funded research center.
- Won 5 fellowships for professional development and academic research.

## Research

- **Particle Physics:** Quantum Field Theory, Relativistic Quantum Mechanics, Higgs Productions and Decays, Symmetry Violation.
- **Data & Statistics:** Analytics for future physics colliders at CERN using Bayesian MCMC and BDT/NN frameworks.
- **Mathematical Epidemiology:** Contact Tracing for COVID-19, Agent Based Models, ML applications, Multi-Layer Network Analysis.
- **Intelligence:** Structure and Dynamics of Intelligence and building fundamental frameworks for information processing.
- **Publications:** 19 papers in peer-reviewed high impact-factor journals with over 1700 citations. Top 1% most cited author in physics (10 yr).
- **Public Speaking:** Presented talks at more than 30 international conferences worldwide.
- **Research Supervision:** Co-advisor for several masters and PhD students and supervised the work of several junior postdoctoral fellows.

## Education

### University of Notre Dame du Lac, Department of Physics

Notre Dame, Indiana

MS & PHD IN THEORETICAL PARTICLE PHYSICS

2005 - 2012

- *Physics Graduate Research and Dissertation Award* for the best dissertation of the year.
- *Founding Member of the Executive Board* of Graduate Physics Society and GPS Spring Conferences.

### S. N. Bose National Center for Basic Sciences

Calcutta, India

M.Sc. IN PHYSICS

2003 - 2005

- Recipient of the *National CSIR Scholarship* for Junior Fellows.

# Ayan Paul

FELLOW @ DESY, HAMBURG & SENIOR SCIENTIST @ HUMBOLDT UNIVERSITÄT ZU BERLIN

Institut für Physik, Humboldt Universität zu Berlin, Notkestraße 15, 12489 Berlin, Germany.

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## Research Expertise

- *Charm dynamics*: CP violation, hadronic decays, final state interactions, leptonic and semileptonic decays.
- *Beauty dynamics*: Semileptonic and leptonic decays, decay distributions, tests of lepton flavour universality and BSM
- *Higgs and EW Physics*: Effective Field Theories, Higgs productions and decays, BSM and future colliders
- *Physics Computation*: Active developer for the statistical core (MCMC based Bayesian Analysis) and flavour physics in **HEPfit**
- *Liaison with Experiments*: Contributor to B2TiP and associate member of the former Consorzio Laboratorio Nicola Cabibbo
- *Mathematical Epidemiology*: Modeling of COVID-19 disease spread, mitigation and exit strategies.

## Academic Appointments

### Deutsches Elektronen-Synchrotron (DESY)

FELLOW

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

Hamburg, Germany

November 2017 - PRESENT

### Istituto Nazionale di Fisica Nucleare, Sezione di Roma I

POSTDOCTORAL FELLOW

ERC Grant "NPFlavour".

Roma, Italy

September 2012 - October 2017

### University of Notre Dame du Lac

TEACHING ASSISTANT

Employed full-time by the Department of Physics.

