Shirley Ho

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POSITIONS & EDUCATION

Flatiron Institute, Center for Computational Astrophysics	
Interim Director	2021- now
Group Leader, Cosmology X Data Science	2018-now
New York University,	2020-now
Research Professor, Department of Physics	
Affiliate Professor, Center for Data Science	
Princeton University, Department of Astrophysical Sciences	2019-now
Visiting Research Scholar	
Carnegie Mellon University	
Associate (adjunct) Professor of Physics	2018-now
Associate (with Indefinite Tenure) Professor of Physics	2017-now
Associate Professor of Physics	2016-2017
Cooper-Siegel Faculty Development Chair of Physics	2014- 2018
Assistant Professor of Physics	2011-2016
Lawrence Berkeley National Laboratory	2016-2018
Senior Scientist, Physics Division	
Lawrence Berkeley National Laboratory,	2008-2012
Chamberlain and Seaborg Fellow	
Princeton University, Department of Astrophysical Sciences	2004-2008
Ph.D. in Astrophysical Sciences on	
"*Baryons, Universe and Everything Else in Between*"	
Advisor: David Spergel	
University of California, Berkeley,	2000-2004
Bachelor of Arts with Highest Honors in Physics and Computer Science	

CITATION AND AWARDS

- Total Number of Citations: 40215 ; h-index: 62 , i-index: 132; Total Number of Publications: 200+, See Google Scholar Link for more info
- 2020 Elected Fellow at the International Astrostatistics Association
- 2019 Best 10 Physics Article of the Year by Phys.Org 2019, see news: Press Release, Press coverage, the article in the Proceedings of National Academy Sciences
- 2015 Carnegie Science Award

- 2014 Macronix Prize for Outstanding Young Researcher Award by International Organization of Chinese Physicists and Astronomers
- 2012 University of Tokyo RESCEU Professorship
- 2011 NASA Group Achievement Award
- 2008-2011 Seaborg Fellowship, Chamberlain Fellowship (2008-2011)
- 2004-2005 Princeton University Graduate Fellowship,
- 2004-2008 Princeton University Korn Prize for Outstanding Graduate Students at Princeton
- 2002-2004 UC Berkeley International Student Undergraduate Scholarship
- 2000-2004 UC Berkeley Physics Undergraduate Research Scholarship
- 1998 HSBC Outstanding Scholar Awards (Awarded to ~20/130k students every year)

LEADERSHIP IN LARGE COLLABORATION

- **Co-leader** of the Machine Learning Work Package in Euclid**'s Simulations** Working Group (2019-now). Selected to be one of the 40 US scientists to represent US in NASA's effort in **Euclid** Satellite Mission (2013-now). Euclid is the next generation ESA (1 Billion Euro mission class) space missions to probe Dark energy and the geometry of the Universe. The Euclid Consortium has over 2000 participants. NASA has selected a team of 40 scientists through competition to participate in this mission.
- **Co-lead** WFIRST High Latitude Survey Light Cone Simulations (2016-now). WFIRST is a next generation NASA space mission (~3.5 Billion USD mission class) to probe both exoplanets using coronograph and the dark universe using both imaging and spectroscopy.
- **Co-Chair** of Dark Energy Spectroscopic Instrument (DESI) Clustering Working Group (2014-2017), CMU institutional representative in DESI. DESI collaboration contains over 20 Universities, 20 foreign institutions and 5 national labs. I am co-chair of the scientific flagship of DESI (the clustering working group which probes Dark Energy and Gravity).
- **Co-Chair** of Large Synoptic Survey Telescope Cooperation (LSSTC**)** Science Collaboration and **Large Synoptic Survey Telescope** (LSST) **Dark Energy Science Collaboration** (DESC) Large Scale Structure Working Group (2012-2015). LSST collaboration is a collaboration formed by over 40 Universities, and multiple participating institutions from foreign countries (such as Chile, France, Sweden). LSST-DESC is the dark energy science collaboration within LSST.
- **Co-Chair** of Sloan Digital Sky Survey (SDSS) Lyman Alpha Forest (Intergalactic Medium) working group (2013-2015), SDSS 3 member (2008-2016). Sloan Digital Sky Survey is a survey supported by both NSF and DOE, with over 40 Universities, over 250 collaborators in the SDSS collaboration. .
- Planck Core Team Member (2009-2014)
- Actacama Cosmology Telescope (ACT) Team member (2006-2008)

