Matthew Kirk

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Current Position

María Zambrano postdoctoral research fellow – ICCUB, Universitat de Barcelona, Spain

Research Interests

- Explaining anomalies through simplified model building and EFT approaches
- Precision calculations of B physics observables
- Use of open source software to efficiently conduct global fits

Employment and Education

- 2021-2022: Postdoctoral researcher – ICCUB, Universitat de Barcelona, Spain
- 2018-2021: Postdoctoral researcher – Università di Roma “La Sapienza”, Italy
- 2014-2018: PhD – IPPP, Durham University, UK, supervised by Alexander Lenz.
  My PhD thesis was awarded the Springer Thesis Prize in 2019, and subsequently published as a book.
- 2010-2014: MSci, BA in Natural Sciences (Physics) – King's College, University of Cambridge, UK

Publications & Talks

Articles

Large $t \to cZ$ as a sign of vectorlike quarks in light of the W Mass
Andreas Crivellin, Matthew Kirk, Teppei Kitahara, Federico Mescia
Phys.Rev.D 106 (2022) L031704 (arXiv:2204.05962)

Unveiling Hidden Physics at the LHC
Oliver Fisher et. al.
arXiv:2109.06065 (White paper including input from the workshop "Unveiling Hidden Physics Beyond the Standard Model at the LHC")

First-generation new physics in simplified models: from low-energy parity violation to the LHC
Andreas Crivellin, Martin Hoferichter, Matthew Kirk, Claudio Andrea Manzari, Luc Schnell
JHEP 10 (2021) 221 (arXiv:2107.13569)

Cabibbo anomaly versus electroweak precision tests: An exploration of extensions of the Standard Model
Matthew Kirk
Phys.Rev.D 103 (2021) 3, 035004 (arXiv:2008.03261)

Anomalies and accidental symmetries: charging the scalar leptoquark under $L\mu - L\tau$
Joe Davighi, Matthew Kirk, Marco Nardecchia
JHEP 12 (2020) 111 (arXiv:2007.15016)

Vcb and gamma from B-mixing
Daniel King, Matthew Kirk, Alexander Lenz, Thomas Rauh
JHEP 3 (2020) 112 (arXiv:1911.07856)

Charming New B-Physics
Sebastian Jäger, Kirsten Leslie, Matthew Kirk, Alexander Lenz
JHEP 3 (2020) 122 (arXiv:1910.12924)

ΔMs theory precision confronts flavour anomalies
Luca Di Luzio, Matthew Kirk, Alexander Lenz, Thomas Rauh
JHEP 12 (2019) 009 (arXiv:1909.11087)

Updated Bs-mixing constraints on new physics models for $b \to s\ell+\ell-$ anomalies
Luca Di Luzio, Matthew Kirk, Alexander Lenz
Phys.Rev.D 97 (2018) 9, 095035 (arXiv:1712.06572)

Dimension-six matrix elements for meson mixing and lifetimes from sum rules
Matthew Kirk, Alexander Lenz, Thomas Rauh
JHEP 12 (2017) 068 (arXiv:1711.02100)

Charming Dark Matter
Thomas Jubb, Matthew Kirk, Alexander Lenz
JHEP 12 (2017) 010 (arXiv:1709.01930)

Charming new physics in rare B-decays and mixing?
Sebastian Jäger, Kirsten Leslie, Matthew Kirk, Alexander Lenz
Phys.Rev.D 97 (2018) 1, 015021 (arXiv:1701.09183)

On the ultimate precision of meson mixing observables
Thomas Jubb, Matthew Kirk, Alexander Lenz, Gilberto Tetlalmatzi-Xolocotzi
Nucl.Phys.B 915 (2017) 431-453 (arXiv:1603.07770)

Talks

Vector-like Leptons – Invited talk at "Electroweak Precision Physics from Beta Decays to the Z Pole" workshop, MITP (Oct 2022)
Vector-like quarks for $t \to cZ$, B physics, and MW with automated 1-loop matching – Seminar at La Sapienza (Jun 2022)
Review of New Physics in non-leptonic tree level B meson decays – Invited talk at "Status and Prospects of Non-leptonic B meson decays" conference, Siegen (Jun 2022)
CP violation in flavour anomaly models – Invited talk at "Heavy Quarks and Leptons" conference, Warwick (Sep 2021)
Cabibbo Angle Anomaly – Invited talk at "Anomalies and Precision in the Belle II Era" workshop, Vienna (Sep 2021)
Charging a leptoquark under $L\mu$-$L\tau$ - Seminar at Siegen (June 2020)
Anomalies vs Mixing and CPV - Invited talk at "Beyond the Flavour Anomalies" workshop, IPPP (Apr 2020)
BSM in Charming operators? - Seminar at Nikhef (Feb 2020)
Interplay between ΔMs and flavour anomalies - Talk at "bsll 2019" conference, Lyon (Sep 2019)

