

# Dr Alexander Shires

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I am a highly motivated physicist with five years' experience of contributing to the LHCb collaboration at CERN. My research is focussed on searching for physics beyond the standard model in  $b \rightarrow s\ell^+\ell^-$  decays.

## Employment history

### Technische Universität Dortmund

Germany

Post doctoral researcher

2013 to 2015

Post-doctoral position in experimental particle physics as part of the LHCb collaboration in the Emmy Noether group headed by Johannes Albrecht.

## Education

### Imperial College London

UK

PhD, High Energy Physics

Oct 2013

Thesis: *Exploring  $b \rightarrow s$  electroweak penguins at LHCb*, Supervisor: Prof. Ulrik Egede

Research PhD searching for physics beyond the Standard Model on the LHCb experiment at CERN.

### Imperial College London

UK

MSci (Hons), Physics With Theoretical Physics

Jun 2009

First Class degree concentrating on the theoretical aspects of physics, specifically to understand current research into particle physics and cosmology. This four year course involved specific modules in applied mathematics, statistics and computing dedicated to implementing algorithms for modelling and data analysis.

### Hardenhuish School

Wiltshire, UK

A-levels, GCSEs

Aug 2005

A-levels: Physics (A), Mathematics (A), Chemistry (A), Further Mathematics (A).

GCSEs: 3 A\*, 3 A, 3 B.

## Research Experience

**2015 to 2017: Physics analysis group convener** As a convener of LHCb 's electroweak penguin working group, I coordinate research projects internationally and am responsible for thirty researchers ranging from students to faculty members.

**2013 to 2014: Lead analyst on testing lepton universality** The measurement of  $R_K$ , the ratio of  $B^+ \rightarrow K^+\mu^+\mu^-$  to  $B^+ \rightarrow K^+e^+e^-$  decays, was not expected to be possible at LHCb. In October 2013, I took over as the project lead and developed new models to describe the data, implemented the calculations in a coherent framework and brought the result to publication. This measurement was published in PRL and selected as a *Viewpoint in Physics*, one of four from LHCb.

**2010 to 2012: Experimental analyst** The decay  $B^0 \rightarrow K^{*0}\mu^+\mu^-$  is one to the priority measurements for LHCb. Worked on the first data from the LHC for three analyses of  $B^0 \rightarrow K^{*0}\mu^+\mu^-$ , making the world's most precise measurements. These measurements are an area of significant discussion in both the experimental and theoretical community.

**2011 & 2014: Theoretical analyses** The existence of a  $K\pi$  S-wave is a critical aspect to precision measurements of  $B^0 \rightarrow K^{*0}\mu^+\mu^-$  and I performed one of the calculations the effect of the S-wave on experimental measurements. At Dortmund, I initiated a collaboration with theorists to predict the size of the  $K\pi$  S-wave.

**2010 & 2014: Trigger development** The prospects of new physics in  $R_K$  and  $B^0 \rightarrow K^{*0}\mu^+\mu^-$  led me

to develop the electron triggers for Run II of the LHC. Based on my experience developing the muon triggers for Run I, I have ensured that there will be sufficient rate of electron decays for precision studies to test lepton non-universality.

### **Imperial College London**

**UK**

*Undergraduate research placement*

*Summer 2008*

The Ganga project has developed front-end software that allows hundreds of researchers to use many distributed computing systems across the world in a coherent format and is the main user software for LHCb and ATLAS. Developed and integrated autonomous remote testing for the Ganga project and added reporting options to show test failure differences between different versions. Worked with established Python framework as part of a small team of 10 developers to implement the remote testing.

### **Westinghouse Rail Systems**

**Wiltshire, UK**

*Junior engineer*

*Summer 2006 & 2007*

As a scholarship given to the best 3 students from local schools, worked as the sole data analyst for the first live railway trial of a multi-million pound project. Invited back for a second year to develop software to test the integration of a new railway track-side communications protocol.

## **Teaching Experience**

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**2014: English speaking tutorial group**, BSc particle physics, Technische Universität Dortmund.

**Autumn 2014: Lecture**, Particle Identification, MSc particle detectors joint lecture course, Technische Universität Dortmund.

