# Curriculum Vitae for Ulrik Egede



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## Education

**Bachelor of Science in Physics** from Copenhagen University, June 1992.

**Bachelor of Science in Mathematics** from Copenhagen University, January 1994.

**Filosofie Licentiat** from Lund University, May 1996.

**PhD in Physics** from Lund University, January 1998.

## Career

**PostDoc at Rutherford Appleton Laboratory** I was working on the *BABAR* experiment at RAL from April 1998 to December 2000. My main involvement was in charm physics where I started the analysis of the doubly Cabibbo suppressed $D^0 \rightarrow K^+ pi-$ decay with the aim to measure charm oscillations. I was also involved in support for the distributed analysis effort in *BABAR* and the migration away from the ill-fated Objectivity persistency model.

**Lecturer at Imperial College London** I started as a lecturer at Imperial in December 2000. I continued the work in *BABAR* where I for several years coordinated the Charm analysis working group. Some of the most important publication from this period are listed below. During this period I gradually started working on LHC*b* with an emphasis on Rare Decays and Grid analysis tools.

**Reader in Physics at Imperial College London** From October 2007 appointed as Reader at Imperial. My research in this period focused on developing the phenomenology for physics exploitation of the LHC followed by the commissioning of the LHC*b* detector and finally the analysis of the first data.

**Professor in Physics at Imperial College London** From October 2012 appointed as Professor at Imperial. The exploitation of LHC*b* data has continued with an emphasis on collaboration with theorists to achieve the best possible understanding of the data. My work is now also focusing on the the conbstruction of the new Ring Imaging Cherenkov detector for the LHC*b* upgrade.

## Research

I am currently the group leader for the LHC*b* research group at Imperial. The group consist of 3 academic staff, 4 postdocs, 6 PhD students, and 1 engineer. The group has a heavy involvement in the exploitation of the data, the maintenance and operation of the RICH detector, and a key involvement in the upgrade of the LHC*b* detector. My current key involvements are:

**Rare decays.** The very rare flavour changing neutral current (FCNC) decays are among the best places to obtain knowledge about physics beyond the Standard Model (SM). FCNC decays are forbidden at tree level in the SM and as such allow loop induced processes from the SM and from New Physics to occur at the same level. The loop induced processes are sensitive to mass scales well beyond those accessible through direct discoveries at the LHC. My particular interest is in the decay $\overline{B}_d \rightarrow \overline{K}^{*0}\mu^+\mu^-$ where I have been heavily involved in the analysis within LHC*b* as well as the author of a set of highly cited phenomenology papers.

**Semileptonic decays** The precise measurement of the CKM matrix elements is one of the best ways to understand the indirect influence of new and yet undiscovered heavy particles on our Universe. The measurement of the matrix element $V_{\mathrm{ub}}$ is currently poor and with measurements that are internally inconsistent. I am leading a research effort within LHC*b* to determine $V_{\mathrm{ub}}$ in a completely new way using baryon decays and with input from lattice QCD.

**GRID analysis software.** I am project manager of the Ganga user interface for Grid computing. The project is developed together with the ATLAS collaboration and is essential for ensuring a prompt analysis of data from the LHC. In total about 8 s/w developers are involved from the UK, CERN and Germany. In addition Ganga acts as the entry point for a wide range of users of distributed computing resources from areas as diverse as avian flu spread modelling, image classification and lattice QCD.

# Teaching

I have since 2001 had a full teaching load at Imperial. I have lectured various courses including electromagnetism, computational physics and complex analysis. In small groups I have tutored students in all aspects of the undergraduate curriculum. For postgraduate students I give a course on Flavour physics.

I have in total supervised 9 PhD students. Their current jobs are covering a full range of High Energy physics, nuclear power sector research, electronics development, software development, law and teaching.

I have acted as an external PhD examiner at Bristol University (UK), EPFL (CH), Vrie Universität (NL), Lund (SE) and Edinburgh (UK).

My current lecturing includes undergraduate mathematics (2nd year, Fourier Analysis), running practical sessions on computational physics, supervising a number of masterr's students for the their final year projects and lectuing on Flavour Physics to postgraduate students.

# Publications

A selected list of my most important publications in recent years is given below. For a full list see http://inspirehep.net/author/profile/U.Egede.1.