ADVISORY AND COMMUNITY CONTRIBUTIONS

- Served on multiple **Federal Agencies Committees:**
  - **NASA Astrophysics Advisory Committee** Member (2021-2024)
  - **NASA** Artificial Intelligence and NASA Science and Technology Planning Committee (2020)
  - **NASA** Astrophysics Data Research Review Panelist (multiple years),
  - **NASA** Astrophysics Theory Program Review Panelist (multiple years)
  - **NSF** Astrophysics Program Review Panelist (multiple years)
  - **NSF** Computer/Information Sciences (CISE) review panelist (2018-2020)
  - **NASA HST** Review panel (2017-now)
  - **NASA** Postdoctoral Fellowship Review Committee Member (2013,2014,2018,2019)
  - **DFG** (Germany's equivalent of NSF) Program Review Panelist (2011)
- **Community wide Synergistic Activities**:
  - **Organizing Committee** for KITP workshop on ***Building a physical understanding of galaxy evolution with data-driven astronomy,*** 2023
  - **Organizing Committee for** MIAPP workshop ***"Simulations and Cosmology in the Next Decade",*** 2022
  - **Organizing Committee** ***for CCA-5year celebration,*** October 2021
  - Scientific organizing committee, **Cosmology X ML workshop** at CCA, August **2021**
  - **Scientific organizing committee, NeurIPS Machine Learning for Physical Sciences Workshop**, 2020, Virtual, **1000+ participants**
  - **Scientific Organizing committee, Mathematics and Scientific Machine Learning,** 2020, Princeton, 500+ registered participants (currently will be moved to virtual)
  - **Scientific Organizing committee , Cosmic Cartography**, 2020, Tokyo, 200+ participants, (moved to virtual)
  - **Scientific organizing committee, NeurIPS Machine Learning for Physical Sciences Workshop**, 2019, Vancouver, **1000+ participants**
  - **Organizing Committee Chair, Physics for ML workshop,** 2019, Flatiron**, 150+ participants**
  - **Scientific Organizing Committee, "**Cosmo21", 2018, Valencia, Spain, **150+ participants**
  - **Co-chair of Scientific Organizing Committee ,** "Cosmology in the light of Data", 2017, 150+ participants
  - **Chair of Scientific Organizing Committee,** "Statistical Challenges of Modern Astronomy VI", 2016, **200+ participants**

- **Chair of organizing committee,** "Cosmology for the Next Generation" winter school , 2016, 50+ students
- **Chair of organizing committee, LSST** Large Scale Structure Data Challenge, 2015, 300+ participants
- **Chair of Scientific organizing committee,** "Innovative Cosmological Simulations with Machine Learning and Statistics in the era of LSST" , Pittsburgh, 2015, 40+ participants
- **Scientific and Local organizing committee member ,** "LSST-DESC Annual Collaboration Meeting", LSST-DESC annual collaboration meeting, 200+ participants
- **Scientific Organizing Committee** member, "Neighborhood Workshop on Astrophysics and Cosmology", State College, 2013, 70+ participants
- **Chair of Scientific Organizing Committee**, "SDSS3-BOSS annual collaboration meeting", Pittsburgh, 2012, 150+ participants
- **Scientific organizing committee**, " Critical Test of inflation", Garching, Germany, Max Planck Institute of Astrophysics, 2012, 50+ participants
- **Chair organizer** of Lawrence Berkeley National Lab Colloquium (RPM), 2008-2010, 2016-now
- **Chair organizer** of LBL INPA seminar series, 2008-2011
- **Journal Refereeing**
  - Astrophysical Journal, Nature, Nature Astronomy, Monthly Notices of Royal Astronomical Society, Astronomy & Astrophysics, Physics Review D, Journal of Cosmology and Astroparticle Physics

