S	www.mit.edu/wenxuanj/	′ <b>in</b> linkedin.com/in/we	nxuanjia 🛛 🎓 Go	ogle Scholar	
\$	git.ligo.org/wenxuan.jia	🖂 wenxuanj@mit.edu	<b>\$</b> (213)709-7596	💡 185 Albany St., N	IW22-279, Cambridge, MA 02139

#### **E**DUCATION

# 2019 - 2024 Ph.D., Physics Massachusetts Institute of Technology > Thesis title: Squeezing the quantum noise of LIGO beyond the Standard Quantum Limit

> Thesis title: Squeezing the quantum noise of LIGO beyond the Standard Quantum Limit
> Thesis advisors: Professor Matthew Evans and Dean Nergis Mavalvala

University of Southern California

2015 - 2019 B.S., Mechanical Engineering

## **?** Research Experience

Sep. 2024 -	Postdoctoral Associate, MIT Kavli Institute	Cambridge, MA
Present	Supervisors: Dr. Peter Fritschel and Dr. Lisa Barsotti	
	> Built the in-vacuum optical parametric amplifier cavity for squeezing genera	tion with nonlinear crys-
	tal. Set up the experiment in preparation for new crystal characterization for	future LIGO.
	> Explored the potential applications of squeezing in quantum sensing, quantu	im metrology, and quan-
	tum simulation with Xanadu Quantum Technologies.	
	Quantum Squeezing Control Systems Nonlinear Optics Quantum Computing	
Sen 2019-	Graduate Student Researcher MIT LIGO Laboratory	Cambridge MA
Διισ 2024	Advisors: Professor Matthew Evans and Dean Nergis Mavalvala	cumbridge, m/
	<ul> <li>&gt; Developed and commissioned the frequency-dependent squeezing exp gravitational-wave detectors, a key component of the \$20M upgrade on inst</li> <li>&gt; Achieved a record-breaking 6 dB (factor of 2) of quantum shot noise reductio ing record among worldwide gravitational-wave detector networks.</li> <li>&gt; Pioneered the use of squeezed light to benchmark quantum decoherence a plex optical systems such as large-scale interferometers.</li> <li>&gt; Employed hierarchical Markov Chain Monte Carlo techniques to constrain quarameters, providing valuable insights into the detector's quantum behavior.</li> <li>&gt; Quantified the quantum noise of the LIGO Livingston detector post-upgra Standard Quantum Limit by 3 dB at 50 Hz. This breakthrough in quantum mized on the cover of Science magazine.</li> </ul>	eriments at LIGO's twin rumentation. n at 2 kHz, a new squeez- and degradation in com- uantum decoherence pa- de, which surpasses the <b>neasurement was recog-</b>
	Quantum Optics Precision Metrology Laser Interferometry Gravitational Waves Large-scale	e Experiments
Feb. 2016 - May. 2019	<ul> <li>Undergraduate Fellow, USC Center for Advanced Manufacturing</li> <li>Advisor: Professor Yong Chen</li> <li>Prototyped an additive manufacturing system that integrates hybrid source tion and laser vector scanning to facilitate fabrication of micro-scale texture boss. Developed a robust calibration mechanism across two independent s sional accuracy of 50 μm.</li> <li>Developed a mechatronic system using mask-image process to fabricate mu commendate photo gurable regions with high visconity.</li> </ul>	Los Angeles, CA es of mask-image projec- res on macro-scale solid ources to ensure dimen- lti-material parts and ac-

Additive Manufacturing Stereolithography 3D Printing Fabrication Finite Element Analysis Computer-Aided Design

### ✤ Honors and Awards

2022 - 2023	LIGO Scientific Collaboration Fellowship, National Science Foundation
2020 - 2022	MathWorks Science Fellowship, Massachusetts Institute of Technology
2021	Best Paper Award, 2021 ASME Manufacturing Science and Engineering Conference
2019	Summa Cum Laude (highest distinction), University of Southern California
2018	SURF Fellowship, California Institute of Technology
2017-2018	Undergraduate Research Associate Fellowship, University of Southern California
2016 2019	Provest Fellowship University of Southern California

2016-2018 Provost Fellowship, University of Southern California

#### SELECTED PUBLICATIONS (CITATIONS > 7500, H-INDEX = 35, \* = EQUAL CONTRIBUTION)

- E. Capote\*, W. Jia\*, N. Aritomi\*, M. Nakano\*, V. Xu\*, LIGO O4 detector list, "Advanced LIGO detector performance in the fourth observing run," *Physical Review D* 111, 062002 (2025).
- 6. W. Jia, V. Xu, K. Kuns, M. Nakano, L. Barsotti, M. Evans, N. Mavalvala, LIGO O4 detector list, "Squeezing the quantum noise of a gravitational-wave detector below the standard quantum limit," *Science* **385**, 1318-1321 (2024).
  - > "We've just doubled the number of gravitational waves we can find," New Scientist (2024)
- D. Ganapathy\*, W. Jia\*, M. Nakano\*, V. Xu\*, N. Aritomi, T. Cullen, N. Kijbunchoo, S. E. Dwyer, A. Mullavey, L. McCuller, L. Barsotti, LIGO O4 detector list, "Broadband quantum enhancement of the LIGO detectors with frequency-dependent squeezing," *Physical Review X* 13, 041021 (2023).
  - > "LIGO Surpasses the Quantum Limit," Caltech News, MIT News (2023)
  - > "Quieting Noise in Gravitational-Wave Detectors," *Physics* (2023)
  - > "Frequency-dependent squeezing pushes LIGO sensitivity to new records", Physics Today (2024)
- 4. D. Ganapathy, V. Xu, W. Jia, C. Whittle, M. Tse, L. Barsotti, M. Evans, L. McCuller, "Probing squeezing for gravitational-wave detectors with an audio-band field," *Physical Review D* 105, 122005 (2022).
- 3. W. Jia, H. Yamamoto, K. Kuns, A. Effler, and M. Evans, LIGO O3 detector list, "Point Absorber Limits to Future Gravitational-Wave Detectors," *Physical Review Letters* 127, 241102 (2021).
- 2. W. Jia, Y.-S. Leung, H. Mao, H. Xu, C. Zhou, and Y. Chen, "Hybrid-Light-Source Stereolithography for Fabricating Macro-Objects with Micro-Textures," *Journal of Manufacturing Science and Engineering* 144(3), 031003 (2022).
  - "Gold and Silver: USC Viterbi Students Nearly Sweep Top Awards at Nation's Largest Manufacturing Research Conference," USC Viterbi News (2021)
- 1. H. Mao, W. Jia, Y.-S. Leung, J. Jin, and Y. Chen, "Multi-material stereolithography using curing-ondemand printheads," *Rapid Prototyping Journal* 27, 861-871 (2021).

