

# Baojia(Tony) Tong

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## Education

**Harvard University**, Massachusetts, MA

Ph.D., Physics, expected 2017/2018

M.A., Physics, 2014

Thesis: Search for di-Higgs decay to  $4b$  at ATLAS

Committee: Profs. Melissa Franklin (Adviser), Masahiro Morii, Howard Georgi

**California Institute of Technology**, California, CA

B.A. with honors, Physics, 2012

## Research Interest

Search for new physics with the Higgs Boson

Standard Model Electroweak measurement

Charged particle tracking

Detector operation, monitoring, and upgrade development

Application of Machine Learning in High Energy Physics

## Research Experience

**Harvard University**

Class Projects in Machine Learning: CS181 and CS281 at Harvard	2017-present
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Analyzer, $W^\pm W^\pm W^\mp$ search using ATLAS 13TeV data	2017-present
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Analyzer, $X \rightarrow$ boosted di-Higgs $\rightarrow b\bar{b}b\bar{b}$ using ATLAS 13TeV data	2015-present
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Developer, Improvement of Segment Seeding in Muon Reconstruction	2015-2016
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Developer, Offline Data Quality Software for Muon Reconstruction	2015-2016
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Expert and organizer, Offline Muon Data Quality Monitoring	2015
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Analyzer, Prospective study of $HH \rightarrow WW\tau\tau$ for High Lumi LHC	2014
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Calibration of Prototype Micromegas Chambers at Harvard	2014
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Study of Muon Segments in ATLAS detector using 8TeV data	2012-2013
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**California Institute of Technology**

Study of W/Z + jets using CMS 8TeV data	2011-2012
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Design and validation of an optical sensor for telescopes	2009-2010
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Experiment design and study of market convergence	2009-2010
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Modeling on novel methods of space launching	2008-2009
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## Detailed Research Contributions

### Analysis

#### **Search for $W^\pm W^\pm W^\mp$ using ATLAS 13TeV data**

- Develop analysis framework for three lepton channel
- Optimize analysis selection using machine learning techniques

#### **Search for $X \rightarrow$ boosted double Higgs $\rightarrow b\bar{b}b\bar{b}$ using ATLAS 13TeV data**

- Design signal regions and validation regions
- Improve search sensitivities, especially for high mass signals
- Develop data-driven background estimation and reweighting methods
- Validate signal MC simulations and maintain software framework
- Evaluate systematics for detector responses and data-driven methods
- Calculate asymptotic exclusion limits
- Add analysis veto for statistical combination
- Draft supporting documents, produce event displays

#### **Prospective study of double Higgs $\rightarrow WW\tau\tau$ for the HL-LHC**

- Design signal regions and event selections, apply smearing on simulations
- Test multivariate analysis methods to increase signal sensitivities
- Predict cut-based and multivariate analysis combined significances

### Hardware

#### **Prototype Micromegas Chamber Tests**

- Calibrate charge and timing of prototype chambers
- Assist cosmic muon data taking
- Analyze and measure cosmic muon charge and timing distributions

### Software

#### **Muon Reconstruction**

- Create parabolic road extrapolation for raw hits selection
- Improve Muon reconstruction efficiency and reduce fake rate

#### **Muon Monitoring**

- Develop, update, and maintain Muon Performance Monitoring packages
- Design and develop offline Muon Performance Monitoring Displays
- Improve and develop offline Muon Detector and Performance Monitoring algorithms
- Maintain Muon Performance Monitoring packages for prompt online monitoring

### Operation

#### **Muon Data Quality**

- Organise weekly meetings on offline software updates and data quality status
- Coordinate offline Muon Detector Monitoring software updates
- Create offline shifter training materials and instructions, webpages for offline shifter records

#### **Shifts**

- Conduct online ATLAS Control Room Shifts: Muon Desk, Data Quality Desk
- Conduct offline Muon Data Quality Shifter and Expert Shifts: serve as on-call expert

## Publications and Talks (with links)

### Paper

Search for pair production of Higgs bosons using $36\text{ fb}^{-1}$ (in progress )	2017
Search for heavy resonances decaying to a W/Z and a Higgs boson at ATLAS	2017
Search for pair production of Higgs bosons in the $b\bar{b}b\bar{b}$ final state at ATLAS	2016

### Public Notes

ATLAS-CONF-2016-049, $HH \rightarrow b\bar{b}b\bar{b}$ , ATLAS 13TeV, $13\text{ fb}^{-1}$	2016 summer
ATLAS-CONF-2016-083, $VH \rightarrow q\bar{q}b\bar{b}$ , ATLAS 13TeV, $13\text{ fb}^{-1}$	2016 summer
ATLAS-CONF-2016-017, $HH \rightarrow b\bar{b}b\bar{b}$ , ATLAS 13TeV, $3\text{ fb}^{-1}$	2016 spring

### Conference Talks

Search for di-Higgs to $b\bar{b}b\bar{b}$ final state with ATLAS, DPF, Fermilab	2017
Search for di-Higgs production with ATLAS, Higgs Couplings, SLAC	2016
ATLAS $HH \rightarrow b\bar{b}b\bar{b}$ ICHEP Results, Higgs Boson and BSM, Weihai, China	2016

### ATLAS Internal Talks

Neural Net on $HH \rightarrow b\bar{b}b\bar{b}$ , Workshop on ML and b-tagging, SLAC	2017
$HH \rightarrow b\bar{b}b\bar{b}$ , analysis unblinding Approval	2017
$HH \rightarrow b\bar{b}b\bar{b}$ , analysis ICHEP ATLAS Approval	2016
$HH \rightarrow b\bar{b}b\bar{b}$ , analysis ICHEP Exotics Approval	2016
$HH$ searches, Exotics Workshop, Grenoble	2016
Muon Segment Seeding, Muon Week, Software	2016
Muon Hough Transform Tuning, Muon Week, Software	2015
Muon Spectrometer and DQ Status, ATLAS Weekly	2015
Muon DQ 2015 Summary, Muon Week, Operations	2015
Muon DQ Pre Run II Status, Muon Week, Operations	2015

## Teaching Experience

### Physics Department, Harvard University

Teaching Fellow, Physical Science 12, Electromagnetism	2017
Guided summer student Gray Putnam's research	2016
Guided summer student Michael Albergo's research	2015
Teaching Fellow, Physics 125, Widely Applied Physics, Qscore 4.33/5	2014
Teaching Fellow, Physics 16, Classical Mechanics and Relativity, Qscore 4.47/5	2013

### Physics Department, California Institute of Technology

Teaching Assistant, Physics 50, Physics League	2011-2012
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## Honors

Harvard White Teaching Prize for Physics 16	2014
Harvard Traveling Scholar	2015-2016
Caltech Undergrad Summer Research Fellowship	2009-2012

## References

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