Notre Dame IN, USA

August 2005 - December 2011

## Education

### University of Notre Dame du Lac, Department of Physics

PHD IN PHYSICS

Title of dissertation: *Charm Beyond the Standard Model*

PhD Advisor: *Prof. Ikaros I. Bigi*

Notre Dame, Indiana

2007 - 2012

### University of Notre Dame du Lac, Department of Physics

MS IN PHYSICS

Notre Dame, Indiana

2005 - 2007

### S. N. Bose National Center for Basic Sciences

M.Sc. IN PHYSICS

Calcutta, India

2003 - 2005

### Presidency College, University of Calcutta

B.Sc. IN PHYSICS

Calcutta, India

1999 - 2002

## Grants & Awards

2020	<b>DESY Strategy Fund for COVID-19 (100,000€)</b> , Deutsches Elektronen-Synchrotron	Hamburg, Germany
2020	<b>Corona Crisis and Beyond (under review, 120,000€)</b> , Volkswagen Stiftung	Germany
2012	<b>GPS Conference 2012 Sponsorships</b> , Dept. of Physics & Graduate School, University of Notre Dame du Lac	Notre Dame, IN USA
2012	<b>Research and Dissertation Award</b> , Dept. of Physics, University of Notre Dame du Lac	Notre Dame, IN USA
2011	<b>Notebaert Prof. Dev. Fund (II)</b> , Graduate School, University of Notre Dame du Lac	Notre Dame, IN USA
2011	<b>Notebaert Prof. Dev. Fund (I)</b> , Graduate School, University of Notre Dame du Lac	Notre Dame, IN USA
2011	<b>Joseph F. Downes Memorial Award</b> , Graduate School, University of Notre Dame du Lac	Notre Dame, IN USA
2010	<b>W. &amp; L. Stavropoulos Fellowship</b> , Graduate School, University of Notre Dame du Lac	Notre Dame, IN USA
2010	<b>Kaneb Outstanding Graduate Teaching Assistant Award</b> , Kaneb Center, University of Notre Dame du Lac	Notre Dame, IN USA
2009	<b>Reilly Fellowship</b> , Graduate School, University of Notre Dame du Lac	Notre Dame, IN USA
2005	<b>CSIR Junior Research Fellowship</b> , Center for Scientific and Industrial Research (HRDG, Govt. of India)	Calcutta, India
2005	<b>University Lecturership</b> , National Eligibility Test (UGC-CSIR, Govt. of India)	Calcutta, India
2003 - 2005	<b>Research Fellowship</b> , S. N. Bose National Center for Basic Sciences	Calcutta, India

## Computational Skills and Experience

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<b>Programming Languages</b>	FORTRAN, C, C++ (Primary language for HEPfit), Python, Perl, shell scripting, JavaScript and R
<b>Parallel Computing</b>	MPI and OpenMP (Used in HEPfit and BAT)
<b>HEP Tools</b>	MadGraph, FormCalc, FeynRules, FeynCalc, FeynArts, FeynHiggs, LoopTools, MCFM and several other public codes used in HEP
<b>Libraries &amp; Packages</b>	ROOT, GSL, BOOST, BAT (Used in HEPfit), TensorFlow, XGBoost, scikit-learn, scipy ecosystem, etc.
<b>Functional Programming</b>	Mathematica, MatLab and form
<b>Analytic Methods</b>	Bayesian Analysis, Markov Chain Monte Carlo, Statistical Inference, Multivariate Methods, Neural Networks (DNN/LSTM/GRU) and Machine Learning (BDT/SVM/RF).
<b>Code Moderation</b>	Moderator for the core of the HEPfit code (statistical framework and the user interface.)
<b>Flavour@HEPfit</b>	Implemented flavour observables from all flavour sectors in HEPfit
<b>Complex Networks</b>	Network construction and analysis of the authors' collaboration network of all publications in Physical Review C during 2000 – 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 2017)

Github repository for HEPfit: <https://github.com/silvest/HEPfit>.  
My contributions to HEPfit and other codes: <https://github.com/talismanbrandi>.

## Publications

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### COVID-19:

1. H. Kim and A. Paul, *Automated Contact Tracing: a game of big numbers in the time of COVID-19*, DOI:10.1101/2020.04.22.20071043v1 (medRxiv). Submitted for review.
2. A. Paul, P Englert and M. Varga, *Socio-economic disparities and COVID-19 in the USA*, arXiv:2009.04935. Submitted for review.
3. J. Bell et al., *Beyond COVID-19: Network science and sustainable exit strategies*, arXiv:2009.12968. Accepted by J. Phys. Complexity.

