Patrick Dunne

Flat 2, 45A Kingston Road,
London, SW19 1JW
(+44) 7919 405 613
dunnepatrickj@gmail.com

Research Experience

2012-present **PhD Student**, *Imperial College*.

- Carried out searches for invisibly decaying Higgs bosons with the CMS detector
  - Focussed on the most powerful vector boson fusion (VBF) production channel
  - Lead analyser responsible for trigger efficiency measurements, background estimation, systematic uncertainty studies and the setting of limits on the invisible branching fraction of the Higgs boson.
  - Produced several public results including the first result in the VBF channnel
  - Lead analyser on statistical combinations of CMS searches for invisible Higgs decays in different production channels. Performed studies of overlaps and correlations between the different analyses and the setting of limits on the invisible branching fraction of the Higgs boson
  - Currently interpreting the results of these searches as limits on Higgs portal, two Higgs doublet and effective field theory dark matter models and studying data from run II of the LHC
- Co-founded a student seminar club to improve the presentation skills of students and inform the group of our research activities
- Expect to submit my PhD early in 2016

2013 **Long Term Attachment**, *CERN*.

- Based at CERN for four months as part of my PhD research
- Carried out detector operations shifts on the CMS detector

2012 **Masters Project**, *University of Oxford*.

- Investigated the 'Qjets' algorithm for stochastic jet clustering as part of the ATLAS collaboration
- Identified improvements in the resolution of objects within jets with high transverse momentum

2005-2011 **Summer Projects**, *LLNL, Oxford, CERN, MIT*.

- 2011 - Lawrence Livermore National Laboratory (LLNL), California: Performed studies of metals at high pressure using the Jupiter Laser Facility
- 2010 - University of Oxford: Analysed data from the CDF experiment searching for non-standard model couplings in VBF produced W bosons
- 2007 - CERN: Assisted in assembling a frequency scanning interferometry system for monitoring of the ATLAS detector
- 2005 - MIT: Studied algorithms for robot control in the rapid prototyping group

Education

2008-2012 **MPhys Physics**, *University of Oxford*, First class honours degree.

2005-2008 **5 A levels, 11 GCSEs**, *Sutton Grammar School*.

- A grades in physics, maths, further maths, electronics and chemistry A levels
- Advanced extension awards in physics (distinction) and maths (merit)

Academic Awards

2014 **Poster Prize**, *Imperial College Physics Department.*
- Prize at the postgraduate summer research symposium

2014 **Poster Prize**, *Imperial College Graduate School.*
- Won second prize in the college wide graduate school poster competition

2013 **Poster Prize**, *STFC.*
- Awarded for STFC high energy physics summer school poster competition

2012 **Peter Fisher Prize**, *Trinity College Oxford.*
- Prize awarded to the student in college with the best finals results in Physics

2012 **Mitchell Scholarship for Outstanding Students**, *Trinity College Oxford.*
- Scholarship awarded to allow promising students to undertake research projects
- Funds won used to participate in studies of metals at very high pressures using the Jupiter Laser Facility at Lawrence Livermore National Laboratory

2010-2012 **Millard Scholarship**, *Trinity College Oxford.*
- Awarded for continued excellent performance in examinations

2010 **Gibbs Prize for Public Speaking**, *University of Oxford Physics Department.*
- Best talk in department-wide physics speaking competition with 170 entries

2010 **Examiners' Commendation**, *Oxford University Physics Department.*
- Awarded for outstanding performance in second year practical course

2009 **Millard Exhibition**, *Trinity College Oxford.*
- Awarded for performance in preliminary examinations

Teaching Experience

2014-present **Masters Student Supervision**, *Imperial College.*
- Padraic Calpin (Imperial College), Searches for VBF produced invisible Higgs
- Achilleas Fragkoulis (Imperial College), Searches for VBF produced invisible Higgs
- Miha Zgubic (Imperial College), Interpretations of searches for invisible Higgs

