

Julián García Pardiñas

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*“Driven by a constant search for new ways to improve
and for a deeper understanding of whatever reality is.”*

Education

Ph.D. in Nuclear and Particle Physics

USC (UNIVERSIDADE DE SANTIAGO DE COMPOSTELA)

- Thesis defense expected by December 2017.

Santiago de Compostela, Spain

2014 - PRESENT

M.Sc. in Nuclear and Particle Physics and their Technological and Medical Applications.

USC (UNIVERSIDADE DE SANTIAGO DE COMPOSTELA)

- Top student of my promotion. Overall qualification: 9.9/10.
- M.Sc. thesis: *“Measurement of the CP components in $B_s^0 \rightarrow (K^+ \pi^-)(K^- \pi^+)$ decays at LHCb”*

Santiago de Compostela, Spain

2013 - 2014

B.Sc. Physics

USC (UNIVERSIDADE DE SANTIAGO DE COMPOSTELA)

- Top student of my promotion. Overall qualification: 9.65/10.
- B.Sc. thesis: *“U-spin rotation in the three families of quarks at the LHC collider”*

Santiago de Compostela, Spain

2009 - 2013

Complementary education

Sep. 2017	2017 CERN-Fermilab HCP Summer School , CERN-Fermilab	CERN, Switzerland
	66th Lindau Nobel Laureate Meeting , Courses on Physics imparted by 30 Nobel Laureates.	
Jun. 2016	Pre-selected by the CSIC (Spanish Council for Scientific Research) and finally selected by the Meeting Council. Only 10 Spanish young researchers selected from the different Physics fields, and only 400 researchers selected all over the World.	Lindau, Germany
Jun. 2016	2016 European School of High-Energy Physics (ESHEP) , CERN	Skeikampen, Norway
Apr. 2015	LHCb Data Manager Training Course , CERN	Geneva, Switzerland
Feb. 2015	5th IDPASC School , organised by the IDPASC (International Doctorate Network in Particle Physics, Astrophysics and Cosmology), Université Paris Diderot	Paris, France
Jan. 2014	4th IDPASC School , Universidade do Minho	Braga, Portugal
Jan. 2014	First Certificate in English, Grade B , The British Council	Santiago de C., Spain
Jul. 2012	Frontiers of Photonics and LASER Technologies , USC	Santiago de C., Spain

Grants & Honours

GRANTS

2014	Ph.D. Fellowship , FPU (fellowship for the Education of future University Professors)	Spanish Government
2013	Summer Studentship , Student in GSI Helmholtzzentrum für Schwerionenforschung GmbH	GSI, Germany
2012	Research Collaboration Grant , Participation in research activities within GAES (High Energy Physics Group of the USC).	Spanish Government

HONOURS

2015	1st M.Sc. in Nuclear and Particle Physics student in the USC , Extraordinary Award of the Master in Nuclear and Particle Physics and their Technological and Medical Applications	USC, Spain
2015	1st B.Sc. Physics student in Galicia (Spain) , End-of-studies Award of the Region of Galicia	Galician Government
2014	1st B.Sc. Physics student in the USC , Extraordinary Award of the Physics Degree	USC, Spain
2009	Among the top High School students in Galicia , Academic Excellence Award	Galician Government
2013	Among the top High School students in Spain , High School Graduation with Honours	Spanish Government

Research Stays

2016	FPU mobility program: stay at CERN , Given via a competitive tendering process inside the FPU program. Three months (June - August).	<i>CERN, Switzerland</i>
2015	FPU mobility program: stay at CERN , Given via a competitive tendering process inside the FPU program. Three months (July - September).	<i>CERN, Switzerland</i>
2014	Research stay at CERN , One month (July). Funded by GAES, USC.	<i>CERN, Switzerland</i>

Work experience

2013/14	Research Assistant , Part-time job, from November 2013 to July 2014. GAES (Experimental High Energy Physics Group in the USC).	<i>Santiago de C., Spain</i>
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Teaching experience

2016/17	Course: Experimental Techniques III , 24 hours. B.Sc. in Physics, 3rd year.	<i>USC, Spain</i>
2016/17	Course: Nuclear and Particle Physics , 12 hours. B.Sc. in Physics, 4th year.	<i>USC, Spain</i>
2015/16	Course: Mathematical Methods III , 10 hours. B.Sc. in Physics, 1st year.	<i>USC, Spain</i>
2015/16	Course: Experimental Techniques III , 14 hours. B.Sc. in Physics, 3rd year.	<i>USC, Spain</i>
2015/16	Course: Nuclear and Particle Physics , 12 hours. B.Sc. in Physics, 4th year.	<i>USC, Spain</i>
2014/15	Co-supervision of B.Sc. Thesis , B.Sc. in Physics, 4th year. Project: time-reversal symmetry and measurement of triple-product asymmetries in $B^0 \rightarrow \rho^0 \rho^0$ at the LHCb experiment.	<i>USC, Spain</i>

