Yao-Lung Leo Fang — Curriculum Vitae

Personal Information

Chinese name: 方耀龍
Position: Assistant Computational Scientist
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Research interests

Quantum computing, quantum information science, and relevant fields in theoretical physics (quantum optics, open quantum systems, condensed matter physics, photon science, etc); high throughput/high-performance computing.

Education

Duke University, Durham, NC, U.S.A.

PhD in Physics — **Sep. 2011 - Dec. 2017**

MS in Electrical and Computer Engineering — **May 2017**

National Taiwan University (NTU), Taipei, Taiwan

BS in Physics — **Sep. 2005 - Jun. 2009**

Awards & Grants

BNL LDRD No. 19-002 (co-PI; PI: Meifeng Lin)
BNL-CFN Rapid Access Proposal No. 37484 (PI; 20k computer hours)
Fritz London Graduate Fellowship (2016)
Duke Graduate School Conference Travel Award (2014, 2015, 2016)

Publications

D. Wysocki, R. O'Shaughnessy, J. Lange, and **Y.-L. L. Fang**, Accelerating parameter inference with graphics processing units, arXiv:1902.04934 (accepted by *Phys. Rev. D*)

G. Calajò, **Y.-L. L. Fang**, H. U. Baranger and F. Ciccarello, Exciting a Bound State in the Continuum through Multi-Photon Scattering plus Delayed Quantum Feedback, Phys. Rev. Lett. **122**, 073601 (2019)

G. Calajò, **Y.-L. L. Fang**, H. U. Baranger and F. Ciccarello, Exciting Dressed BICs via Photon Scattering and Delayed Quantum Feedback (to appear in Proceedings for IQIS18)

X. Huang *et al.*, Resolving 500 nm Axial Separation by Multi-slice X-ray Ptychography, Acta Cryst. A **75**, 336 (2019)

Z. Dong, **Y.-L. L. Fang** *et al.*, High-Performance Multi-Mode Ptychography Reconstruction on Distributed GPUs, 2018 NYSDS, pp. 1-5 (co-1st author)

Y.-L. L. Fang, FDTD: Solving 1+1D Delay PDE in Parallel, Comput. Phys. Commun. **235**, 422 (2019)

Y.-L. L. Fang, F. Ciccarello and H. U. Baranger, Non-Markovian Dynamics of a Qubit Due to Single-Photon Scattering in a Waveguide, New J. Phys. **20**, 043035 (2018)

Y.-L. L. Fang and H. U. Baranger, Multiple Emitters in a Waveguide: Non-Reciprocity and Correlated Photons at Perfect Elastic Transmission, Phys. Rev. A **96**, 013842 (2017)

Y.-L. L. Fang and H. U. Baranger, Photon Correlations Generated by Inelastic Scattering in a One-Dimensional Waveguide Coupled to Three-Level Systems,

Physica E **82**, 71 (2016)

Y.-L. L. Fang and H. U. Baranger, Waveguide QED: Power spectra and correlations of two photons scattered off multiple distant qubits and a mirror, Phys. Rev. A **91**, 053845 (2015)

Y.-L. L. Fang, H. Zheng and H. U. Baranger, One-Dimensional Waveguide Coupled to Multiple Qubits: Photon-Photon Correlations, EPJ Quantum Technology **1**, 3 (2014)

Research Experience

Computational Science Initiative, Brookhaven National Lab, Upton, NY, USA

Assistant Computational Scientist **Jan. 2019 - present**

Main theme: quantum computing and high-performance computing

- Inaugural member of the CSI Quantum Computing Group
- Investigating quantum compiler optimization at low-level
- Studied photon trapping for building quantum memory and quantum gates

Research Associate **Jan. 2018 - Jan. 2019**

Main theme: high-performance computing and quantum computing

- Optimized GPU code for X-ray ptychography reconstruction
- Built graphical user interface (GUI) for the above software
- Performed exploratory work in quantum computing, optimizing quantum software toolchain, and quantum optics
- Parallelized a special-purpose FDTD solver using threading libraries
- Starting investigating and benchmarking workflow managements
- Exploring advanced programming and optimization techniques

Department of Physics, Duke University, Durham, NC, U.S.A.

Research Assistant **Jan. 2013 - Dec. 2017**

Project Waveguide Quantum Electrodynamics:

- Studied time-dependent, multi-photon scattering analytically *and* numerically.
- Carried out the first study of photons scattered off an atom in front of a mirror.
- Systematically investigated the nonlinear, inelastic scattering for different number of distant atoms coupled to a 1D waveguide.
- Calculated photon power spectra using the scattering formalism and found good agreement with experiments in the weak-pumping limit.

Project Dissipative Electron Transport:

- Adopted and significantly extended the CT-HYB solver from the ALPS project.
- Incorporated the resistive environment into the Monte Carlo simulation.
- Implemented a novel (linear) conductance measurement procedure and a worm update.
- First numerical study in the field of dissipative electron transport.