2013-present **Undergraduate Lab Demonstration**, *Imperial College.*
- Demonstrated in second year radioactivity lab
- Voted best lab demonstrator by students in AC 2013/14 and 2014/15
- Responsible for interviewing students and marking their work

Outreach

2015 **Searching for the Higgs boson at the LHC**, *Sutton Grammar School.*

2014 **Royal Society Summer Exhibition**, *London.*

2014 **High Energy Physics Masterclass**, *Imperial College, London.*

2013 **Tour Guide**, *CMS detector, CERN.*

2013 **Bang Fair**, *ExCel Centre, London.*

2013 **High Energy Physics Masterclass**, *Imperial College, London.*

Memberships and Collaborations

2012-present **CMS Collaboration**.

2008-present **Institute of Physics**.

2012 **ATLAS Collaboration**.

Talks

2015 **CMS Higgs Group**, *Approval and pre-approval talks for analysis HIG-15-012*, A combination of searches for the invisible decays of the Higgs boson using the CMS detector.

2015 **IOP HEP Group Conference**, *Manchester*, Searches for invisible decays of the Higgs boson with the CMS detector.

2015 **CMS UK Collaboration Meeting**, *VBF Higgs to Invisible - Towards Run II*.

2014 **CMS Higgs Group**, *Pre-approval talk for analysis HIG-14-038*, Search for invisible decays of Higgs bosons in the vector boson fusion production mode.

2014 **PANIC Conference**, *Hamburg*, Searches for invisible decay modes of the Higgs boson with the CMS detector.

2014 **CMS Higgs Group**, *Approval talk for analysis HIG-13-030*, Search for invisible decays of Higgs bosons in the vector boson fusion and associated ZH production modes.

2014 **CMS UK Collaboration Meeting**, *Higgs to invisible analyses at CMS*.

Publications

Co-author on 134 publications as part of the CMS collaboration (inSPIRE HEP, October 2015) and have an h_{hep} index of 29. Selected papers with substantial contributions are given below:

2015 **CMS Collaboration**, *'A combination of searches for the invisible decays of the Higgs boson using the CMS detector'*, CMS Physics Analysis Summary - HIG-15-012.
- Was the main analysis contact for the CMS review process
- Lead analyser of the statistical combination of the separate searches and studies of correlations between channels

2015 **CMS Collaboration**, *'Search for invisible decays of Higgs bosons in the vector boson fusion production mode'*, CMS Physics Analysis Summary - HIG-14-038.
- Was the main analysis contact for the CMS review process
- Lead analyser responsible for trigger efficiency measurement, background estimation, systematic uncertainty studies and setting limits on the Higgs boson invisible branching fraction

2014 **CMS Collaboration**, *'Search for invisible decays of Higgs bosons in the vector boson fusion and associated ZH production modes'*, Eur. Phys. J. C 74 (2014) 2980.
- One of the lead analysers responsible for background estimation, systematic uncertainty studies and the setting of limits on the Higgs boson invisible branching fraction in the most powerful VBF channel
- Lead analyser of the statistical combination of the separate searches and studies of correlations between channels

2013 **CMS Collaboration**, *'Search for invisible decays of Higgs bosons in the VBF channel'*, CMS Physics Analysis Summary - HIG-13-013.
- One of the lead analysers responsible for background estimation and systematic uncertainty studies
- First limit on Higgs invisible branching fraction in the most sensitive VBF channel

Further Information

Computing.

- Experienced in C++, C, python and the ROOT analysis framework
- Use the MagGraph and Delphes packages for Monte Carlo event generation and detector simulation

Languages.

- English (native), French and German (limited working proficiency)

Positions of Responsibility.

- Youth representative to national council of the Scout Association
- Returning officer and webmaster for Trinity College Junior Common Room

References

Prof. Gavin Davies, *Professor of High Energy Physics*, Imperial College, g.j.davies@imperial.ac.uk.

Dr. David Colling, *Reader in High Energy Physics*, Imperial College, d.colling@imperial.ac.uk.

Third referee to be asked!!.