

# CHANGHAO LI

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## WORK EXPERIENCE

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**JPMorgan Chase** New York, NY Jan. 2023 - now  
Global Technology Applied Research, Applied Research Lead in quantum information science.

## EDUCATION

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**Massachusetts Institute of Technology** Cambridge, MA Sept. 2017 - Dec. 2022  
Ph.D., Quantum Engineering Group, Research Laboratory of Electronics and Department of Nuclear Science and Engineering. Profile article in [MIT news](#).

**Supervisor:** [Prof. Paola Cappellaro](#)

**Thesis committee:** [Prof. Ju Li](#), [Prof. Edward Boyden](#), [Prof. Mingda Li](#)

**Xi'an Jiaotong University** Xi'an, Shaanxi, China Sept. 2013 - June 2017  
B.S., Physics Elite Class in School of Science Cumulative GPA: 3.8/4.0 Overall Ranking: 2/29

**University of California, Berkeley** Berkeley, CA Aug. 2015 - May 2016  
Exchange student, Department of Physics and Astronomy

**University of Notre Dame** South Bend, IN May 2015 - Aug. 2015  
Undergraduate researcher, Department of Physics

## RESEARCH INTEREST

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Quantum computation and quantum algorithm, quantum control, quantum sensing and magnetic resonance imaging, nitrogen-vacancy (NV) centers in diamond, quantum network.

## SELECTED PUBLICATIONS

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**Changhao Li\***, Jiayu Shen, Ruslan Shaydulin, Marco Pistoia, “Quantum counterdiabatic driving with local control”, [arXiv 2403.01854](#) (\*the only corresponding author).

Mo Chen\*, **Changhao Li\***, Giandomenico Palumbo, Yan-Qing Zhu, Nathan Goldman and Paola Cappellaro, “A synthetic monopole source of Kalb-Ramond field in diamond”, [Science 375, 1017-1020 \(2022\)](#) (\*equal contribution).

**Changhao Li**, Mo Chen and Paola Cappellaro, “A geometric perspective: experimental evaluation of the quantum Cramer-Rao bound.”, [arXiv 2204.13777](#).

Haowei Xu, **Changhao Li**, Guoqing Wang, Hua Wang, Hao Tang, Ariel Rebekah Barr, Paola Cappellaro, and Ju Li, “Two-photon interface of nuclear spins based on the optonuclear quadrupolar effect.”, [Phys. Rev. X 13, 011017 \(2023\)](#). Highlighted in [MIT news](#).

Guoqing Wang, **Changhao Li**, Hao Tang, Boning Li, Francesca Madonini, Faisal F Alsallom, Won Kyu Calvin Sun, Pai Peng, Federica Villa, Ju Li, Paola Cappellaro, “Manipulating solid-state spin concentration through charge transport.”, [Proc. Natl. Acad. Sci. \(2023\)](#). Highlighted in [MIT news](#).

**Changhao Li**, Rouhollah Soleyman, Mohammad Kohandel and Paola Cappellaro, “SARS-CoV-2 quantum sensor based on nitrogen-vacancy centers in diamond.”, [Nano Letters 22 \(1\), 43-49 \(2022\)](#). Highlighted in [MIT news](#), [APS Press Release](#).

Guoqing Wang\*, **Changhao Li\*** and Paola Cappellaro, “Observation of symmetry-protected selection rules in periodically driven qubits.”, *Phys. Rev. Lett.* **127**, 140604 (2021), *Editor’s Suggestions*. (\*equal contribution). Highlighted in [MIT news](#).

**Changhao Li**, Tianyi Li, Yi-Xiang Liu and Paola Cappellaro, “Effective routing design for remote entanglement generation on quantum networks.”, *npj Quantum Information* **7**, 10 (2021).

**Changhao Li**, Mo Chen, Dominika Lyzwa and Paola Cappellaro, “All-optical quantum sensing of rotational Brownian motion of magnetic molecules.”, *Nano Letters* **19** (10), 7342-7348 (2019).