Outreach experience

Jul. 2017	Summer Scientific Campus on the LHC for High School students , Organiser of the event, speaker and instructor during the laboratory sessions. USC in collaboration with the Spanish Government.	<i>Santiago de C., Spain</i>
Apr. 2017	Minicampus on Particles and Quantum Physics for elementary students , Organiser of the event and instructor of one of the four laboratory sessions. CEIP Pio XII.	<i>Santiago de C., Spain</i>
Apr. 2017	CMS Masterclass 2017 , Main organiser of the event, speaker and instructor of the laboratory session. USC in collaboration with CERN.	<i>Santiago de C., Spain</i>
Mar. 2016	CMS Masterclass 2016 , Speaker and instructor of the laboratory session. USC in collaboration with CERN.	<i>Santiago de C., Spain</i>
Sep. 2015	High school group visit to CERN , Speaker and guide. IES Rosalía de Castro	<i>CERN, Switzerland</i>
Mar. 2015	CMS Masterclass 2015 , Speaker and instructor of the laboratory session. USC in collaboration with CERN.	<i>Santiago de C., Spain</i>
Mar. 2014	ATLAS Masterclass 2014 , Speaker and instructor of the laboratory session. USC in collaboration with CERN.	<i>Santiago de C., Spain</i>

Research activities

Lepton Universality tests using tauonic B^0 decays that involve a D^+

ANALYSIS OF RUN2 LHCb DATA

2016 - Present

- **Goal:** measure the $R(D^+)$ and $R(D^{*0})$ ratios by studying the decays $\bar{B}^0 \rightarrow D^{(+,*0)} \tau^- \bar{\nu}_\tau$ and $\bar{B}^0 \rightarrow D^{(+,*0)} \mu^- \bar{\nu}_\mu$, where $D^{*0} \rightarrow D^+ \pi^-$.
- **My participation:** in charge of the event selection, the signal isolation against events with extra neutral particles and the study of background control samples.
- **Exportable new techniques/tools developed by me:**
 - Implementation of Monte Carlo truth-matching algorithms for two existing tools used in LHCb to identify neutral candidates, one focused on resolved π^0 's and the other one focused on cones of neutral particles around a given track. I used these algorithms to train a combined multivariate tool for neutral isolation. This technique can be used in similar analyses.
- **Status of the analysis:** in preparation.

Measurement of the CP violating phase $\phi_s^{d\bar{d}}$ in $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$

ANALYSIS OF RUN1 LHCb DATA

2014 - Present

- **Goal:** measure the mixing-induced CP violating phase $\phi_s^{d\bar{d}}$ in $B_s^0 \rightarrow (K^+\pi^-)_{j_1}(K^-\pi^+)_{j_2}$ decays, with $j_1, j_2 \in \{0, 1, 2\}$, where the $K\pi$ pairs are restricted to be in a invariant mass window of $[750, 1600]$ MeV/ c^2 . These decays are dominated by the $j_1 = j_2 = 1$ component, the $B_s^0 \rightarrow K^{*0}\bar{K}^{*0}$, which is a golden channel in the search for New Physics involving CP violation. The inclusion of the other j_1, j_2 components (9 decays in total), assumed to share the same $\phi_s^{d\bar{d}}$ phase, implies an approximate quadruplication of the available statistics. A time-dependent and flavour-tagged amplitude analysis is needed, including three angular variables and the two $K\pi$ invariant masses.
- **My participation:** main analyst, in charge of the analysis strategy and the implementation of all its aspects, excluding the tuple production and the signal selection. My work in this analysis includes: the design of the phenomenological model, its implementation in the form of a new software package, the development of a software framework for the parallelisation of the main fit using Graphics Processor Units (GPUs), the study of $K\pi$ mass dependent amplitudes, the treatment of the Flavour Tagging effects, the parameterisation of the angular, $K\pi$ mass and decay time acceptance and resolution, the implementation of a specific event generator used for toy Monte Carlo studies and the computation of the systematic uncertainties.
- **Exportable new techniques/tools developed by me:**
 - Design of a weight-based correction for acceptance in data, using machine learning techniques trained on simulation. The multi-dimensional acceptance in angles, masses and decay time can be reasonably well reproduced in an easy way, automatically accounting for correlations among the variables. For this analysis, this technique was only used for a check (the nominal results rely on normalisation weights for angles and masses and splines for the time acceptance), but could be used in future analyses.
 - Development of several techniques for parallelisation using GPUs. Basing on the **Ipanema** software package (to which I also contributed) [arXiv:1706.01420 (2017)], I implemented new methods for the parallel computation of several quantities, including bi-dimensional $K\pi$ mass integrals, the set of normalisation weights (380 in total) and the covariance matrix of these weights. Using some of these tools and modifying the likelihood minimisation algorithm, I was able to float the shape of the not-so-well-known scalar $K\pi$ mass amplitude (dominated by the $K_0^*(1430)^0$ but with a non-resonant component and/or the $K_0^*(800)$) in the time-dependent fit, otherwise impossible for technical reasons. All these tools are very powerful and easy to export to other analyses.
- **Status of the analysis:** in Review Committee inside the LHCb Collaboration.

