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Vladimir Vava Gligorov

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Date of birth : 27/06/1982

Employment and Education

- **CNRS, France** : research scientist (CRCN grade), Feb 2016 - present

- **CERN, Geneva, Switzerland**

  - CERN Staff Research Physicist (Limited Duration), Aug 2012 - Feb 2016
  - CERN COFUND Marie Curie Research Fellow, Aug 2009 - Aug 2012

- **University of Glasgow, UK** : research assistant, 2007 - 2009

- **University of Oxford, UK**

  - DPhil in Physics, June 2008.
    Advisers: Dr. Guy Wilkinson and Dr. Jonas Rademacker.
    Thesis title: Measurements of B meson lifetimes and the CKM angle γ at the LHCb detector.
    http://cdsweb.cern.ch/record/1106345.
  - MPhys in Physics, June 2003

Awards and Research Leadership Roles

- Co-chair, LHCb Upgrade Software Planning Group, December 2017 - present

- Co-editor, Software Trigger and Event Reconstruction chapter, HSF Community White Paper.

- ERC Consolidator Grant "RECEPT" (GA724777)

- LHCb Deputy physics coordinator, January 2016 - January 2018

- Project leader of the LHCb High Level Trigger, September 2014 - March 2016

- Deputy project leader of the LHCb High Level Trigger, January 2013 - September 2014

- Convener, B2OpenCharm Physics Working Group, LHCb, March 2012 - March 2014

- Deputy convener, Gamma-With-Trees Physics Working Group, LHCb, June 2009 - January 2011

Research Interests & Experience

My primary research interest is understanding the discrepancies between our theories of the microscopic and macroscopic universe. If the particles and force carriers in the Standard Model are all that exists in nature, then how does sufficient CP violation arise to explain the residual matter density in the universe following the Big Bang? If General Relativity describes the motion of galaxies, then what does the necessary yet unseen dark matter consist of? My research career has been spent on the LHCb experiment trying to find answers to these questions.

I have performed a wide range of physics analyses, with particular highlights being the measurement of time-dependent CP violation and the CKM angle γ in $B_s^0 \to D_s^\pm K^\mp$ decays, the observation of new B^{**} resonances, and measurements of time-dependent CP violation in two-body D^0 meson decays. As part of the $B_s^0 \to D_s^\pm K^\mp$ analysis, my student and I showed for the first time that LHCb's particle identification information could be used in a maximum likelihood fit (instead of as a selection criterion) to substantially improve the fit sensitivity, work for which she subsequently won the collaboration's thesis prize. My current research focus is on understanding

whether the hints of lepton universality breaking which LHCb and other experiments have glimpsed over the last years are really the harbingers of New Physics or simply the latest mirages in the desert of the Standard Model. To this end, I am currently leading a team carrying out a systematic investigation of lepton universality breaking in b-hadron decays, as part of my ERC grant "RECEPT". I have also recently co-proposed a novel detector, CODEX-b, which has the potential to greatly expand LHCb's sensitivity to long-lived particles Beyond the Standard Model, and am leading the effort to secure support for its construction.

I took an interest in triggering and real-time data processing during my PhD, when I studied the data-driven determination of how the trigger system biases the distribution of heavy flavour decay-times. I was deeply involved in the commissioning of LHCb's High Level Trigger (HLT) with first data in 2010, during which time I developed a novel trigger strategy of searching for a single displaced charged particle – instead of the traditional displaced vertex – at the first stage of the HLT. This approach greatly reduced the processing time required for the HLT reconstruction and allowed a much more efficient selection of heavy flavour decays. During this period I also co-authored the first large-scale use of a Boosted Decision Tree (BDT) in the HLT of an LHC experiment, also novel because the BDT was specifically designed to be insensitive to data-simulation differences and to variations in detector performance over time. This "topological" trigger was used to select displaced b-hadron vertices at the second HLT stage, gaining a factor 3 in output rate for the same signal efficiency over previous approaches, and was used by over half of all LHCb Run 1 analyses. Because the huge production rate of heavy flavour decays at the LHC meant that the LHCb trigger's bandwidth was saturated by the signal, I subsequently proposed a redesign of the HLT in order to enable the alignment, calibration, and full offline-quality reconstruction of the detector to be performed in real-time. This design, whose implementation I coordinated and commissioned as the HLT project leader, allowed LHCb to perform physics analyses with the trigger-level reconstruction from the very first data taken in Run 2, and therefore to greatly increase the amount of signal which could be saved for the same output bandwidth. This real-time analysis concept also serves as the prototype for the upgraded LHCb detector, which will take data with a 5 times higher instantaneous luminosity from 2021, and operate an entirely software trigger. Together with my "RECEPT" team, my current focus is on reoptimising LHCb's HLT software and reconstruction algorithms to take advantage of modern parallel computing architectures, allowing the upgraded LHCb detector to reach its full potential across the whole range of the collaboration's physics programme.

Conferences, schools, reviewing roles and other responsibilities

I am an elected member of the physics faculty Administrative Council ("Conseil UFR") of Sorbonne Université. I served as an ex-officio member of the LHCb Physics and Operations planning groups and its Technical Board, and contributed to numerous LHCb detector documents, TDRs, and reports to external committees. I have served as an expert reviewer for the LHCC for the CMS and ATLAS HL-LHC trigger and DAQ upgrades, as a reviewer for the journals NIMA and TNS, and as an expert reviewer for the ERC.