## RESEARCH EXPERIENCE

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### Global Technology Applied Research in JPMorgan Chase

Manager: **Dr. Marco Pistoia**

Jan. 2023 - Present

- Exploring novel quantum algorithms and quantum control techniques for both noisy intermediate-scale and fault-tolerant quantum devices.

### Quantum Engineering Group in MIT

Advisor: **Prof. Paola Cappellaro**

Sept. 2017 - Present

- Explored experimental simulation of exotic gauge fields and topological phases using spin defects.
- Worked on bio-sensing based on NV centers in nanodiamonds. Developing hybrid sensors based on NV center and magnetic molecules that is capable of sensing and diagnosing virus.
- Proposed optimal protocols of managing entanglement generation in quantum networks.

### Quantum Optics Group in Xi’an Jiaotong University (XJTU)

Advisor: **Prof. Pengbo Li**

Feb. 2017 - July 2017

- Theoretically proposed a hybrid coupling system which involves the coupling between a single NV center and a superconducting qubit via electro-optics effect. Demonstrated its capacity in achieving high fidelity quantum state transfer as well as highly entangled quantum states.

### Quantum Information Group in Beijing National Lab, Chinese Academy of Sciences

Advisor: **Prof. Xinyu Pan**

July 2016 - Oct. 2016

- Investigated single-shot readout of a nuclear spin via manipulating a weakly-coupled electron spin at room temperature. Successfully demonstrated a novel readout scheme with a high signal-to-noise ratio using dynamical decoupling sequences.

### UC Berkeley AMO Physics Group

Advisor: **Prof. Dmitry Budker**

Aug. 2015 - May 2016

- Investigated the spatial distributions of NV centers in a diamond irradiated by electrons via a transmission electron microscope. Built the experiment setups for scanning control and data analysis;
- Measured longitudinal spin relaxation and vapor density as a function of temperature in antirelaxation-coated cesium vapor cells (Observed merit improvement at temperatures over 100 °C).

## FELLOWSHIPS AND HONORS

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### Students Awards and Fellowships — Xi’an Jiaotong University

- Outstanding Students Union Executive Award (Percentage: 4.0%) May 2014
- Sakura Festival Outstanding Volunteer June 2014
- National Encouragement Scholarship (Percentage: 3.2%) Sept. 2014
- Mount Everest First Prize Scholarship (Percentage: 5.6%) Nov. 2014, Mar. 2016
- Pengkang Scholarship (Percentage: 1.1%) Sept. 2015
- Siyuan Scholarship Oct. 2016
- Outstanding Student Award Sept. 2014, Sept. 2015, Oct. 2016

· Best Undergraduate Thesis Award (Percentage: 0.3%) June 2017

### Students Awards and Fellowships — MIT

· William T and Ann D. McCormick Fund Jan-May. 2022  
· Helen Carr Peake and William T. Peake Research Prize Jun. 2022

### Competition Awards

· Second Prize of the University Mathematical Contest in Modeling June 2014  
· Second Prize of the 5th China Undergraduate Physics Tournament Aug. 2014  
· Third Prize of the China Undergraduate Mathematical Competition May 2015  
· Technical Merit Award in MIT Quantum Hackathon Jan. 2020

## PRESENTATIONS AND CONFERENCES

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“Local counterdiabatic driving for ground state preparation: mechanism, improvement and implementations”, Talk at [APS March Meeting 2024](#), Mar. 2024

“Communication-efficient blind quantum machine learning with quantum bipartite correlator”, Poster at [APS March Meeting 2024](#), Mar. 2024

“Exploring practical applications of quantum information: from nanoscale sensing to near-term quantum algorithms”, **Invited talk** at [Institute of Physics, CAS](#), Jan. 2024

“Explore quantum applications with spin defects in diamond”, **Invited talk** at [School of Qian Xuesen, Xian Jiaotong University](#), Xi’an, China, Sep. 2022

“A geometric perspective: experimental evaluation of the quantum Cramer-Rao bound”, Talk at [APS DAMOP Meeting 2022](#), May 2022; Poster at QIP conference 2022

“Virus quantum sensor based on nitrogen-vacancy centers in diamond”, Talk at [APS March Meeting 2022](#), Mar. 2022.