### Flavour Physics:

1. M. Ciuchini, M. Fedele, E. Franco, A. Paul, L. Silvestrini, M. Valli, *Lessons from the  $B^{0,+} \rightarrow K^{*0,+} \mu^+ \mu^-$  angular analysis.*, arXiv:2011.01212. Submitted for review. (1 citation)
2. L. Alasfar, A. Azatov, J. de Blas, A. Paul, M. Valli, *B anomalies under the lens of electroweak precision*, arXiv:2007.04400. Accepted by JHEP. (2 citation)
3. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *New Physics in  $b \rightarrow s \ell^+ \ell^-$  confronts new data on Lepton Universality*, Eur. Phys. J. **C79** (2019) no.8, 719. [arXiv:1903.09632]. (112 citations)
4. F. Buccella, A. Paul and P. Santorelli,  *$SU(3)_F$  breaking through FSI phases and CP asymmetries in  $D \rightarrow PP$  decays*, Phys. Rev. **D99** (2019) no.11, 113001. [arXiv:1902.05564]. (16 citations)
5. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *Hadronic uncertainties in the  $B \rightarrow K^* \ell^+ \ell^-$  decays*, Proceedings of the International Conference on B-Physics at Frontier Machines, BEAUTY 2018. PoS **BEAUTY2018** (2018) 044. [arXiv:1809.03789]. (7 citations)
6. Belle II Collaboration (E. Kou (ed.) et. al.), *The Belle II Physics Book*, PTEP 2019 (2019) 12, 123C01. [arXiv:1808.10567]. (502 citations)
7. M. Ciuchini, A. Coutinho, M. Fedele, E. Franco, A. Paul, L. Silvestrini and M. Valli, *On Hadronic uncertainties polluting the New Physics hunt in  $b \rightarrow s$  transitions*, Proceedings of the 7<sup>th</sup> 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]. (1 citation)
8. M. Ciuchini, M. Fedele, E. Franco, S. Mishima, A. Paul, L. Silvestrini and M. Valli, *Knowns and Unknowns in the Predictions for  $B \rightarrow K^* \ell^+ \ell^-$* , Proceedings of the 6<sup>th</sup> 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]. (6 citations)
9. 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]. (6 citations)
10. 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]. (212 citations)
11. M. Ciuchini, M. Fedele, E. Franco, S. Mishima, A. Paul, L. Silvestrini and M. Valli,  *$B \rightarrow K^* \ell^+ \ell^-$  in the Standard Model: Elaborations and Interpretations*, PoS **ICHEP2016** (2016) 584. [arXiv:1611.04338]. (25 citations)
12. A. Paul and D. Straub, *Constraints on new physics from radiative B decays*, JHEP **04** (2017) 027. [arXiv:1608.02556.] (63 citations)
13. M. Ciuchini, M. Fedele, E. Franco, S. Mishima, A. Paul, L. Silvestrini and M. Valli,  *$B \rightarrow K^* \ell^+ \ell^-$  decays at large recoil in the Standard Model: a theoretical reappraisal*. JHEP **06** (2016) 116. [arXiv:1512.07157]. (183 citations)

14. 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]. (0 citation)
15. 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]. (28 citations)
16. I. I. Bigi and A. Paul, *On CP Asymmetries in Two-, Three- and Four-Body D Decays*. JHEP **03** (2012) 021. [arXiv:1110.2862]. (43 citations)
17. I. I. Bigi, A. Paul and S. Recksiegel, *Theoretical Conclusions from CDF Analyses of CP Violation in  $D^0 \rightarrow \pi^+ \pi^-$ ,  $K^+ K^-$  and Future Tasks*. JHEP **06** (2011) 089. [arXiv:1103.5785]. (54 citations)
18. A. Paul, I. I. Bigi and S. Recksiegel, *On  $D \rightarrow X_u l^+ l^-$  within the Standard Model and Frameworks like the littlest Higgs model with T Parity*. Phys. Rev. **D 83** (2011) 114006. [arXiv:1101.6053]. (62 citations)
19. A. Paul, I. I. Bigi and S. Recksiegel,  *$D^0 \rightarrow \gamma \gamma$  and  $D^0 \rightarrow \mu^+ \mu^-$  rates on an unlikely impact of the littlest Higgs model with T parity*. Phys. Rev. **D 82** (2010) 094006. [arXiv:1008.3141]. (39 citations)