I served on the pedagogical/program committee of the TESHEP and MLHEP summer schools, and the standing committee of the Data Science At The LHC/HEP conference series. Member of the LOC of the 2015 CERN-Fermilab summer school, co-convener of the flavour session at LHCP 2016, co-convener of the "mixing" Working Group (WG) of CKM 2016. Have served in various roles in the ECFA HL-LHC workshops since 2014, most recently as LHCb editor of the Flavour WG of the 2018 CERN yellow report on the physics of the HL-LHC.

Teaching Experience

Currently supervising two HEP PhD students and co-supervising a joint Computer Science/HEP master's student on the application of advanced reconstruction algorithms to HEP data. During my time at CERN I supervised 5 summer students, a master's student, a technical student, and a PhD student. Lecturer at the 2017 CERN-Fermilab summer school. As a postdoc and graduate student I supervised lab projects over a number of years.

Outreach

I have a strong commitment to popularising science because I feel that scientific research is meaningless unless scientists engage with the general public. I coordinated LHCb's entry into the International Masterclass programme in 2014, co-writing the first version of our exercise with a technical student, and subsequently served as one of the LHCb contacts to the International Masterclass steering group. I also organise the annual masterclasses at

LPNHE, which typically involve three schools and around 100 students per year, and have regularly lectured and supervised projects at the Petnica Science Centre for talented high-school students in Serbia.

Publications in peer-reviewed journals

My full publication list can be found at my INSPIREHEP profile. As a member of LHCb, most of my papers are signed along with the hundreds of other analysts and detector experts without whom the measurements would not be possible. Here I list the ten which I consider most significant and where I made a major personal contribution.

- "Searching for Long-lived Particles: A Compact Detector for Exotics at LHCb"
  V. V. Gligorov et $al.$
  Phys. Rev. D **97**, no. 1, 015023 (2018) HEP entry

- "Measurement of CP asymmetry in $B_s^0 \to D_s^\mp K^\pm$ decays"
  R. Aaij et $al.$ [LHCb Collaboration].
  JHEP **1803**, 059 (2018) HEP entry

- Search for Structure in the $B_s^0 \pi^\pm$ Invariant Mass Spectrum
  R. Aaij et $al.$ [LHCb Collaboration].
  Phys. Rev. Lett. **117**, 152003 (2016) HEP entry

- "Tesla : an application for real-time data analysis in High Energy Physics"
  R. Aaij et $al.$ [LHCb Collaboration].
  Comput. Phys. Commun. **208**, 35 (2016) HEP entry

- "Precise measurements of the properties of the $B_1(5721)^{0,+}$ and $B_2^*(5747)^{0,+}$ states and observation of $B^{+,0}\pi^{-,+}$ mass structures"
  R. Aaij et $al.$ [LHCb Collaboration].
  JHEP **1504**, 024 (2015) HEP entry

- Measurements of indirect CP asymmetries in $D^0 \to K^- K^+$ and $D^0 \to \pi^- \pi^+$ decays
  R. Aaij et $al.$ [LHCb Collaboration].
  Phys. Rev. Lett. **112** (2014) no.4, 041801 HEP entry

- Efficient, reliable and fast high-level triggering using a bonsai boosted decision tree
  V. V. Gligorov and M. Williams.
  JINST **8**, P02013 (2013) HEP entry

- Charged Particle Tracking with the Timepix ASIC
  K. Akiba et $al..$
  Nucl. Instrum. Meth. A **661**, 31 (2012) HEP entry

- Determination of f_s/f_d for 7 TeV pp collisions and a measurement of the branching fraction of the decay $B_d \to D^- K^+$
  R. Aaij et $al.$ [LHCb Collaboration].
  Phys. Rev. Lett. **107**, 211801 (2011) HEP entry

- The LHCb Trigger and its Performance in 2011
  R. Aaij et $al.$ [LHCb Collaboration].
  JINST **8**, P04022 (2013) HEP entry

Key invited talks

I have given numerous other talks at conferences, workshops, and seminars. Starred talks are on behalf of LHCb.

- **ICNFP 2017***, Kolymbari, Crete.
  Flavourful roads to New Physics

- **HEP-ML Workshop, NIPS 2014**, Montreal, Canada.
  Real time data analysis at the LHC : present and future.

- **2nd HL-LHC workshop**, Aix-Les-Bains, France.
  DAQ, Online, and Software Triggers Summary.

- **CKM 2014***, Vienna, Austria.
  Measurement of CP observables in $B_s \to D_s K$ at LHCb.

- **CERN EP Seminar**, June 2014.
  Flavour physics: status and prospects.

- **DIS 2013***, Marseille, France.
  Studies of excited charm and beauty mesons at LHCb.

- **Moriond EW 2013***, La Thuille, Italy.
  Hadronic b decays to open charm (γ).

- **Pisa Advanced Detector Workshop 2012***, Elba, Italy.
  Performance and upgrade plans of the LHCb trigger system.

- **Physics at the LHC 2011***, Perugia, Italy.
  CP-violation studies with charm decays at LHCb.

- **CKM 2010***, Warwick University, UK.
  Time dependent measurements of the CKM angle γ at LHCb.