“SARS-CoV-2 quantum sensor based on nitrogen-vacancy centers in diamond”, **Invited talk** at [Shenzhen Institute for Quantum Science, SUSTech](#), Shenzhen, China, Dec. 2021

“Building quantum ion sensors based on solid-state defects in nanodiamond”, [OPTICA Quantum Information and Measurement VI conference](#), Nov. 2021; **seminar talk** in Department of Nuclear Science and Engineering at MIT, Nov. 2021

“Experimental characterization of the 4D tensor monopole and topological nodal rings”, Talk at [APS March Meeting 2021](#), Mar. 2021

“Quantum dots: from fundamental science to applications”, [iCAN-X talk](#), [X challenger](#), Mar. 2021 ([video](#))

“Why we are interested in quantum technologies”, **Invited talk** for [Tsinghua Alumni in Boston Talk Series](#), Boston, MA, Jan. 2021

“Experimental characterization of the tensor monopole in synthetic 4D space”, [MIT-Harvard CUA seminar](#), Cambridge, MA Nov. 2020

“SARS-CoV-2 quantum sensor based on spin defect in nanodiamonds”, seminar talk in Department of Nuclear Science and Engineering at MIT, Sep. 2020

“Quantum sensing of rotational Brownian motion of magnetic molecules”, seminar talk in Department of Nuclear Science and Engineering at MIT, Sep. 2019

“Routing protocol of purified entanglement in quantum repeater networks.” Poster at [Conference on Quantum Information and Quantum Control-VIII](#), Toronto, Canada, Aug. 2019.

“Optical sensing of biological processes with nitrogen-vacancy centers in nanodiamonds.” [APS March Meeting 2019](#), Mar. 2019.

“Resolution and Stability Analysis of the ATF2 Straightness Monitor”. University of Notre Dame Summer Research Program Final Presentation, July 2015.

## SKILLS

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**Languages** Mandarin (native), English (fluent: TOEFL iBT 106; GRE General 326+3.0)  
**Programming** Python  
**Scripting/Analysis** Matlab, Mathematica, ROOT, LabView, Origin, L<sup>A</sup>T<sub>E</sub>X, JavaScript, HTML

## PEDAGOGICAL TRAINING

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**TA Days Training – MIT Teaching + Learning Lab** Feb. 2022  
*Workshop series introducing evidence-based teaching practices for TAs*

Explored how to engage students and lead discussions in general teaching settings; Studied strategies to lead a problem-solving session, implement in Course 22.51; Learned to provide effective feedback on reports, proposals, and essays to students from a variety of disciplines.

## COMMUNITY SERVICE

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- APS March Meeting 2024 Session Chair for Quantum Machine Learning Mar. 2024
- APS March Meeting 2024 abstract sorter Nov. 2023
- Session Chair of the 1st Quantum Science and Engineering Consortium (QSEC) Annual Research Conference in Cambridge, MA. Feb. 2022
- Program committee member of the 1st Student Conference on Quantum Computing in Shenzhen, China Aug. 2019
- **Reviewers:** Phys. Rev. Lett, Phys. Rev. X Quantum, Phys. Rev. A, Phys. Rev. Applied, Phys. Rev. B, Phys. Rev. Research, IEEE/ACM Transactions on Networking, IEEE Network, Materials for Quantum Technology, Physica Scripta, Communication Physics etc.

## PUBLIC WELFARE

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Writing popular science articles in Chinese social media platforms which has over 6 million reads and with over 40 thousands followers.

Performed scientific demos to elementary schoolers during Science Festival in 2018.

Mentor of [MIT Summer Research Program](#) for underrepresented minorities and underserved (e.g. low socio-economic background, first generation) students in engineering and science in the United States.