### Higgs and Electroweak Physics:

1. C. Grojean, A. Paul, Z. Qian, *Ressurrecting  $b\bar{b}h$  with kinematic shapes*. arXiv:2011.13945. (0 citations)
2. Q. Bonnefoy, L. Di Luzio, C. Grojean, A. Paul, A. N. Rossia, *The Anomalous Case of Axion EFTs and Massive Chiral Gauge Fields*. arXiv:2011.10025. (0 citations)
3. 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]. (18 citations)
4. J. de Blas et. al., *CLIC Potential for New Physics*. CERN Yellow Rep. Monogr. Vol. 3 (2018). [arXiv:1812.02093]. (80 citations)
5. S. Gori, C. Grojean, A. Juste, A. Paul, *Heavy Higgs Searches: Flavor Matters*. JHEP **01** (2018) 108. [arXiv:1710.03752]. (18 citations)
6. 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]. (41 citations)
7. A. Azatov, C. Grojean, A. Paul and E. Salvioni, *Taming the off-shell Higgs boson*. J. Exp. Theor. Phys. **120** (2015). [arXiv:1406.6338]. (83 citations)
8. A. Azatov and A. Paul, *Probing Higgs couplings with high  $p_T$  Higgs production*. JHEP **01** (2014) 014. [arXiv:1309.5273]. (102 citations)

### Computation for Physics:

1. 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]. (28 citations)

## Teaching & Mentoring

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### SCHOOL LECTURES

September 2019 **Berlin QFT Master Class**, Electroweak Symmetry Breaking.

### THESIS SUPERVISION

- 2015 **Claudio Fabiani**, MS Thesis, Università di Roma La Sapienza.  
*The decays of  $B_{s,d}$  in the Standard Model.*
- 2014 **Marco Fedele**, MS Thesis, Università di Roma La Sapienza.  
*Study of the  $B \rightarrow K^{(*)} \ell^+ \ell^-$  decays in the Standard Model and Beyond.*

### COVID-19 WORKING GROUP

**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.

### TEACHING AT UNIVERSITY OF NOTRE DAME DU LAC

- 2006 – 2010 **Tutor** for the Academic Services for Student Athletes for *Physics* and *Mathematics*
- 2006 – 2011 **Instructor** for *FORTRAN* for REU Summer Students
- August 2014 Lectures on *CP Violation*
- 2005 - 2011 **Teaching Assistant** for undergraduate and graduate courses. (Kaneb Outstanding Graduate TA Award recipient)  
**Graduate Courses:**
  - Classical Mechanics
  - Special and General Relativity
  - Quantum Field Theory I
  - Quantum Mechanics
  - Particle Physics
  - Atomic Physics
  - Statistical Mechanics

## Academic and Outreach Activities

Present	<b>Member</b> , KI Community, Interface for AI experts and users.	Berlin, Germany
Present	<b>Co-Founder</b> , Diversity@DESY-Theory, Promoting Diversity and Inclusion in Academia.	Hamburg, Germany
Present	<b>Guest Editor</b> , "Symmetries in Particle Physics" – special edition for Symmetry	
2013 – Present	<b>Referee for peer reviewed journals</b> , JHEP, Nucl. Phys. B, EPJ C and Scipost	
September 2019	<b>DESY Theory Workshop 2019</b> , Chair for the Particle Phenomenology sessions	Hamburg, Germany.
2016	<b>CKM 2016</b> , Convener of WG7 – Charm Physics	Mumbai, India.
2012-2016	<b>Content Editor</b> , Global editions of Physics textbooks for Pearson Education.	Pearson India
2012	<b>GPS Conference 2012</b> , Founding Organizer	Notre Dame IN, USA.
2011-2012	<b>Graduate Physics Society</b> , Member of Founding Committee	Notre Dame IN, USA.
2010-2012	<b>Science Outreach</b> , Judge for several science fairs for junior and middle school students	Notre Dame IN, USA.
2007-2008	<b>Graduate Student Union</b> , Representative for the Physics Department	Notre Dame IN, USA.
2003-2005	<b>Institute Sports Committee</b> , Sports equipments acquisition and auditing at S N Bose National Center for Basic Sciences	Kolkata, India.