ADVISING AND MENTORING

- **Past and Current Postdoctoral Advisees/ Mentees:**
  - Nishant Agarwal (2011-2014):
    - Inflation constraints from large scale structure
    - Current position: Assistant Professor at University of Massachusetts, Lowell
  - Mariana Vargas-Magana (2012-2015):
    - Large Scale Structure analysis in BOSS;
    - Current Position: Assistant Professor at National Autonomous University of Mexico (UNAM)
  - Xiaoying Xu (2012-2013):
    - BAO analysis in BOSS and Machine Learning application in cosmology;
    - Current Position: Machine Learning Engineer at Google .
  - Anthony Pullen (2014-2016):
    - New probes of Gravity

- Current Position: New York University Assistant Professor

- Sebastian Fromenteau (2015-2017):
  - New probes using Redshift Space distortions
  - Current position: Assistant Professor at UNAM, Mexico

- Layne Price (2015-2016):
  - Using Machine Learning and Statistical methods to improve our understanding of the initial conditions of the Universe
  - Current Position: Amazon Senior Data Science Analyst

- Siamak Ravanbaksh (2015-2017), MLD:
  - Developing and Applying Machine Learning algorithms to a variety of cosmological problems
  - Current Position: Assistant Professor (Computer Science) at University of British Columbia

- Simeon Bird (2015-2016), McWilliams Fellow:
  - Determining Properties of Damped Lyman Alpha system
  - Current Position: Assistant Professor at UC Irvine

- Simone Ferraro , Miller Fellow (2016-2018):
  - Using CMB X Large Scale Structure to understand the evolution and the contents of the Universe
  - Current Position: LBL Division Fellow (2018-)

- Zachary Slepian, Chamberlain Fellow (2016-2018):
  - Using higher order correlation function in large scale structure to understand neutrinos, dark energy, contents of the Universe
  - Current Position: Assistant Professor at University of Florida at Gainsville

- Elena Giusarma (2015-2019):
  - Gravitational Redshifts and Large scale applications of ML and Statistics to Cosmological Dataset.
  - Current Position: Assistant Professor at Michigan Technological University

- Elena Massara, (2016-2019):
  - simulate galaxies for WFIRST and Euclid
  - Current Position: Postdoctoral Fellow University of Waterloo

- Francesco Navarro-Villescua, (2018-2020):
  - New probes of cosmology, using machine learning as a simulator
  - Current Position: Research Associate at Princeton University

- Gabrielle Contardo (2018-now):
    - Machine Learning application and development, with astrophysics application in mind
- Laurence Levasseur (2018-2019):
    - Using Machine Learning to remove 21cm foreground (work with Lachlan Lancaster)
    - Current Position: Assistant Professor at McGill University
- Yashar Hezevah (2018-2019):
    - Machine Learning, ALMA, strong lensing
    - Current Position: Assistant Professor at McGill University
- Yin Li (2019-now):
    - Machine Learning, Cosmological forward modeling
- Megan Ansdell (2019-2020):
    - Machine Learning, Planets
    - Current Position: NSF Program Chair
- Lehman Garrison (2019-now):
    - Cosmological Simulations, Numerical methods
- Chirag Modig (2020-now) :
    - Machine Learning, Cosmology
- William Coulton (2020-now):
    - CMB, Non-gaussianity, Machine Learning
- Ashley Villar (2020-2021):
    - Time series data exploration
    - Current Position: Assistant Professor at Penn State University
- Kaze Wong (2021- now):
    - ML application in astrophysics (GW, cosmology)
- Christian Pederson (2021-now):
    - ML application in simulation based inference in cosmology
- Fiona McCarthy (2021-now):
    - Cosmology non-gaussian statistics

- **Current and Past PhD Students:**
    - Bin Fu (SCS, co-advisor, 2013):
        - Accelerating 3D correlation function calculations with novel sampling;

