Liting Xiao

Curriculum Vitae

Contact Information

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Research Interests

Gravitational wave physics/astrophysics/cosmology, black hole astrophysics, gravitational wave data analysis with machine learning, astrophysical inference with Bayesian statistics

Skills

Areas: Data Science, Machine Learning, Statistical Inference, Signal Processing
Computing: Python, Matlab, BASH, Condor, C/C++, ROOT, Java, Vim, LaTeX
Languages: English (*full professional proficiency*), Mandarin Chinese (*native*)

Education

California Institute of Technology (Caltech), Pasadena, CA *Sept 2016 – Present*

Ph.D. student in Physics (GPA: 4.0); Advisor: Prof. Alan J. Weinstein

- **Graduate research assistant at the LIGO Laboratory at Caltech**
- Relevant coursework: Learning Systems; Machine Learning and Data Mining; Bayesian Statistics and Data Analysis; Computational Cameras

University of Virginia (UVA), Charlottesville, VA *Aug 2011 – May 2015*

B.A. with High Distinction, Astronomy-Physics; B.A., Mathematics (GPA: 3.75)

- Senior Theses: (1) Probing the Orbital Lifetime and Stability in Kepler Multi-planet Extrasolar Systems; (2) The Occurrence of Compact Groups of Galaxies through Cosmic Time

Université Joseph Fourier, Grenoble, France *Jun – Jul 2012*

Summer, Bachelor Summer Program – Physics Large Scale Facilities

PhD Research Highlights

- Implemented a real-time Kalman filter for optimal thermo-optical aberration estimates in the Thermal Compensation System of the LIGO Livingston detector
- Improved the calibration of suspension cavity lengths of the LIGO Livingston detector
- Performed a range of measurements to characterize the LIGO Livingston detector for commissioning towards Observing Run 3
- Developing novel features for streamline detection pipeline PyCBC and operating the pipeline to detect gravitational waves (GW) from compact binary coalescences
- Characterizing exceptional compact binary coalescence events during observing runs
- Developing the Bayesian inference module Bilby for GW astrophysical inference
- Developing a rapid gravitational waveform generation algorithm Roman, and a rapid Bayesian parameter estimation module Percival using Deep Learning
- Mentored three Caltech LIGO SURF students in summer, 2019
- *The 2017 Nobel Prize in Physics* was awarded to three LIGO founders: Rainer Weiss (MIT), Kip Thorne (Caltech), Barry Barish (Caltech)

Selected Publications

[1] *LIGO Scientific Collaboration and Virgo Collaboration,* GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs, Phys. Rev. X 9, 031040 (2019).

[2] *LIGO Scientific Collaboration and Virgo Collaboration,* GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral, Phys. Rev. Lett. 119 161101 (2017).

[3] *S. Sachdev, ..., L. Xiao,* The GstLAL Search Analysis Methods for Compact Binary Mergers in Advanced LIGO's Second and Advanced Virgo's First Observing Runs, arXiv:1901.08580.

[4] *D. Mukherjee, ..., L. Xiao,* The GstLAL template bank for spinning compact binary mergers in the second observation run of Advanced LIGO and Virgo, arXiv:1812.05121.

[5] *C. D. Wiens, T. V. Wenger, P. Tzanavaris, K. E. Johnson, S.C. Gallagher, L. Xiao,* The Occurrence of Compact Groups of Galaxies Through Cosmic Time, ApJ (2019) 873 124.

[6] *L. Xiao, A. J. Weinstein, T. G. F. Li, S. Sachdev,* Searching for Gravitational Waves from the Coalescence of High-mass Black Hole Binaries, AJUR, Vol.12, Iss. 3, p.77-103, (2015).