## Presentations

### PLENARY TALKS (7)

28 <sup>th</sup> May 2020	<b>COVID-19 Beyond Center Workshop</b> , "The Curious Case of Automated Contact Tracing"	Tempe, USA.
18 <sup>th</sup> May 2020	<b>CHARM 2020</b> , "Flavour Symmetries and CP violation in Charm"	Mexico City, Mexico.
28 <sup>th</sup> April 2020	<b>Quantum Universe Workshop</b> , "COVID-19 and a Theorist's Dilemma"	Hamburg, Germany.
2 <sup>nd</sup> December 2016	<b>CKM 2016</b> , "A Summary on Charm Dynamics from WG7"	Mumbai, India.
6 <sup>th</sup> September 2016	<b>CHARM 2016</b> , "Theoretical aspects on NP search in rare and (semi-)leptonic decays"	Bologna, Italy.
4 <sup>th</sup> April 2013	<b>XII IFAE, Cittadella Universitaria di Monserato</b> , "A Higgs and the World of Flavour"	Cagliari, Italy.
16 <sup>th</sup> January 2013	<b>XX DAE-BRNS HEP Symposium</b> , "For When the Bells toll..."	Santiniketan, India.

### INVITED TALKS (15)

4 <sup>th</sup> December 2020	<b>Round Table on Machine Learning @ DESY 2020</b> , "Machine Intelligence @ DESY Theory"	Hamburg, Germany.
2 <sup>nd</sup> November 2020	<b>TOOLS 2020</b> , "HEPfit: The Bayesian MCMC for HEP"	Lyon, France.
28 <sup>nd</sup> October 2020	<b>KI Community Meetup</b> , "Machine Intelligence and COVID-19"	Berlin, Germany.
23 <sup>rd</sup> July 2018	<b>Higgs Hunting 2018</b> , "Flavour Physics meets Heavy Higgs Searches"	Orsay-Paris, France.
24 <sup>th</sup> May 2018	<b>HXSWG Offshell Meetings: BSM/EFT studies</b> , "Looking Inside Gluon Fusion Loops"	Geneva, Switzerland.
9 <sup>th</sup> November 2017	<b>LHCb Implications 2017</b> , "CP violation in charm: from Rags to Riches"	Geneva, Switzerland.
30 <sup>th</sup> May 2017	<b>Beyond the LHCb Phase-1 Upgrade</b> , "The On-Shell Story"	Isola d'Elba, Italy.
23 <sup>rd</sup> May 2016	<b>4<sup>th</sup> B2TiP Workshop</b> , "Prospects of estimating hadronic uncertainties in $B \rightarrow K^* \gamma$ "	Pittsburgh, USA.
9 <sup>th</sup> March 2016	<b>Towards the Theory of Flavour</b> , "Musings on the Future of Beauty and Charm Dynamics"	Munich, Germany.
29 <sup>th</sup> October 2015	<b>3<sup>rd</sup> B2TiP Workshop</b> , "An Introduction to HEPfit"	Tsukuba, Japan.
27 <sup>th</sup> April 2015	<b>2<sup>nd</sup> B2TiP Workshop</b> , "Tutorial on SusyFit"	Krakow, Poland.
27 <sup>th</sup> April 2015	<b>2<sup>nd</sup> B2TiP Workshop</b> , "Diagrammatic approaches to understanding the SU(3) framework"	Krakow, Poland.
25 <sup>th</sup> February 2015	<b>New Physics at Belle II</b> , "An Introduction to SusyFit"	Karlsruhe, Germany.
10 <sup>th</sup> December 2014	<b>The landscape of Flavour Physics towards the high intensity era</b> , "The Charm of the Future"	Pisa, Italy.
18 <sup>th</sup> November 2011	<b>Workshop on Antiproton Physics at the Intensity Frontier</b> , "TAPAS and Charm Physics"	Fermilab, Batavia, USA