    - Current Position: Google Software Engineer
- Andrea Klein (SCS-MS, co-advisor, 2014):
    - Using Machine Learning in cosmological simulations;
    - Current Position: Apple Staff ML Engineer
- Shadab Alam (Physics, advisor, 2017):
    - Redshift Space Distortions, Lensing and Gravity;
    - Current Position: Postdoctoral Fellow at University of Edinburgh
- Yen-Chi Chen (Stat, co-advisor, 2016):
    - Innovative Statistical Methods to Reconstruct the Cosmic Web;
    - Current Position: Assistant Professor at University of Washington, Seattle
- Sunny Vagnozzi (co-advised with Katie Freese, PhD 2018):
    - Theory work on astroparticle physics, early Universe ; application of large scale structure and CMB dataset to put constraints on cosmological parameters such as neutrinos
- Siyu He (Physics, advisor, 2019):
    - Particle Mesh simulation and initial conditions of the Universe.
    - Current Position: ML engineer at PlusAI
- Alex Krolewski (UC Berkeley , PhD, 2016-2020):
    - Understanding Angular momentum of galaxies using SDSS IV dataset
- Lachlan Lancaster (Princeton, co-advised with David Spergel, PhD, 2019-)
    - Recovering true 21cm signals with machine learning
- Miles Cranmer (Princeton, co-advised with David Spergel, PhD, 2018-)
    - Applying machine learning to astrophysical challenges, currently on stream detection in Gaia
- Kaze Wong (JHU, close collaborator, PhD, 2018-2021)
    - Applying Machine Learning to gravitational waves data analysis and simulations
    - Current: Flatiron Fellow (2021)
- Jay Wateker (NYU, PhD, 2017-2021)
    - Applying Machine Learning to model Neutral Hydrogen
    - Current: IAS postdoc (2021)
- Avery Kim (Columbia, PhD, 2019-)
    - Applying Machine Learning to learn galaxy properties
- Chang Chen (NYU, PhD, 2016-)
    - Interpolating across different time steps in cosmological simulations

- Ana Delgado (Harvard, PhD, 2020-)
    - Understanding galaxy connections to dark matter using deep learning
- Ji-Woon Park (Stanford, 2021-now):
    - Modeling Quasar Lightcurves and using Deep Learning to derive astrophysical parameters from the observed light curves
- Drew Jamieson (StonyBrook, 2021):
    - Accelerating cosmological simulations using machine learning and generalizing beyond training set

- **Research Project with MS and other graduate students**:
    - Khee-Gan Lee (Princeton, PhD):
        - Astrophysical Constraints using arcminiute-scale CMB Measurements;
        - Currently position: University of Tokyo/ IPMU Assistant Professor
    - Arthur Stril (ENS-Paris, MS):
        - SZ effects from CMB;
        - Current Position: Head of Ministère des Affaires sociales et de la Santé;
    - Thibaut Louis (ENS-Lyon, MS):
        - Lyman-alpha forest BAO modeling;
        - Current Position : Postdoctoral Fellow at IAP
    - Aldo Riello (ENS-Paris, MS):
        - Future Constraints from Redshift Space Distortions;
        - Current Position: Postdoc at Perimeter Institute;
    - Tommy Dessup (ENS-Paris, MS):
        - Investigating reconstruction of Baryon Acoustic Oscillations.
        - Current Position: PhD candidate at University of Paris 7
    - Adrien Bolens (ENS-Paris, MS):
        - Investigating the cross-correlations between CMB and large scale structure
        - Current Position: Graduate Student at University of Geneva
    - 17 New York University Center Data Science students whom we usually work on applying Machine Learning on astrophysical problems. Often leading to publications
    - David Schaurecker (ETH, 2019-2021):
        - Increasing resolution in cosmological simulations

- Elaine Cui (NYU, 2019-2021):
  - Accelerating fluid simulations with radiative transfer, deriving analytical expressions that may describe small scale interactions in coarse grained simulation
- Joshua Lin (UIUC, 2021) :
  - Graph Neural Network and Cosmology
- Billy Lee (CUHK, 2021)
  - Finding a new fitting formula for SZ observable from clusters. (With Will Coulton and Leader Thiele)
- Leon Chan (CUHK, 2021)
  - Develop a deep-learning based classifier to find anomalies for time-series data from ZTF and LSST. (With Ashley Villar)