Hints of new physics in flavour anomalies - Invited talk at "7th Rome Joint Workshop", Frascati (Dec 2018)
What Mixing and Lifetimes can tell us about NP - Invited talk at "LHCb Implications", CERN (Oct 2018)
Constraints on new physics from the latest results in meson mixing - "From Flavour to New Physics" conference, Lyon (April 2018)
Future of CP violation in asl - "Towards the Ultimate Precision in Flavour Physics" workshop, Warwick (April 2018)
Meson mixing and lifetimes – LHCb-UK annual meeting, Glasgow (January 2018)
What is the ultimate precision of meson mixing variables? – "Heavy Flavour 2016 – Quo Vadis?" workshop, Islay, Scotland (July 2016)
Charming Dark Matter – YTF 8, IPPP (January 2016)
Combining dark matter and charm bounds – LHCb-UK annual meeting, Liverpool (January 2016)

Poster Presentations

Charming Dark Matter – UK HEP Forum, Abingdon (November 2015)
Looking forward to new lattice inputs for flavour phenomenology – "Lattice 2016" conference, Southampton (July 2016)

Scientific Activities

- Theory convener for the "Mixing and CP violation in Beauty and Charm" stream at the "Implications of LHCb measurements and future prospects" workshop in 2019 and 2022
- Peer referee for European Physical Journal C, Physical Review D (2022 – present)
- ICCUB seminar organiser

Supervisory and Teaching Activities

- 2022: Co-supervisor (with Professor Federico Mescia) of undergraduate thesis on perturbative unitarity bounds on new physics.
- 2017–2018: Introduction to Programming in Python (1st year undergraduate course) – examples class demonstrating, project marking.
- 2016–2017: Computational Physics (2nd year undergraduate course) – examples class demonstrating.
- 2015–2016: Mathematics Workshop (3rd year undergraduate course) – problem class demonstrating.
- 2014–2015: Mathematical Methods in Physics (2nd year undergraduate course) – problem class demonstrating, exam marking.

Outreach

- August 2018: Chi ha ordinato quel?
  Talk to postgraduate students at Grey College, Durham University as condition of "Grey College Trust Student Experience" funding award.
- February 2018: Phenomenology: Not Just a Long Word
  Talk to postgraduate students at Grey College, Durham University as part of postgraduate academic programme.
- July 2017: Modelling the Invisible (Royal Society Summer Science Exhibition)
  The Summer Science Exhibition is a week long event at the Royal Society in London each year, with approximately 14000 visitors total, and 20 exhibitors. I was involved with the preparation of the exhibition pieces, publicising our stand through a blog post by the Raspberry Pi Foundation, and engaging with the public over four days at the exhibit.

- April 2017: Durham University Supported Progression tutorial supervisor
  Program to support school students from the local area into university, including small group tutorials with university style problems, with reduced entry requirements for participants.
- October 2016: Dark Matter – A Particle Physicist's Perspective
  Talk to postgraduate students at Grey College, Durham University as part of postgraduate academic programme.
- August 2016: Sutton Trust Summer School tutorial supervisor
  The Sutton Trust organises summer schools for school students from disadvantaged backgrounds, which include small group tutorials .
- June 2016: What don't we know?
  Talk to postgraduate students at Grey College, Durham University as part of postgraduate academic programme.
- August 2015: Sutton Trust Summer School tutorial and poster project supervisor
  The Sutton Trust organises summer schools for school students from disadvantaged backgrounds, which include small group tutorials and poster creation and presentation sessions.
- Summer 2012: Raspberry Pi (Undergraduate Research Program, Computer Science Department, University of Cambridge)
  10 week project to produce materials for students and the general public, following the launch of the Raspberry Pi earlier that year, and working with several of the founders of the Raspberry Pi Foundation.