**Summer 2014: Project supervision**, BSc and MSc final year projects, Technische Universität Dortmund.

**Winter 2014: Lecture**, Particle identification, MSc particle detectors joint lecture course, Technische Universität Dortmund.

**2012: Lab demonstrator**, BSc computational physics, Imperial College London.

**2011: Lab demonstrator**, BSc experimental physics, Imperial College London.

## **Skills**

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**Key skills:** Problem solving, Data Analysis, Programming

**Computing:** C++, PYTHON, FORTRAN

**Frameworks:** ROOT, boost, gsl, numpy/scipy

**OS:** Linux, Windows

**Tools:** SVN, Git, MS Office, L<sup>A</sup>T<sub>E</sub>X, Vim

**Languages:** English (native), German (working)

**Additional:** Full, clean UK driving licence

## **References**

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Available on request

## Publications

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### LHCb peer-reviewed papers.....

Publications with a significant contribution

LHCb collaboration, R. A. et al, *Measurement of  $B^+ \rightarrow \pi^+ \mu^+ \mu^-$  at LHCb*, (in review).

LHCb collaboration, R. Aaij et al., *Test of lepton universality using  $B^+ \rightarrow K^+ \ell^+ \ell^-$  decays*, Phys. Rev. Lett. **113** (2014) 151601, arXiv:1406.6482

LHCb collaboration, R. Aaij et al., *Measurement of form-factor-independent observables in the decay  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$* , Phys. Rev. Lett. **111** (2013) 191801, arXiv:1308.1707

LHCb collaboration, R. Aaij et al., *Differential branching fraction and angular analysis of the decay  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$* , JHEP **08** (2013) 131, arXiv:1304.6325

LHCb collaboration, R. Aaij et al., *Differential branching fraction and angular analysis of the decay  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$* , Phys. Rev. Lett. **108** (2012) 181806, arXiv:1112.3515

Additional author on more than 200 papers as a member of the LHCb collaboration.

### Peer-reviewed papers outside LHCb.....

D. Das, G. Hiller, M. Jung, and A. Shires, *The  $\bar{B} \rightarrow \bar{K} \pi \ell \ell$  and  $\bar{B}_s \rightarrow \bar{K} K \ell \ell$  distributions at low hadronic recoil*, JHEP **09** (2014) 109, arXiv:1406.6681

T. Blake, U. Egede, and A. Shires, *The effect of S-wave interference on the  $B^0 \rightarrow K^{*0} \ell^+ \ell^-$  angular observables*, JHEP **03** (2013) 027, arXiv:1210.5279

### LHCb conference submissions.....

LHCb collaboration, *Differential branching fraction and angular analysis of the  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$  decay*, LHCb-CONF-2012-008

LHCb collaboration, *Angular analysis of  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$* , LHCb-CONF-2011-038

### LHCb documents.....

A. Shires, *Optimising the electron triggers for 2015*, LHCb-INT-2014-038. CERN-LHCb-INT-2014-038

## Invited Talks

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### International conferences.....

**Frontiers in Particle Physics**, Aspen, Jan, 2014, *Rare heavy flavour decays at the LHC*,

**Spin-PRAHA**, Prague, Jul, 2012, *Testing the helicity structure of new physics with rare decays at LHCb*,

### Seminars.....

**GDR-Terascale annual meeting**, Heidelberg, Dec, 2014, *Testing lepton universality in  $b$  decays*,

**Theoretical Physics Seminars**, TU Dortmund, Oct, 2014, *Searching for new physics in  $b \rightarrow (s, d) \ell^+ \ell^-$  transitions*,

**Collider cross talk**, CERN, Sept, 2014, *Test of lepton universality using  $b \rightarrow s \ell^+ \ell^-$  decays at LHCb*,

**High Energy Physics Seminar**, University of Bonn, Oct, 2013, *Electroweak penguins at LHCb*,

**High Energy Physics Seminars**, TU Dortmund, Apr, 2013, *Exploring  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$  at LHCb*,

**IOP HEPP Annual Meeting**, Queen Mary, University of London, Apr, 2012, *Angular analysis of  $B^0 \rightarrow K^{*0} \mu^+ \mu^-$  at LHCb*,