### SEMINARS (22)

16 <sup>th</sup> January 2020	<b>LPT, Orsay</b> , "Flavour Physics: A Precision Tool for Exploring Scale Separations"	Orsay, France.
11 <sup>th</sup> January 2019	<b>IACS</b> , "Looking Inside Gluon Fusion Loops for Effective Higgs Couplings"	Kolkata, India.
15 <sup>th</sup> August 2018	<b>Arizona State University</b> , "Higgs Dynamics with Effective Field Theories"	Tempe, USA.
7 <sup>th</sup> May 2018	<b>IFIC</b> , "Flavour@HEPfit"	Valencia, Spain.
25 <sup>th</sup> January 2018	<b>TIFR</b> , "Flavour Physics meets Heavy Higgs Searches"	Mumbai, India.
10 <sup>th</sup> July 2015	<b>CERN</b> , " $B \rightarrow K^* \mu^+ \mu^-$ decays in the Standard Model: a theoretical reappraisal"	Geneva, Switzerland.
15 <sup>th</sup> May 2013	<b>University of Edinburgh</b> , "The Industrial Revolution for Charm: From Sweatshops to Factories"	Edinburgh, UK.
21 <sup>st</sup> August 2012	<b>IMSc</b> , "Flavour in the Warped Extra Dimension"	Chennai, India.
9 <sup>th</sup> July 2012	<b>IMSc</b> , "Prospects of Charm"	Chennai, India.
21 <sup>st</sup> May 2012	<b>Università di Roma La Sapienza</b> , "Charm Beyond the Standard Model"	Roma, Italy.
22 <sup>nd</sup> December 2011	<b>University of Calcutta</b> , "Charm Dynamics: the Today and the Tomorrow"	Calcutta, India.
21 <sup>st</sup> December 2011	<b>University of Calcutta</b> , "Little Higgs Models; and with T Parity too...!!"	Calcutta, India.
19 <sup>th</sup> December 2011	<b>SINP</b> , "Yet another Era of Charm Physics"	Calcutta, India.
1 <sup>st</sup> December 2011	<b>TIFR</b> , "Charm: A Portal for ND"	Mumbai, India.
15 <sup>th</sup> November 2011	<b>University of Notre Dame du Lac</b> , "ND @ ND"	Notre Dame IN, USA.

22 <sup>nd</sup> March 2011	<b>Argonne National Laboratory</b> , “LHT and Charm: the Expected, the Unexpected and the Gamble”	Argonne IL, USA.
17 <sup>th</sup> February 2011	<b>Michigan State University</b> , “LHT and Charm: Hopes from a Pocket Pair of Twos”	East Lansing MI, USA.
14 <sup>th</sup> February 2011	<b>University of Illinois at Urbana Champaign</b> , “LHT and Charm: Gambling with a Hand that Others have Folded”	Urbana IL, USA.
16 <sup>th</sup> December 2010	<b>Fermilab</b> , “LHT and Charm: Gambling in Standard Model’s Backyard”	Batavia IL, USA.
2 <sup>nd</sup> November 2010	<b>University of Notre Dame du Lac</b> , “Not LHT but LHT-like... and beyond”	Notre Dame IN, USA.
8 <sup>th</sup> December 2009	<b>University of Notre Dame du Lac</b> , “LHT @ Work: Unleashing the Jack in the Box”	Notre Dame IN, USA.
1 <sup>st</sup> July 2005	<b>SINP</b> , “Simplicial Homology and its Application to Electrical and Electronic Circuits”	Calcutta, India.

