

# Patrick Dunne

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## Research Experience

- 2012-present **PhD Student**, *Imperial College*.
- Carried out searches for invisibly decaying Higgs bosons with the CMS detector
    - Focussed on the vector boson fusion (VBF) production channel
    - 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
    - Performed statistical combinations of CMS searches for invisible Higgs decays in different production channels
  - 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*.
- Attached to 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*.
- Judge’s favourite poster 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 radioactivity lab demonstrator by students in 2013/14 and 2014/15 academic years
  - 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*.
- 2013 **Tour Guide**, *CMS detector, CERN*.
- 2013 **Bang Fair**, *ExCel Centre, 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*.
- 2014 **CMS Higgs Group**, *Approval talk for analysis HIG-14-038*.
- 2015 **IOP Conference**, *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 **PANIC Conference**, *Searches for invisible decay modes of the Higgs boson with the CMS detector*.
- 2014 **CMS Higgs Group**, *Pre-approval talk for analysis HIG-13-030*.
- 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
  - Performed 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
  - Performed the primary analysis and the setting of 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.
  - Performed a cross-check of the primary analysis and the setting of limits on the Higgs boson invisible branching fraction
- 2013 **CMS Collaboration**, ‘*Search for invisible decays of Higgs bosons in the vector boson fusion and associated ZH production modes*’, CMS Physics Analysis Summary - HIG-13-013.
  - Performed a cross-check of the main analysis

## Further Information

### Computing.

- Experienced in C++, C, python and the ROOT analysis framework
- Used 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!!.**