#### 🖌 Skills

Theory	Quantum optics, Partial differential equation, Differential geometry
Experiment	Photonics, Control systems, Vacuum systems, Analog circuits, Noise hunting
Analysis	Parameter estimation, Markov chain Monte Carlo, Bayesian statistics, Uncertainty analysis, Optimization
Programming	Python (expert), MATLAB (expert), C/C++ (expert), Java (familiar), Mathematica (familiar)
Computing	Multi-core parallel processing, Cloud computing, Image processing
Software	SolidWorks, COMSOL, Visual studio, EPICS, Linux OS, MS office, Keyshot, Web developing
Languages	English (proficient), Chinese (native)

#### Teaching & Services

2024	Session chair, Quantum Metrology and Sensing: General I 55th Annual Meeting of the APS Division of Atomic, Molecular and Ontical Physics (DAMOP)
2024	Journal referee, American Physical Society (APS)
2024	Journal referee, Optical Society of America (Optica)
	Optica, Optics Letters
2024	Journal referee, Institute of Electrical and Electronics Engineers (IEEE)
2024	Iransactions on Quantum Engineering
2024	<b>Teaching assistant</b> AME 341: Mechantronics Laboratory, University of Southern California Department of
2013	Aerospace and Mechanical Engineering

#### **SS** REFERENCES

2023

#### Matthew Evans

Professor of Physics, MIT ☐ m3v4n5@mit.edu Nergis Mavalvala Dean, School of Science, MIT nergis@mit.edu Lisa Barsotti Sr. Principle Investigator, MIT ☑ lisabar@ligo.mit.edu

# ♥ INVITED TALKS

16.	<i>Beating the Quantum Limit Using Squeezed Light</i> MIT Interdisciplinary Quantum Information Science and Engineering (iQuISE) seminar, Cambridge, MA	9/2024
15.	<i>LIGO operates with Quantum Noise beyond the Standard Quantum Limit</i> 55th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), Fort Worth, TX	6/2024
14.	<i>LIGO operates beyond the Standard Quantum Limit</i> Plenary, LIGO-Virgo-KAGRA (LVK) Collaboration Meeting, Baton Rouge, LA	3/2024
13.	Broadband Quantum Enhancement of the LIGO Detectors with Frequency-Dependent Squeezing Physics Seminar, Instituto Nacional de Pesquisas Espaciais (INPE), Brazil (Virtual)	11/2023
12.	Broadband Quantum Enhancement of the LIGO Detectors with Frequency-Dependent Squeezing 2023 Frontier in Optics + Laser Science Conference (FiOLS), Tacoma, WA	10/2023
11.	<i>LIGO as a Quantum Nondemolition Interferometer</i> 2023 Quantum Control of Light and Matter, Gordon Research Conference (GRC), Newport, RI	8/2023
10.	Direct Calculation of Quantum Noise in the quadrature-sideband picture with higher-order spatial modes Seminar, LIGO Livingston Observatory, Livingston, LA	4/2023
9.	Frequency-Dependent Squeezing in LIGO A+ Joint instrument plenary, LIGO-Virgo-KAGRA (LVK) Collaboration Meeting, Evanston, IL	3/2023
8.	Cartoon Picture of Frequency-Dependent Loss Due to Mode-Mismatch LIGO Commissioning Meeting, LIGO Hanford, WA	11/2022
7.	<i>Non-Invasive Beam Position Monitoring using Cameras</i> LIGO Commissioning Meeting, LIGO Hanford, WA	11/2022
6.	Squeezed Light in LIGO: The Path towards Frequency Dependent Squeezing Joint instrument plenary, LIGO-Virgo-KAGRA (LVK) Collaboration Meeting, United Kingdom (Virtual)	9/2022
5.	Point Absorber Limits to Future Gravitational-Wave Detectors LIGO-Virgo-KAGRA (LVK) Collaboration Meeting (Virtual)	9/2021
4.	Point absorber in advanced gravitational wave detector LIGO-Virgo-KAGRA (LVK) Collaboration Meeting (Virtual)	9/2020
3.	<i>Noise testing of the Piezo SAMS actuator</i> LIGO-Virgo-KAGRA (LVK) Collaboration Meeting (Virtual)	3/2020
2.	Physical-Statistical Analysis of Scatter in Febry-Pérot Arm Cavity of aLIGO Caltech Summer Undergraduate Research Fellowships Presentation, Pasadena, CA	8/2018
1.	IRISolid - Direct 3D Printed Colorful Props with Multi-Material 3D Printer USC Maseeh Entrepreneurship Prize Competition. Los Angeles, CA	3/2017