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# FRANCISCA VASCONCELOS

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## EDUCATION

**Massachusetts Institute of Technology** *Class of 2020*

Major Electrical Engineering & Computer Science, Physics GPA: 5.0/5.0 Societies IEEE ◇ APS ◇ SWE
Honors Tau Beta Pi - Top 12.5% School of Engineering ◇ Eta Kappa Nu - Top 25% EECS Department
Courses *Enrolled Fall 2019:* Quantum Mechanics II, Experimental Physics I, Ethics of Technology
*Planned Spring 2020:* Quantum Mechanics III, Statistical Mechanics I, Quantum Information Science [Graduate]

**Torrey Pines High School** *Class of 2016*

GPA Unweighted (9-12) 4.00/4.00 ◇ Weighted (9-12) 4.58/4.00 ◇ Weighted (10-12) 4.79/4.00
Awards National Merit Scholar Finalist ◇ National AP Scholar ◇ Top 4 Student in Science, Math, and Art

## PUBLICATIONS

**Journal**

Bharath Kannan, Daniel Campbell, Roni Winik, **Francisca Vasconcelos**, Morten Kjaergaard, Philip Krantz, David Kim, Alexander Melville, Bethany Niedzielski, Jonilyn Yoder, Terry Orlando, Simon Gustavsson, and William Oliver. "Generation of Spatially Correlated Itinerant Photons in a Waveguide QED Architecture Using Superconducting Qubits." *Under Preparation.* ◇

Antti Vepsalainen, Amir Karamlou, Aksunna Dogra, Ben Loer, John Orrell, Brent VanDevender, **Francisca Vasconcelos**, Simon Gustavsson, Joseph Formaggio, and William Oliver. "Ionizing Radiation Induced Quasiparticle Poisoning in Superconducting Transmon Qubits." *Under Preparation.* ◇

**Conference**

**Francisca Vasconcelos**, Morten Kjaergaard, Terry Orlando, Simon Gustavsson, and William Oliver. "Extending Quantum State Tomography for Superconducting Quantum Processors." In *2019 MIT Microsystems Annual Research Conference (MARC)*, page 3. MIT MTL, 2019. ◇

**Francisca Vasconcelos** and Nuno Vasconcelos. "Person-following UAVs." In *2016 IEEE Winter Conference on Applications of Computer Vision (WACV)*, pages 1-9. IEEE, 2016. ◇

## RESEARCH & WORK EXPERIENCE

**MIT RLE Engineering Quantum Systems SuperUROP** *June 2018 - Present*
Supervisor: Morten Kjaergaard (Postdoc) ◇ Prof. William Oliver, Terry Orlando, and Simon Gustavsson's Lab

- expanded lab's quantum state tomography suite (based on MLE) from 2-qubit to n-qubit systems, improved runtime by 100x
- developing novel QST approach using generative adversarial networks
- programmed an FPGA (with Megan Yamoah) to speed-up lab's measurement of the quantum computer
- improved speed and computation resources of data analysis code for waveguide QED experiment

**Rigetti Computing Junior Quantum Engineering Intern** *June - August 2019*
Supervisors: Peter Karalekas, Marcus DaSilva ◇ Full Stack Quantum Engineering Group

- research to improve the algorithmic performance of noisy quantum devices using ensembling techniques from machine learning

**MIT Media Lab Camera Culture UROP** *Sept. 2017 - Sept. 2018*
Supervisor: Achuta Kadambi (Grad Student) ◇ Prof. Ramesh Raskar's Lab

- worked on LIDAR to "see through fog," using 2-laser interferometry
- worked on learning a general transformation to boost ImageNet classification performance of major networks (i.e. AlexNet)

**NASA Jet Propulsion Laboratory (JPL) Engineering Intern** *June 2017 - Aug. 2017*
Supervisor: Jose Velazco (Researcher) ◇ Ground Communication Group (333K)

