

MATTHEW KENZIE

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RESEARCH INTERESTS

I have worked in the Higgs to two photons group at CMS for the length of my PhD. It was amazing to be a part of the discovery of the new boson last year. My research interests are fairly broad and anything which looks for or probes physics beyond the Standard Model (SM) at the LHC is interesting, whether this be indirectly through rare decays and Higgs coupling measurements or by direct searches for new physics in Supersymmetry (SUSY) or exotics. The latter will be of particular interest when the LHC turns back on at a higher centre-of-mass energy given the large increase in production cross-sections of new particles which have a mass in the TeV range. My expertise lies predominantly in using advanced data analysis techniques to extract maximal signal sensitivity, distinguish statistical hypotheses and measure properties. I have considerable experience in analysis software; object reconstruction, event selection and using multivariate techniques and model parametrisations to extract and measure physical quantities. The simplest path would be the continuation of my work within the CMS $H \rightarrow \gamma\gamma$ group although I am particularly interested in the bigger challenge of applying my skills to direct searches for SUSY which will be especially relevant at the LHC in 2014/2015 when new data at $\sqrt{s} = 13$ TeV may be the boundary for natural SUSY.

EDUCATION

PhD High Energy Physics

Imperial College London

October 2010 - Present (Defence date: March 2014)

MSc Theoretical Physics

Distinction (highest attainable)

Imperial College London

October 2009 - September 2010

BSc (Hons) Physics

1st Class (highest attainable)

Durham University

October 2006 - July 2009

EXPERIENCE

PhD student based at CERN, Geneva, working in the CMS Collaboration

Imperial College London

- Worked as one of the main members of the Higgs to gamma gamma group developing analysis techniques, writing the code and technical implementation of new ideas and producing the main results for public notes and conferences. Work has directly contributed towards the discovery of the new particle last summer.
- Developed the spin analysis on Higgs to gamma gamma and was editor of the public Physics Analysis Summary (CMS-PAS-HIG-13-016) which contained the

spin analysis results and other property measurements of the new state in its decay to two photons.

- Have spent much time working on alternatives to the background model which is a significant source of systematic error in low signal-to-background analyses. Developed a method of extracting the background from sidebands which cross checks the main result. In the process of developing a completely new method of estimating the background which can reduce Higgs coupling errors by 10% in the diphoton channel.
- Produce the main results and plots for the Higgs to gamma gamma group. Also responsible for the handover of the final results for statistical combination with the other Higgs channels at CMS.
- Produced a method, which is the basis of the one currently used, for correcting photon energies, as a function of their position and raw energy, and estimating the per-photon energy resolution.
- Trained for and worked as Detector on Call for the CMS ECAL team. This consists of week long shifts as the main contact person, available 24/7, for any problem with the CMS ECAL. I have also done shifts in Data Quality Management for the CMS ECAL as a Prompt Feedback Expert and contributed towards the Detector Performance Group at CMS with work on photon and electron clustering.

Masters in Theoretical Physics

Imperial College London

- I wrote a thesis on Unparticle Physics which considers the implication of coupling a conformally invariant sector to the Standard Model. The first half concentrated on the technical implication of such a theory whilst the second half discussed the phenomenological consequences of it and how experimental signatures could be observed in Hidden Valley like scenarios.
- Achieved a distinction overall, the highest possible grade, which required over 80% in the thesis and each examination of the taught courses which included Quantum Field Theory, Group Theory, General Relativity, Differential Geometry, Unification and The Standard Model.

Undergraduate in Industry Program

Durham University

- Worked alongside an industrial arm of General Electric developing and testing new strategies for oil and gas pipeline inspection vehicles.

Student Associates Teaching Scheme

Durham University

- Assisted teachers in school science lessons. Helping less able students, improving class participation, teaching parts of lessons, providing demonstrations and promoting higher education.

PUBLICATIONS & PUBLIC NOTES

**(with significant
contribution)**

CMS Collaboration, "Observation of a new boson with mass near 125 GeV in pp collisions at $\sqrt{s}=7$ and 8 TeV", *JHEP* **06** (2013) 081, doi:10.1007/JHEP06(2013)081

CMS Collaboration, "Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC", *Phys. Lett. B* **716** (2012) 30, doi:10.1016/j.physletb.2012.08.021

CMS Collaboration, "Search for the standard model Higgs boson decaying into two photons in pp collisions at $\sqrt{s} = 7\text{TeV}$ ", *Phys. Lett. B* **710** (2012) 403, doi:10.1016/j.physletb.2012.03.003

CMS Collaboration, “Updated measurements of the Higgs boson at 125 GeV in the two photon decay channel”, *CMS Physics Analysis Summary CMS-PAS-HIG-13-016* (2013)

CMS Collaboration, “Properties of the observed Higgs-like resonance decaying into two photons”, *CMS Physics Analysis Summary CMS-PAS-HIG-13-001* (2013)

CONFERENCES, Higgs Hunting, Orsay 2013

TALKS & SCHOOLS **Higgs to two photons at CMS** (On behalf of CMS collaboration)
Conference plenary invited talk

LHC Collider Cross Talk, CERN 2013

Higgs to two photons at CMS (On behalf of CMS collaboration)
Invited workshop chalk and talk

CMS UK, Oxford 2013

Jackknifing the Higgs to gamma gamma analysis
Invited workshop talk

CERN Summer School, Arequipa 2013

Higgs to two photons at CMS
Poster

RAL High Energy Physics Summer School, Oxford 2011

Higgs to two photons at CMS
Poster

COMPUTER *Languages: C, C++, python, bash, HTML*

SKILLS *Software: L^AT_EX, Microsoft Word, Excel, Powerpoint, ROOT, RooFit, RooStats*

Operating Systems: Windows, Mac OS, Linux, SLC

REFERENCES **Prof. Paul Dauncey** (PhD Supervisor)

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