- **Research Projects with undergraduate students**:
  - Ashley Disbrow (CMU): Cosmic Magnifications;
  - Leslie Bartsch (CMU): Modeling Damped Lyman-alpha systems;
  - Eric Chandler (CMU): Accelerating correlation functions calculations using GPUs;
  - Rich Lyons(CMU): Exoplanet Statistics;
  - Keisuke Osumi (CMU): New Statistics with Baryon Acoustic Oscillations;
  - Yui Fai Siu (Chinese University of Hong Kong): Detecting SZ effect from galaxies in SDSS;
  - Katy McKeough (CMU): Relating Blackholes it the dark matter through SDSS;
  - Douglas Trippe (CMU): Improving Correlation Function Code;
  - Kaze Wong (Chinese University of Hong Kong): Large Scale Structure of the Universe;
  - Raphael Segal (SCS): Cosmology Video Games;
  - Isabelle Goldstein (CMU): Large Scale Structure Data analysis;
  - Shelby Zasasky (CMU): BAO analysis;
  - Brent Tan (CMU): Analyzing the correlations between galaxies and CMB;
  - Rachel Cooper (Vassar): Large Scale Data analysis;
  - Carolina Nunez (Princeton): Photometric Target Selection
  - Surbhi Dhiman (UC Berkeley, 2016-2018): Filament properties as a cosmological probe
  - William Ma (UC Berkeley, 2016): eBOSS Baryon Acoustic Oscillations
  - Fei Ge (UC Berkeley, 2016): Machine learning with cosmology
  - Jiashu Han (UC Berkeley, 2016-2018): Cross-correlation of high redshift quasars with CMB lensing

- Rocky Kamen-Rubio (UC Berkeley, 2016): Neutrinos constraints from CMB and LSS
- Anya Nugent (UC Berkeley, 2017): Anisotropic 3 point function
- Pok Fung Chan (Hong Kong University, 2018) : Galaxy-spin alignment
- Lucas Makinen (Princeton University, 2019) : Machine Learning in Cosmology
- Shai Slav (Princeton University, 2020-now): Machine Learning in Cosmology
- Timothy Chan (CUHK, 2021-now): mapping gas density to dust density in turbulence simulations
- Peter Cheung (CUHK, 2021-now): designing a new variable star classifier with deep learning
- Damon Cheung (CUHK, 2021-now): Machine learning application in gravitational waves analysis

- **Teaching**
  - **Graduate Classes**: Observational Cosmology for graduate students (2012), CMU.
  - **Undergraduate Classes**: The Astrophysics of Stars and Galaxies for undergraduates (2013, 2014, 2015), CMU. Average Teaching Evaluation score : 4.5/5.
  - **Publicly available Lecture Materials** : class websites are available for public at http://terapix.phys.cmu.edu/Teaching.html
  - Lecturer at **LSST-DESC Dark Energy School**, 2015
  - Lecturer to **Cosmology Summer Schools**, organized by University of Tokyo, Japan, (2011, 2012);
  - Lecturer at **Theoretical Advanced Study Institute summer school**, University of Colorado, Boulder (2012).
  - Lecturer at **SISSA (Trieste) summer school** (2017)
- **Outreach**
  - Serves on the **Committee of Participation of Women** in Sloan Digital Sky Survey (2014-2016)
  - Co-leading the development of **International Student Exchange Program** at CMU Physics Department, with partnerships in ENS-Paris, National Taiwan University, Chinese University of Hong Kong and University of Geneva. (2012-2016)
  - **Co-founded non-profit online educational game** company Cirkl (2014-2016), which produces online educational games for college students. Aims to improve learning experience through machine learning algorithms. Currently used by 100+ beta users.
  - Lecturer to **Cosmology summer schools for under-represented high school students** for 3 summers (2008- 2010) as part of the Berkeley Center for Cosmological Physics Outreach effort.
  - **Deliver Public lectures** "New Light on the Dark" at **Berkeley Repertory Theater** (2011), 600+ audience; regular public lectures at **Allegheny Observatory** and at **Carnegie Science Center** (2012-now), 70+ audience ; **Aspen Center for Physics; Public Simons Foundation Lecture (2020)**