- worked with other interns to create "smart" monitoring system for new Deep Space Network amplifiers, consisting of thousands of ESP32s connected to central database and visualization/control webpage
- modified CAD designs of Inter-Satellite Omnidirectional Optical Communicator transmitters for LIDAR functionality

**MIT CSAIL NetMIT UROP** *Oct. 2016 - June 2017*
Supervisors: Deepak Vashit (Grad Student) & Anubhav Jain (MEng) ◇ Prof. Dina Katabi's Lab

- developed an API and "Smart Home" application (smart alarm clock) for the group's research on wireless location tracking
- developed location data collection iOS application to train neural network to improve localization pattern recognition

**Sidus Solutions Engineering Intern** *June 2015 - Aug. 2015*
Small San Diego Marine Technology Company

- soldered micro-controllers, programmed GUIs, CADed product parts on Solidworks, fixed broken camera systems, tested products, and laser etched logo information into products

## TEACHING & EDUCATION EXPERIENCE

**MIT Undergraduate Research Journal (MURJ) Copy Editor & Features Staff** *Sept 2018-Present*
Volume 36 Fall 2018 & Volume 37 Spring 2019

- Author of "Quantum Computing @ MIT" - conducted interviews with Prof. Isaac Chuang, Prof. Dirk Englund, Prof. Aram Harrow, Prof. William Oliver; article to be featured MURJ Fall 2019 publication

**MIT EECS Intro to Quantum Computing IAP Course Instructor** *Jan 2019*
6.s089 ◇ Taught with Amir Karamlou & Megan Yamoah

- 4 week crash course on quantum computing open to MIT community, no quantum mechanics knowledge required
- specifically lectured on quantum algorithms: Grover search and Quantum Fourier Transform
- developed QuTip problem set questions and ran tutorials on QuTip and IBM Quantum Experience
- received a 6.7/7 rating on MIT course evaluations (6/20 eligible students responded)

***The Coding School* Nonprofit Curriculum Developer & Teacher** *June 2018 - Present*
Curriculum Development Head, TCS Advisory Board, and Volunteer Teacher

- revamped Python curriculum, taught high-school girl for 2-weeks, and created LaTeX template to be used for entire curriculum
- leading development of a Quantum Computing curriculum; on TCS Young Professionals Advisory Board

**TPHS Math Tutoring** *Nov 2012 - Jan 2015*
After-School Math Tutoring Center (Unpaid)

- tutored students in all grade levels in high school math courses including geometry, algebra, and calculus

## LEADERSHIP EXPERIENCE

**MIT iQuise Public Relations Manager** *July 2019 - Present*
MIT Interdisciplinary Quantum Information Science and Engineering program

- only undergrad board member of grad weekly seminars on quantum information, manage social media accounts and publicity

**MIT IEEE URTC Conference Chair** *Jan. 2017 - Present*
2018 MIT IEEE Undergraduate Research Technology Conference

- led small group of students to organize 4th IEEE URTC (2018), a 3-day conference (approx. 300 attendees), at Stata Center
- there were 67 posters, 59 papers, and 16 lightning talks with 8 different conference tracks and 5 keynote speakers
- managed almost all logistics including sponsorship, publicity, registration, set-up, attendee housing, etc.
- served as Paper/Posters Chair for the 2017 conference, getting reviewers for all the submissions and keynote speakers
- serving as Conference Advisor for the 2019 conference, guiding the new conference chairs and board

**MIT SWE Technology Chair** *Nov. 2016 - Present*
MIT Society of Women Engineers

- organize workshops to teach SWE club members about tech topics (ie. Personal Websites, LaTeX, Quantum Computing, etc.)
- volunteer at STEM education events for local elementary and high-school girls

**MIT Associate Academic Advisor** *Sept. 2017 - May 2018*
Assistant to Prof. Dennis Freeman

- advised group of freshman on classes and navigating MIT, attended registration meetings with advisor