MENTORSHIP

- Caltech LIGO SURF student, Mahlet Shiferaw. *Summer 2019*
- Caltech LIGO SURF student, Phoebe McClincy. *Summer 2019*
- Caltech LIGO SURF student, Sierra Garza. *Summer 2019*

PAST RESEARCH HIGHLIGHTS

Experimental High Energy Physics with the CMS Detector at the LHC, Physik-Institut der Universität Zürich, Zürich, Switzerland
Research Assistant *Sept 2015 – Jun 2016*

- Analyzed trigger efficiencies of the CMS Higgs searches using Monte Carlo simulations for the upgraded LHC running at 13 TeV *(C/C++, ROOT)*

The Occurrence of Compact Groups of Galaxies through Cosmic Time, UVA Department of Astronomy, Charlottesville, VA
Undergraduate Research Assistant *Jan – May 2015*

- Studied the population of "compact groups of galaxies" and the population of galaxies within compact groups at different epochs in the evolution of the universe using the Millennium Simulation

Searching for Gravitational Waves from the Coalescence of High-mass Black Hole Binaries, LIGO Laboratory at Caltech, Pasadena, CA
Undergraduate Research Assistant *Jun – Sept 2014*

- Developed data analysis pipeline software in search for gravitational waves produced in the coalescence of binary black holes
- Included the population of spinning black holes in the analysis pipeline for Advanced LIGO, improved upon previous non-spinning searches in Initial LIGO
- Expanded the search parameter space and analyzed simulations to evaluate the pipeline search sensitivity
- Performed detailed timing analysis of the pipeline for future optimization work regarding sensitivity and timeliness

NASA-UVA JefferSat Cosmic Ray Mission, UVA Department of Mechanical and Aerospace Engineering, Charlottesville, VA
Science Investigator *Aug 2013 – May 2014*

- Adapted the existing JefferSat CubeSat balloon satellite design to accommodate one spectrometer for cosmic ray measurements at ∼124,000 feet in the atmosphere
- Integrated onboard power system, thermal insulation system, and navigation system within the payload structural and high-altitude environmental limitations
- Designed and implemented both the ground and the payload data handling and communication hardware and software
- Measurements were used to validate and improve the NASA NAIRAS model for predicting commercial flight crew and passenger exposure to cosmic radiation

Identification of Upward-going Muons for an Indirect Dark Matter Search in the NOνA Experiment, Fermilab, Batavia, IL
Undergraduate Research Assistant *Mar 2013 – Jan 2014*

- Searched for energetic neutrinos originating from dark matter annihilation at the solar core using the NOνA Far Detector at Fermilab
- Designed and implemented an algorithm to reconstruct muon tracks and separate muon signals from cosmic rays efficiently *(C/C++, ROOT, Grid computing)*

- Generated and ran simulations to evaluate the sensitivity of the search algorithm
- Performed electronics testing and liquid scintillator leak testing and helped assembly of the NOνA Near Detector

HONORS, FELLOWSHIPS, & AWARDS

- University of Virginia Echols Scholar
- Member of Sigma Pi Sigma, National Physics Honor Society
- 2015 UVA International Studies Office Award for Academic Excellence
- 2014 UVA Public Day: invited to showcase two of my research projects
- 2014 UVA Outstanding Undergraduate Physics Research Award
- 2014 – 2015 UVA Physics Department Mitchell Scholarship
- 2013 – 2014 UVA Physics Department Mitchell Scholarship
- 2013 UVA Undergrad Physics Research Symposium: 3rd Place in oral presentation
- University of Virginia Dean's List 7/8 Semesters

TALKS & POSTERS

Talks

- Searching for Gravitational Waves from the Coalescence of High-mass Black Hole Binaries
  - 2014 Caltech SURF Summer Seminar Series at LLO, Livingston, LA *Aug 2014*
- Identification of Upward-going muons for NOνA Dark Matter Searches
  - 2013 80th Annual Meeting of SESAPS, Bowling Green, KY *Nov 2013*
- NOνA Dark Matter Searches Triggering
  - 2013 July NOνA Collaboration Meeting, Lemont, IL *Jul 2013*

Posters

- Searching for Dark Matter with the NOνA Neutrino Telescope
  - 2014 National Collegiate Research Conference, Boston, MA *Jan 2014*
  - 2013 80th Annual Meeting of SESAPS, Bowling Green, KY *Nov 2013*

Conferences

- 2015 APS Conference for Undergraduate Women in Physics at the North Carolina Research Triangle, Duke University, Durham, NC *January 2015*
- 2014 National Collegiate Research Conference, Harvard University, Boston, MA *January 2014*
- 2013 80th Annual APS Southeastern Section Meeting, Western Kentucky University, Bowling Green, KY *November 2013*
- 2013 July NOνA Collaboration Meeting, Argonne National Laboratory, Lemont, IL *July 2013*