Matthew Rossetter

Curriculum Vitae

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EDUCATION

2016 – 2020 **Master of Physics – First Class Honours**

STATEMENT OF MARKS:

- FOURTH YEAR - 1ST (78%)
- THIRD YEAR - 2:1 (69%)
- SECOND YEAR - 1ST (77%)
- FIRST YEAR - 1ST (72%)

Theoretical Physics
University of Durham

2009 – 2016 **Secondary Education**

- Advanced Highers - A in Physics, Maths, Chemistry, and English
- Highers - A in Physics, Chemistry, Biology, Maths, and English
- National 5s - 7 As and 1 C, including Maths, Physics, and English at A

The High School of Glasgow

MASTERS THESIS

"CP Violation In and Beyond The Standard Model: Two Higgs Doublet Model Type II Contributions to Flavour Observables"

In this study, we first cover the theory of the Standard Model (SM) and then test the Two Higgs Doublet Model (2HDM) of Type II as an extension to the SM using indicative flavour observables, such as leptonic and semileptonic decays of B and D mesons, $B\bar{B}$ mixing, and the $b \to s\gamma$ radiative decay. Testing the 2HDM parameter space (m_{H^+}, $\tan\beta$) to find alignment between theoretical calculations and experiment, constraints on the parameters were found for flavour phenomena to work towards a global fit. We perform this fit in both the alignment and wrong sign limits of the 2HDM. Strongly dominated by the $b \to s\gamma$ branching ratio, the mass of a charged Higgs particle would be expected to have a minimum value at 95% CL of 490 GeV in the alignment limit and 740 GeV in the wrong sign limit. The value of $\tan\beta$ is limited by $B_q \to \mu^+\mu^-$ decays, yielding maximum values at 95% CL of 20.8 in the alignment limit and 4.03 in the wrong sign, for the fixed choices of other parameters. This work was then joined with constraints from the oblique parameters S, T, U from another work, to better give judgement on the state of the 2HDM fit. The results of this combined fit are no more conclusive than flavour alone, due to additional parameter dependency in S, T, U; the only additional constraint we definitively find here is that $m_{H^+} \approx m_{H^0} \approx m_{A^0}$ in both the alignment and wrong sign limits. The validity of this fit is heavily influenced by the semileptonic ratio $\mathcal{R}(D^*)$ which remains in disagreement with the 2HDM fit to 3σ; the statistical fit of these observables points to exclusion of this model at 95% CL in the wrong sign limit, and 85% CL in the alignment limit, at 2σ error significance. This model cannot be excluded at 3σ error significance, where $\mathcal{R}(D^*)$ no longer causes disagreement in the fit.

AWARDS

2019 President's Vote of Thanks, and Full Colours
St Mary's College, Durham University

2018 BIIAB Level 2 Award for Personal License Holders

2017 RLSS National Pool Lifeguard Qualification

2016 British Red Cross Emergency First Aid and ITC Outdoor First Aid

2015,16 National Finalist and Company President at UK Space Design Competition

2014,15 CREST Bronze & Silver Science Awards

COMPUTER SKILLS

BEGINNER	Perl, HTML, Fortran
INTERMEDIATE	C++, Microsoft Office
EXPERT	Python, Unix, LaTeX

SKILLS

Critical Thinking

I am able to conceptualise and analyse complex ideas and concepts. It is an important part of any role, particularly in science, to perceive the merits and flaws of a system and comprehend how to optimise this based on the information provided. One must also know when a system is flawed and must be reviewed.

Goal Oriented and Dedicated

Understanding tasks properly is important to me. Performing these tasks properly is important to the efficient running of a workspace. I use my judgement to act and achieve goals quickly and efficiently. As part of a workplace, I dedicate myself fully to the task at hand. Focusing on what task needs done and putting the full effort needed towards its completion results in a better job being performed.

Passionate

I have been interested in theoretical physics such as quantum mechanics and particle phenomenology from an early age. My education and research have cemented this interest into a passion. I greatly enjoy carrying out fundamental physics research with potential experimental implications.

Communication Skills and Collaborative Working

I have spent a lot of time working in customer service and enjoy interacting with people of all backgrounds. I have learned how to work together with other people to achieve a goal, and adapt to many working environments to best make use of my resources.

ACADEMIC EXPERIENCES

Quarkonia Modelling

Throughout my degree course, I have had several courseworks that have required extensive Python programming, thus far leading up to the year-long project in my Third Year, where I modelled the early (n,l) wave-functions for a Hydrogen atom, and then applied this to Quarkonia phenomena. I was able to calculate good approximations for several lower state masses, with the inclusion of hyperfine splitting. A full repository of this study can be found in my github profile.

Python Tutoring

As part of my fourth year undergraduate, I volunteered to help tutor in First Year programming workshops, assisting in teaching the new students the fundamentals of Python programming for physics. I put my knowledge of Python to good use by sharing with newer students, and this allowed me to develop a better understanding of the language in teaching it.

WORK EXPERIENCE

OCT 2018 – JUL 2020 (PT)

Freemans Quay Leisure Centre
Casual Leisure Assistant/Lifeguard

The challenge of being a lifeguard is in the potential for life-or-death situations. As a lifeguard, I present a positive leisure experience, which focuses on dealing with any customer issues and maintaining an enjoyable environment for all. This must be balanced with constant vigilance over the pool area in case of the need for intervention or rescue, with the proper knowledge and ability to save any lives that may be at risk.

OCT 2017 – JUN 2020 (PT)

St Mary's College Bar
Bar Staff

I am responsible for serving and interacting with customers. This requires developing keen social skills to balance a friendly atmosphere for customers with a presence of authority to those who may cause trouble. It is important to maintain a high level of cleanliness in a frequently messy environment, and keep a mind for potential welfare issues such as binge drinking which must be monitored and reported.

SEP 2018 – JUL 2019 (PT)

St Mary's College Bar
Bar Steward

Over the academic year 18/19, I was in charge of the college bar with duties such as stock control, staff hiring and training, shift assignment, and maintainence and cleaning. I was selected for my strong work ethic and commitment to the role, and developed skills into this management role to improve the college bar to bring in more customers, creating a safer and more efficient working environment for staff. When managing staff who were also my peers, it was important to find the proper balance in the workplace so I would be taken seriously in my role as their manager.

REFERENCES

Dr. Alexander Lenz

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Universität Siegen

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