## SCHOLARSHIPS & FELLOWSHIPS

**2017-18** Johnson & Johnson MIT Summer Research Fellowship ($5,520) ◇ D.E. Shaw Latitude Fellowship ($1,500)
Palantir Women in Technology Scholarship ($7,000) ◇ SWE GE Women's Network Scholarship (x2, $10,000)

**2015-16** SanDisk Scholar ($10,000) ◇ Athena Pinnacle Scholarship ($10,000) ◇ SD AFCEA Scholarship ($8,000)
SWE Paula Loring Simon Scholarship ($1,250) ◇ SD Society of Women Engineers ViaSat Scholarship ($1,000)
Professional Engineers in CA Government Fellowship ($1000) ◇ Cabrillo Civics Scholarship ($400)
National Space Club Foundation Scholarship ($1,000) ◇ ISEF+JSHS Awards ($7,000)

## AWARDS & HONORS

**2019** Hertz PhD Fellowship Finalist ◇ Rhodes Scholarship Recipient ◇ Marshall Scholarship Recipient [Declined]
MIT Churchill (1 of 2) Scholarship Nominee ◇ MARC Conference Top-10 Presentation Award

**2018** MIT School of Engineering Barry Goldwater Nominee (2 nominees each year) ◇ SWE Outstanding Board Member

**2017** Minor Planet 33680 (Main-belt Asteroid, discovered 5/13/99 by Lincoln Labs) named "Vasconcelos" [ISEF Award]

**2016** MIT Museum "Girl's Day: The Secret Life of Robots" Invited Speaker
ISEF: "Robotics & Intelligent Machines" 2nd Place Grand Award ◇ WebValley Special Award
GSDSEF: ISEF Sweepstakes ◇ Intel Excellence in Computer Science ◇ IEEE ◇ SWE ◇ AFCEA ◇ ASME ◇ AMS
SoCal JSHS 1st Place ◇ Scholastic Gold Key & 3 Honorable Mentions

**2015** ISEF: "Robotics & Intelligent Machines" 4th Place Grand Award ◇ CERN & United Technologies Special Awards
GSDSEF: Sweepstakes ◇ MTS 1st Place ◇ Intel Excellence in Computer Science ◇ AFCEA ◇ EAA ◇ NAVY ONR
2 Scholastic Silver Keys & 2 Honorable Mentions ◇ UCSD COSMOS Panelist

**13-14** CA Senate Award ◇ NHS & NAHS Inductee ◇ Trained with Portuguese WU17 National Soccer Team

[ISEF = Intel International Science & Engineering Fair, GSDSEF = Greater San Diego Science & Engineering Fair]

## SUMMER SCHOOLS

**Undergraduate School on Experimental Quantum Information Processing (USEQIP)** *May - June 2019*
University of Waterloo Institute for Quantum Computing

- 2-week summer school with lectures and labs by IQC faculty
- lectures: ion traps, superconducting qubits, photonics, NMR computing, NV centers, quantum algorithms, QKD, quantum error correction, quantum measurement, superconductivity
- labs: NV centers, low temperature superconductivity, superconducting qubit fabrication, BB84 QKD photonics implementation, optical donuts with birefringent optics, NMR 2-qubit computer Grover's algorithm implementation

**Fondazion Bruno Kessler WebValley Student & Developer** *June 2016 - July 2016*
Summer Program (3 weeks) - ISEF Special Award

- 1 week of lectures & 2 weeks of work (with 13 other international students) on low-cost portable spectrometer to measure fruit ripeness (works on berries, basilica leaves, and grapes)
- worked on machine learning for fruit classification (Random Forests, SVMs, PCA, etc.)