## CONTRIBUTED TALKS (17)

12 <sup>th</sup> July 2019	<b>EPS 2019</b> , “EFT Fits for Higgs and EW @FCC-ee”	Ghent, Belgium.
11 <sup>th</sup> July 2019	<b>EPS 2019</b> , “Disentangling Higgs and EW Measurements at Future Lepton Colliders”	Ghent, Belgium.
7 <sup>th</sup> June 2019	<b>WIN 2019</b> , “Disentangling Higgs and EW Measurements at Future Lepton Colliders”	Bari, Italy.
23 <sup>rd</sup> May 2018	<b>Planck 2018</b> , “Flavour Physics meets Heavy Higgs Searches”	Bonn, Germany.
28 <sup>th</sup> November 2017	<b>Terascale Workshop</b> , “Flavour Physics meets Heavy Higgs Searches”	Hamburg, Germany.
7 <sup>th</sup> July 2017	<b>EPS 2017</b> , “ $SU(3)_F$ Breaking through Final State Interactions and CP Asymmetries in $D \rightarrow PP$ Decays”	Venice, Italy.
6 <sup>th</sup> July 2017	<b>EPS 2017</b> , “Flavour Physics meets Heavy Higgs Searches”	Venice, Italy.
6 <sup>th</sup> August 2016	<b>ICHEP 2016</b> , “ $b \rightarrow s$ transitions in the Standard Model and Beyond”	Chicago IL, USA.
4 <sup>th</sup> August 2016	<b>ICHEP 2016</b> , “Higgs productions in the gluon fusion channel: a complete EFT analysis”	Chicago IL, USA.
17 <sup>th</sup> June 2016	<b>LHCP 2016</b> , “Test of the Standard Model and the Search for New Physics Using UFit”	Lund, Sweden.
25 <sup>th</sup> August 2015	<b>SUSY 2015</b> , “A critical examination of the $SU(3)$ framework in the hadronic decays of $D$ ”	Tahoe City CA, USA.
25 <sup>th</sup> August 2015	<b>SUSY 2015</b> , “An Introduction to HEPfit”	Tahoe City CA, USA.
24 <sup>th</sup> July 2015	<b>EPS 2015</b> , “A critical examination of the $SU(3)$ framework in the hadronic decays of $D$ ”	Vienna, Austria.
23 <sup>rd</sup> July 2015	<b>EPS 2015</b> , “Questioning the anomalies in $B \rightarrow K^* \mu^+ \mu^-$ decays”	Vienna, Austria.
20 <sup>th</sup> May 2015	<b>CHARM 2015</b> , “Charm loop contributions in $B \rightarrow K^* \mu^+ \mu^-$ decays”	Detroit MI, USA.
19 <sup>th</sup> May 2015	<b>CHARM 2015</b> , “A case for $SU(3)$ in $D \rightarrow PP$ decays”	Detroit MI, USA.
28 <sup>th</sup> May 2014	<b>Planck 2014</b> , “Probing Higgs couplings with high $p_T$ Higgs production”	Paris, France.