Study of penguin pollution in $\phi_s^{c\bar{c}}$ using $B_s^0 \rightarrow J/\psi\bar{K}^{*0}$

ANALYSIS OF RUN1 LHCb DATA

2014 - 2015

- **Goal:** measure the polarisation fractions and CP asymmetries in the $B_s^0 \rightarrow J/\psi\bar{K}^{*0}$ mode, with $J/\psi \rightarrow \mu^+\mu^-$ and $\bar{K}^{*0} \rightarrow K^-\pi^+$. Use them to estimate the contribution of high order (penguin) diagrams to the theoretical computation of the $\phi_s^{c\bar{c}}$ phase of the $B_s^0 \rightarrow J/\psi\phi$ decay, by applying isospin relations.
- **My participation:** model-independent study of the $K\pi$ mass propagators corresponding to the S, P and D waves. Use this information to compute the C_{SP} factors needed for the angular analysis and estimate the systematics due to the presence of the D-wave.
- **Status of the analysis:** published in November 2015 with the title "Measurement of CP violation parameters and polarisation fractions in $B_s^0 \rightarrow J/\psi\bar{K}^{*0}$ decays", JHEP 11 (2015) 082.

Presentations

TALKS AT INTERNATIONAL CONFERENCES

- Aug. 2017 **Flavour Physics, 13th Rencontres du Vietnam**, "Searches for LFU breaking at LHCb". Quy Nhon, Vietnam
- Dec. 2015 **9th International Workshop on the CKM Unitarity Triangle**, "CPV results from time-dependent analysis of $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$ ". Proceedings: PoS CKM2016 (2017) 095. Mumbai, India

TALKS AT NATIONAL CONFERENCES

- Jul. 2017 **XXXVI Meeting of the Royal Spanish Society of Physics**, "Measurement of the CP-violating weak phase ϕ_s in $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$ decays at LHCb" Santiago de C., Spain
- Dec. 2015 **VII CPAN Days**, "Measurement of the CPV weak phase ϕ_s in $B_s^0 \rightarrow K^{*0}\bar{K}^{*0}$ at LHCb". Invited talk. Segovia, Spain

TALKS AT INTERNAL LHCb MEETINGS

- Mar. 2017 **83rd LHCb Week**, "Status and plans with Flavour Tagging". Invited talk. Summary of the Flavour Tagging Group's activities. CERN, Switzerland
- Mar. 2016 **79th LHCb Week**, " $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$ TD amplitude analysis". Invited talk. CERN, Switzerland
- Apr. 2015 **59th LHCb Analysis & Software Week**, " $B_s^0 \rightarrow K^{*0}\bar{K}^{*0}$ time-dependent analysis". Invited talk. CERN, Switzerland

Many talks in meetings of the BnoC Working Group and several in the SL, B2CC, FT, CPTT and VELO Testbeam Analysis Group.

POSTERS

- 66th Lindau Nobel Laureate Meeting**, "Measurement of the CP violating phase ϕ_s in $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$ decays at LHCb". Only 30 posters were selected to be presented at the event by attending students (from a total of 80 applications). *Lindau, Germany*
- 2016 European School of High-Energy Physics**, "Measurement of the CP violating phase ϕ_s in $B_s^0 \rightarrow (K^+\pi^-)(K^-\pi^+)$ decays at LHCb". *Skeikampen, Norway*

Publications

167 published papers and 10 in arXiv. LHCb author since June 2014. Find the whole list [here](#).

LHCb Service Tasks

Member of the organising committee for the 81st LHCb Week

- ORGANISED IN SANTIAGO DE COMPOSTELA, SPAIN.

September 2016

Role of Flavour Tagging Liaison at the BnoC Working Group

- PARTICIPATION IN THE FT RE-OPTIMISATION CAMPAIGN FOR RUN 2 PRODUCING NTUPLES OF CONTROL SAMPLES.

October 2015 - Present

Shifts as LHCb Data Manager

- SHIFTS IN SEPTEMBER 2015 (3 SHIFTS), JULY 2016 (5 SHIFTS) AND AUGUST 2016 (5 SHIFTS).

2015 - Present

Participation in the test beam for the VELO Upgrade

- DATA TAKING SHIFTS DURING THE TEST BEAM CAMPAIGNS OF JULY 2015 (6 SHIFTS), SEPTEMBER 2015 (2 SHIFTS) AND AUGUST 2016 (1 SHIFT).
- ANALYSIS OF THE TEST BEAM DATA TO STUDY THE POTENTIAL NOISE INDUCED BY THE FAST OSCILLATOR.

2015 - 2016

Languages

English Reading: excellent. Writing: excellent. Oral communication: excellent.

French Reading: very good. Writing: good. Oral communication: good.

Spanish Native Language.

Galician Native Language.

Portuguese Reading: good. Writing: basic. Oral communication: basic.

Computing Skills

Programming languages Python (excellent), CUDA C (good), C (good), C++(good), Fortran (basic)

Statistical analysis tools ROOT (good), RooFit (very good).

Parallel computing tools PyCUDA (good).

Simulation tools Geant4 (basic) and Pythia (basic).

Advanced calculus tools MadGraph (basic).

Markup languages LaTeX (excellent).