**CERN Student Visitor** *June 2015 - Aug 2015*
Trip to the European Center for Nuclear Research (1 week) - ISEF Special Award

- lectures by CERN engineers, scientists, & mathematicians with visits to experimentation facilities

## TECHNICAL STRENGTHS

**Languages** Python ◇ Matlab ◇ Verilog ◇ C/C++ ◇ Visual Basic ◇ HTML ◇ Java ◇ Mathematica ◇ Swift ◇ Android
**Software** Unix/Linux ◇ LaTeX ◇ PyTorch ◇ SciPy, SciKit Learn, NumPy ◇ OpenCV
**Hardware** SolidWorks ◇ 3D Printing ◇ Laser Cutting ◇ Arduino ◇ RaspberryPi

## PERSONAL & CLASS PROJECTS

**LED Audio Visualizer (It's Lit)** *June 2017 - Jan 2018*
Sponsored by MIT MakeLodge

- used two parallel series of 250+ LEDs to create audio visualization lighting to hang in dorm kitchen and room
- built small circuit with microphone and Arduino to receive and process audio input, developed processing algorithm

- LEDs changed color according to frequency, based on Fast Hartley Transformation (FHT) binning of audio signal
- LEDs changed brightness according to beat, based on local derivative of audio signal

**'Beta' CPU Design** *Feb 2017 - May 2017*
MIT Computation Structures (6.004) Class Lab/Project

- over course of semester designed components of CPU from AND, OR, MUX, etc. logic level
- design and combined an Arithmetic Logic Unit (ALU), Register File (REGFILE), Program Counter (PC), Control Logic (CTL), and Data Memo to design small 'Beta' CPU with Jade software

**Strobe Shoes** *Jan 2017 - April 2017*
MIT ProjX Project

- put resistive sensor pressure in sole of shoe to detect steps and mounted LED strips around sole
- sewed and programmed embedded electronics onto shoe in order create multi-color sparkling effect around sole with each step

**Levitating Water Droplet Fountain** *Nov 2016 - Dec 2016*
MIT Mens Et Manus (6.A01) Freshman Seminar Project

- built box with dripping water and strobe lights to make droplets appear as though they were levitating
- CADed and laser cut wooden enclosure, designed and soldered LED circuit, programmed Arduino with color pattern

**Object Recognition Based UAV Control (Person-following UAVs)** *July 2014 - May 2016*
Research Project

- programmed an AR Parrot drone to follow people based on computer vision recognition of a patterned badge
- created real time badge-detection algorithm based on Harris corner detection, light-compensating dot product, and affine transformation (inspired by human vision)
- presented at 2015 GSDSEF, 2015 CSSF, 2015 ISEF, 2015 C4ISR Symposium, 2016 IEEE WACV, 2016 SCJSHS [awards below]

**Shape-Shifting Origami Robotics** *Nov 2015 - May 2016*
Science Fair Project

- designed, 3D-printed, and constructed a robot that can fold into several shapes inspired by principles of origami
- presented at 2016 GSDSEF, 2016 CSSF, 2016 ISEF [awards below]

**FruitiPy** *June 2016 - July 2016*
FBK WebValley Project

- created a low-cost spectrometer to measure fruit ripeness (works on berries, basilica leaves, and grapes)
- worked on machine learning for fruit classification (Random Forests, SVMs, PCA, etc.)

**Quantum** *July 2015 - August 2015*
Android App

- developed an app that explains the Standard Model, with goal of making quantum physics easily accessible and understandable
- free on Google Play (100,000+ installs), presented to Congressman Scott Peters, displayed in US Capitol Building for 1 year

## OTHER ACTIVITIES

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| **MIT** | MIT SWE ◇ MIT IEEE/ACM ◇ MIT MURJ ◇ MIT Women's Club Soccer ◇ MIT Women's Club Volleyball<br>MIT WMBR ◇ MIT TBP ◇ MIT HKN ◇ MIT Associate Advisors ◇ The Coding School Nonprofit |
| **TPHS** | TPHS NAHS ◇ TPHS Red Cross ◇ TPHS NHS ◇ TPHS FRC Robotics ◇ TPHS UAV Club<br>GSDSEF Student Advisory Board ◇ TPHS Math Tutoring ◇ Limbs with Love Nonprofit |