Department of Physics, National Taiwan University, Taipei, Taiwan

Research Assistant **Jan. 2010 - Jul. 2010**

- Oversaw the operation and performed routine maintenance of the GPU cluster in the Taiwan Lattice QCD Collaboration (TWQCD) led by Prof. Ting-Wai Chiu.

Undergraduate Researcher **Dec. 2008 - Jan. 2010**

- Investigated the magnetized phases of the multiferroic material $TbMnO_3$ using Ginzburg-Landau theory with Prof. Chong-Der Hu.

Service Experience

Reviewer

- Frontiers of Physics, New Journal of Physics
- DOE 2018 SBIR/STTR program on quantum network technologies

Mentor

- BNL-CSI GPU Hackathon 2018 (team: rapid_pe_gpu@RIT)

Organizer

- Graduate Student Seminars @Duke Physics

Platoon Leader of Field Artillery, second lieutenant, Taiwan Army (2010-11)

Participated Workshops and Conferences

(since 2018)

GTC 2019
APS March Meeting 2019
DOE 2018 SBIR/STTR review panel
EMN Meeting on Photonics 2018 (link)
ALS User Meeting 2018 (link)
DOE Quantum Networks for Open Science Workshop (link)
GPU Hackathon 2018 (link)
Argonne Training Program on Extreme-Scale Computing (link)
From Nanoscale Electronics to Quantum Information Processing workshop (link)
NSLS-II & CFN User Meeting 2018 (link)
APS March Meeting 2018 (link)
KNL Hackathon 2018 (link)
Performance Analysis and Modeling Workshop (link)

Presentations

GPU acceleration of X-ray ptychography reconstruction, poster presentation @GTC 2019

CuPy: Painlessly Accelerating Python Programs Using GPU, invited talk @Data Analysis Study Group, NSLS-II (slides)

Photon Trapping in Qubit-Waveguide Systems with Delayed Quantum Feedback, invited talk @CSI seminar

Non-Markovianity and Photon Trapping in Waveguide QED, invited talk @EMN Phonics 2018

Acceleration of Multi-mode X-ray Ptychography Reconstruction via Distributed and GPU computing, invited talk @NSRRC, Taiwan (2018/10/18)

Non-Markovianity and Photon Trapping in Waveguide QED, invited talk @NTHU, Taiwan (2018/10/17)

Acceleration of Multi-mode X-ray Ptychography Reconstruction, invited talk @ALS User Meeting 2018

Performance Studies of NSLS-II Image Analysis Workflows, poster presentation @DOE ASCR annual PI meeting for IPPD (presented by K. Kleese van Dam)

GPU Acceleration of X-ray Ptychography Reconstruction, poster presentation @CSI advisory board meeting

X-ray Ptychography Reconstruction on Distributed GPUs, contributed talk @NYSDS 2018 (presented by M. Lin)

GPU Acceleration of X-ray Ptychography Reconstruction, invited talk @CSI Summer Seminar Series

Non-Markovian Dynamics of a Qubit Due to Photon Scattering in a Waveguide, poster presentation @WQED18 (presented by H. U. Baranger)

A Case Study of Quantum Non-Markovianity: 1D Photon Scattered from a Qubit in Front of a Mirror, contributed talk @APS March Meeting 2018

Non-Markovian dynamics of a qubit due to photon scattering in a waveguide, invited talk @Condensed Matter Seminar, Duke University (2017/03/30)

Non-Markovian Dynamics of a Qubit Due to Photon Scattering in a Waveguide, poster presentation @APS March Meeting 2017

Strongly Correlated Photons at Full Transmission, contributed talk @APS March Meeting 2016

Resonance Fluorescence and Photon Correlations Produced by 1-10 Qubits in 1D Infinite or Semi-Infinite Waveguides, contributed talk @APS March Meeting 2015

Photon Correlations in a Waveguide Coupled to Multiple Two- and Three-Level Systems, contributed talk @APS March Meeting 2014

Computer Skills

Proficient: C, C++, Python
Experienced: distributed & parallel programming (MPI, OpenMP, CUDA, pthreads), Mathematica, Qt/PyQt5, shell script
Other tools: LaTeX, Vim, GCC/Clang/ICC, GDB/LLDB, Git, Make/CMake, Valgrind, HDF5, Callgrind/gperftools/TAU, Doxygen, Docker/Singularity, Matlab.

Teaching Experience

Department of Physics, Duke University, Durham, NC, U.S.A.

Teaching Assistant **Sep. 2017 - Dec. 2017**

- Graded for one graduate course (Graduate Advanced Physics)

Teaching Assistant **Sep. 2011 - Dec. 2012**

- Graded for one graduate course (Statistical Mechanics) and two undergraduate courses.

Department of Physics, National Taiwan University, Taipei, Taiwan

Teaching Assistant **Sep. 2009 - Jun. 2010**

- Graded and led recitations for the full-year course "Electricity and Magnetism."

Undergraduate Teaching Assistant **Feb. 2009 - Jun. 2009**

- Graded for the undergraduate course "Applied Mathematics I."