## Workshops & Conferences

November 2020	<b>TOOLS 2020</b> , Tools for High Energy Physics and Cosmology.	Lyon, France.
May 2020	<b>Beyond COVID-19 Workshop</b> , Conference on COVID-19 Exit Strategies.	Tempe, USA.
May 2020	<b>Charm 2020</b> , Conference on Flavour Physics.	Mexico City, Mexico.
April 2020	<b>Quantum Universe Workshop</b> , Conference on Particle Physics and Cosmology.	Hamburg, Germany.
October 2019	<b>Implications of LHCb measurements and future prospects 2019</b> , Conference on Flavour Physics.	Geneva, Switzerland.
September 2019	<b>Quantum field theory meets gravity</b> , DESY Theory Workshop.	Hamburg, Germany.
July 2019	<b>EPS 2019</b> , Conference on High Energy Physics.	Ghent, Belgium.
June 2019	<b>WIN 2019</b> , International Workshop on Weak Interactions and Neutrino.	Bari, Italy.
May 2019	<b>BSM with Precision Flavour Experiments</b> , Workshop on BSM and Flavour physics.	Munich, Germany.
October 2018	<b>Implications of LHCb measurements and future prospects 2018</b> , Conference on Flavour Physics.	Geneva, Switzerland.
September 2018	<b>Beyond Standard Model: Where do we go from here?</b> , Conference on High Energy Physics.	Firenze, Italy.
July 2018	<b>Higgs Hunting 2018</b> , Conference on High Energy Physics.	Orsay-Paris, France.
April 2018	<b>Planck 2018</b> , Conference on High Energy Physics.	Bonn, Germany.
November 2017	<b>Terascale Workshop</b> , Helmholtz Alliance Annual Meeting	Hamburg, Germany.
October 2017	<b>Implications of LHCb measurements and future prospects 2017</b> , Conference on Flavour Physics.	Geneva, Switzerland.
July 2017	<b>EPS 2017</b> , Conference on High Energy Physics.	Venice, Italy.
May 2017	<b>Beyond the LHCb Phase-1 Upgrade</b> , Conference on Flavour Physics.	Isola d’Elba, Italy.
December 2016	<b>CKM 2016</b> , Conference on Flavour Physics.	Mumbai, India.
September 2016	<b>CHARM 2016</b> , Conference on Charm Physics.	Bologna, Italy.
August 2016	<b>ICHEP 2016</b> , Conference on High Energy Physics.	Chicago IL, USA.
June 2016	<b>LHCP 2016</b> , 4 <sup>th</sup> Annual Large Hadron Collider Physics Conference.	Lund, Sweden.
June 2016	<b>Flavour and Electroweak Symmetry Breaking</b> , Workshop on Flavour Physics.	Anacapri, Italy.
April 2016	<b>4<sup>th</sup> B2TiP Workshop</b> , Belle Flavour Factory Workshop.	Pittsburgh, USA.
April 2016	<b>Higgs Tasting Workshop</b> , Workshop on Higgs Physics.	Benasque, Spain.
March 2016	<b>Toward The Theory of Flavour</b> , Munich, Germany.	Benasque, Spain.
April 2016	<b>3<sup>rd</sup> B2TiP Workshop</b> , Belle Flavour Factory Workshop.	Tsukuba, Japan.

November 2015	<b>Implications of LHCb measurements and future prospects 2015</b> , Conference on Flavour Physics.	<i>Geneva, Switzerland.</i>
September 2015	<b>Gearing up for LHC13</b> , Workshop on physics at the LHC.	<i>Firenze, Italy.</i>
August 2015	<b>SUSY 2015</b> , Conference on High Energy Physics.	<i>Tahoe City CA, USA.</i>
July 2015	<b>EPS 2015</b> , Conference on High Energy Physics.	<i>Vienna, Austria.</i>
May 2015	<b>CHARM 2015</b> , Conference on Charm Physics.	<i>Detroit MI, USA.</i>
April 2015	<b>2<sup>nd</sup> B2TiP Workshop</b> , Belle Flavour Factory Workshop.	<i>Cracovia, Poland.</i>
February 2015	<b>New Physics at Belle II</b> , Belle II meeting.	<i>Karlsruhe, Germany.</i>
December 2014	<b>The landscape of Flavour Physics towards the high intensity era</b> , Conference on Flavour Physics.	<i>Pisa, Italy.</i>
April 2013	<b>XII IFAE</b> , Conference on High Energy Physics.	<i>Cagliari, Italy.</i>
July 2011	<b>CTEQ Workshop 2011</b> , Summer School on QCD Analysis and Phenomenology	<i>Madison WI, USA.</i>
June 2011	<b>LHC – Fermilab HCP</b> , Sixth School on Hadron Collider Physics.	<i>Geneva, Switzerland.</i>
May 2011	<b>MadGraph Spring 2011</b> , Workshop for MadGraph and FeynRules developers.	<i>Batavia IL, USA.</i>
May 2011	<b>SLAC Summer Institute</b> , “Nu: Nature’s Mysterious Messengers”	<i>Menlo Park CA, USA.</i>

## List of Teaching References

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## Selected List of Research Collaborators

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