Weijun Yuan

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PROFESSIONAL SUMMARY

- Highly skilled optical engineer with 7 years of experience in optical system simulation, calibration, and software development (Python) for electro-optical systems, achieving reliable results in complex experimental setups
- Proven ability to collaborate effectively across disciplines, working with mechanical engineers, nanophotonics experts and theoretical quantum chemists to deliver innovative solutions. Passionate about interdisciplinary learning and applying quantitative methods to advance research and technology.
- Proven research leadership in a collaborative working environment, demonstrated scientific writing and data visualization via five co-first-author publications in peer-reviewed journals, including *Nature*.

EDUCATION

- **Columbia University**   New York, NY
  ***Ph.D. in Physics**, Atomic, Molecular and Optical experiment*   *Sept. 2020 – May. 2026 (expected)*

- **Hong Kong University of Science and Technology (HKUST)**   Hong Kong
  ***B.S.C in Physics**, Academic achievement medal, Full-ride scholarship*   *Sept. 2016 – June 2020*

TECHNICAL SKILLS

- **Python / MATLAB**
  - Image processing, package development, data analysis, numerical simulation, statistical machine learning,
  - Control software development such as automation, signal generation and acquisition

- **Optical Hardware**
  - Expertise in laser design, optical imaging, beam shaping, and integration of precision metrology systems
  - Nonlinear crystals (AOM, AOD, EOM, SHG) optimization, photodetectors (EMCCD, scientific CCD, photodiodes) maintenance and repair
  - High resolution and diffraction-limited imaging system design (involving high N.A objective)

- **Laser stabilzation and Characterization**
  - Extensive experience working with laser frequency and power stablization using control loops.
  - Familiar with laser characterization, including optical spectrum analysis, frequency / power noise characterization, spatial and temporal properties characterization

- **Commercial Simulation/Design Software**
  - **COMSOL**: Electric field simulation, simulation of radio frequency (RF) /microwave for antenna design
  - **SolidWorks and Autodesk Inventor**: mechanical design and simulation
  - **Zemax**: Aberration simulation, lens system optimization

- **RF/Microwave System and Electronics**
  - Analog circuit design, micro-controller, high-frequency and low-noise electronics, RF antenna design with COMSOL and MATLAB, RF system design and construction

Research Experience

- **Optical System Design, Simulation and Construction**
  Graduate Research Assistant (GRA) at Columbia University
  - Design optical system for integration of eletro-optical (AOD) and nanophotonic devices (metasurface) for optical tweezers generation using high N.A objectve
  - Simulating optical aberration via Zemax, resulting in a high-quality imaging system of ultracold molecules
  - Extensive experience in various optical devices including acoustic optical modulator(AOM) and deflector(AOD), free-space and fiber electric optical modulator(EOM), and digital micromirror devices (DMD)

- **Laser Design, Fabrication, and Maintenance**
  RA at HKUST and GRA at Columbia University
  - Built a laser system with home-built Tapered Amplifier seeded by an home-built External Cavity Diode Lasers (ECDL), resulting in Watt-level outputs for laser cooling of Cesium
  - Maintained and repaired various lasers including Ti:Sapph, Raman Amplifier, high power Fiber Amplifiers, external cavity diodes laser (ECDL),etc.

- **Software Development and Programming**
  RA at HKUST and GRA at Columbia University
  - Developed MATLAB code for simulating optical dipole trap and designed optimized system parameters
  - Developed numerical modeling of intermolecular potential under microwave dressing
  - Developed GUI and control software for controlling opto-electronic devices (AOD), enabling the creation of optical tweezer arrays

- **Radio Frequency Engineering**
  GRA at Columbia University
  - Designed a cloverleaf antenna for microwave control of molecules, resulted in 1 first-author paper in Review of Scientific Instrument
  - Designed and optimized a complex RF network for quantum control of molecules via microwave, resulting in significant breakthrough for quantum control of molecules evidenced by publications on *Nature* and *Nature Physics.*

- **Analog and Digital Electronics Design and Debugging**
  GRA at Columbia University
  - Designed fast analog electronics with > few MHz bandwidth and high voltage output.
  - Designed and optimized an programmable Phase-lock-loop with microcontroller for stabilizing RF signal, significantly reducing jittering noise
  - Extensive experience in Printed Circuit Board (PCB), debugging and refining the design to a finished product.