1. LHCb collaboration, R. Aaij *et al.*, *Determination of the quark coupling strength* $|V_{ub}|$ *using baryonic decays*, Nature Phys. **11** (2015) 743 `arXiv:1504.01568`.

   15 citations. This paper arose from discussions that I had with different theorists working on Lattice QCD in 2012. I realised that the LHC*b* experiment had a unique opportunity to make a world leading measurement. The entire analysis of the data was carried out within my research group at Imperial. In the Standard Model of particle physics, the strength of the couplings of the $b$ quark to the $u$ and $c$ quarks, $|V_{ub}|$ and $|V_{cb}|$, are governed by the coupling of the quarks to the Higgs boson. Using data from the LHCb experiment at the Large Hadron Collider, the probability for the $\Lambda_b^0$ baryon to decay into the $p\mu^-\overline{\nu}_\mu$ final state relative to the $\Lambda_c^+\mu^-\overline{\nu}_\mu$ final state is measured. Combined with theoretical calculations of the strong interaction and a previously measured value of $|V_{cb}|$, the first $|V_{ub}|$ measurement to use a baryonic decay is performed. This measurement is consistent with previous determinations of $|V_{ub}|$ using $B$ meson decays to specific final states and confirms the existing incompatibility with those using an inclusive sample of final states.

2. U. Egede, T. Hurth, J. Matias, M. Ramon, and W. Reece, *New observables in the decay mode* $B^0 \to K^{*0}\ell^+\ell^-$, JHEP **11** (2008) 032, `arXiv:0807.2589`

   186 citations. In collaboration with theorists from CERN and Barcelona I was in the period from 2006 to 2010 leading an effort on new methods for extracting Wilson Coefficients in the $B^0 \to K^{*0}\mu^+\mu^-$ decay. This is the first of several papers resulting from that collaboration. The paper was created on my initiative. The paper was important to this area as it for the first time made a systematic evaluation of how to combine theoretical and experimental information in the most optimal way to further the understanding of how contributions to physics beyond the Standard Model might affect this decay. My involvement has given rise to a large number of invited talks at conferences and workshops and also

formed the basis of new collaborations with theorists on related matters. The paper serves now as one of the standard references for experimental analysis carried out in this area.

3. CMS and LHCb Collaborations, V. Khachatryan *et al.*, *Observation of the rare $B_s^0 \to \mu^+\mu^-$ decay from the combined analysis of CMS and LHCb data*, Nature **522** (2015) 68, `arXiv:1411.4413`

   86 citations. The branching fraction of the decay $B_s^- \to \mu^+\mu^-$ is highly sensitive to the scalar Higgs sector of any extension to the Standard Model. The combined analysis from the LHCb and CMS data is an observation of the signal at a rate compatible with the predictions from the Standard Model. This puts severe constraints on the allowed parameter space for models such as the NUHM supersymmetric model. Indeed the constraints on supersymmetry from this analysis is stronger that the constraints imposed by any direct searches for supersymmetric particles.

4. LHCb collaboration, R. Aaij *et al.*, *Measurement of Form-Factor-Independent Observables in the Decay $B^0 \to K^{*0}\mu^+\mu^-$*, Phys. Rev. Lett. **111** (2013), 191801, `arXiv:1308.1707`

   170 citations. The measurement of the angular $B^0 \to K^{*0}\mu^+\mu^-$ with the full dataset collected from the LHC in 2011 was a major milestone for the analysis of Flavour Changing Neutral Current decays. The results reveal an intriguing deviation from the Standard Model expectation that have led to a very active discussion in the literature. further analysis and phenomenological work will reveal if this deviation is related to our understanding of higher order QCD effects or may indeed be one of the first signs of new physics, such as a heavy $Z'$ particle.

5. LHCb collaboration, R. Aaij *et al.*, *Observation of a resonance in $B^+ \to K^+\mu^+\mu^-$ decays at low recoil*, Phys. Rev. Lett. **111** (2013), 112003, `arXiv:1307.7595`

   42 citations. The clear observation of a new resonance in the dimuon spectra of $B^+ \to K^+\mu^+\mu^-$ events unexpected. It demonstrates that the estimates based on quark-hadron duality are not numerically valid and that corrections to a naive factorisation framework are larger than expected. The impact of the observation is not yet fully developed but ideas have emerged on how experimental measurements can further our understanding of higher order QCD effects in the decays.