- **Laser Cooling and Quantum Control of Atoms and Molecules**
  GRA at Columbia University
  - Worked on laser cooling and quantum control of sodium and cesium, creation and coherent manipulation of ground-state sodium-cesium (NaCs) molecules
  - Led the efforts for developing microwave shielding for NaCs molecules, Obtained the first Bose Einstein condensate of dipolar molecules with a wide-range tunable dipolar interaction in the world
  - Developed the optical tweezers setup for trapping and manipulating single strontium atoms

- **Teamwork and Collaboration**
  GRA at Columbia University
  - Participated collaborations with Radbund (Netherland), Purdue and Harvard (USA) researchers for frontier quantum few-body physics calculations, publishing theoretical works in PRX Quantum and PRL
  - Led the interdisciplinary collaboration on integrating nanophotonic platform (metasurface) for single atoms trapping, resulting in 1-first-author paper in Progress in Quantum Electronics.
  - Worked collaboratively in a 6-people team and mentored three undergraduate and two junior graduate students

Selected Publications

11 refereed publications, including 1 in *Nature*, 1 in *Nature Physics*, 4 in *PRL/PRX Quantum*. Full list available upon request. 2 under review

- **Extreme Loss Suppression and Wide Tunability of Dipolar Interactions in an Ultracold Molecular Gas** 2025
  W Yuan*, Siwei Zhang*, N Bigagli, H Kwak, C Warner, T Karman, I Stevenson and S Will
  Under review in Science

- **Observation of Self-Bound Droplets of Ultracold Dipolar Molecules** 2025
  Siwei Zhang*, **W Yuan***, N Bigagli, H Kwak, T Karman, I Stevenson and S Will
  Under review in Nature

- **Observation of Bose–Einstein condensation of dipolar molecules** 2024
  N Bigagli*, **W Yuan***, S Zhang*, B Bulatovic , T Karman, I Stevenson and S Will
  Nature 631, 289–293 (2024).

- **Metasurface Holographic Optical Traps for Ultracold Atoms** 2023
  X Huang*, **W Yuan***, A Holman, M Kwon, S Masson, R Gutierrez-Jauregui, A Asenjo-Garcia, S Will, and N Yu.
  Progress in Quantum Electronics (2023): 100470.

- **A Planar Cloverleaf Antenna for the Creation of Circularly Polarized Microwave Fields** 2023
  W Yuan*, S Zhang*, N Bigagli, C Warner, I Stevenson and S Will
  Rev. Sci. Instruments 94, 123201 (2023)

Selected Conferences

- **W Yuan**, S Zhang, et al. Poster presenter at GRC: *A Dipolar Quantum Gas of Molecules with Strong and Tunable Interactions* 2025

- **W Yuan**, S Zhang, et al. Poster presenter at ICAP: *Exploring dipolar quantum phases with a dipolar BEC of NaCs molecules* 2024

- **W Yuan**, N Bigagli, et al. Oral presenter at DAMOP: *Long-lived ultracold molecules via double microwave shielding* 2024

- **W Yuan**, N Bigagli, et al. Poster presenter at DAMOP: *Collisional Studies of NaCs Molecules. Collisional Studies of NaCs Molecules* 2023

- **W Yuan**, A. Holman, et al. Oral presenter at DAMOP: *Optical Tweezer Arrays Created by Holographic Metasurface* 2022

- **W Yuan**, A. Holman, et al. Poster presenter at ICAP: *Towards Programmable Strontium Atomic Arrays with Holographic Metasurfaces* 2022

- **W Yuan**, N Bigagli, et al. Poster presenter at DAMOP: *Towards Strongly Correlated 2D Systems of Dipolar NaCs Molecules* 2021

Selected Awards

- Dean's Fellowship, *Columbia University* 2020
- Croucher Scholarship for doctoral study, *Croucher Foundation* 2020
- Academic achievement medal(Top 2% of class), *HKUST* 2020
- Innovation and Technology Scholarship, *HSBC* 2018
- Dean's list (five semesters), *HKUST* 2016 -2020
- Full-ride scholarship, *HKUST* 2016-2020