

FAHD A. MOHIYADDIN

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CAREER PROFILE

- Postdoctoral research associate focused at designing quantum devices with Technology CAD and atomistic techniques.
- Extensive software skills developed with semiconductor modeling, programming microcontrollers and implementing image processing algorithms.
- Proven ability to adapt and work on diverse projects in academia and industry.
- Aim to work in a challenging, R&D based dynamic environment with an organization that values hard work, integrity and creativity.

EDUCATION

Doctor of Philosophy (Electrical Engineering) **Mar 2011 – Nov 2014**
University of New South Wales (UNSW), Australia

- **Thesis Title:** Designing a large scale quantum computer with classical & quantum simulations.
- **Synopsis of Research:** My research focused on the designing novel devices, in a team that performs world leading research, to develop a fully scalable quantum computer in silicon. Extensive modeling of a wide range of experimental devices was carried out, emphasizing their operation at the nanoscale quantum regime. They include single donor qubits, quantum dots, exchange coupled donor-pairs and many-body spin systems. Device parameters – such as defects, capacitances, electric fields & band-structure – were completely described and perfectly matched to fabricated devices, including the world's first quantum bit in silicon. Based on close agreement with experiments, required device topologies and operation methods were proposed, for realizing the next generation of solid state quantum computer devices.
- Research resulted in 6 journal articles & 2 conference papers.
- Presented 3 talks and 9 posters at international conferences, and won 2 best poster awards.
- Collaborated with leading groups at Purdue University, University of Melbourne & University of Maryland.

Master of Engineering Science (Microelectronics & Microsystems) **July 2009 – Feb 2011**
University of New South Wales, Australia

- High distinction average of 90.33%.
- **Thesis:** Modelled a robust electron transport protocol across quantum dots in silicon, highlighting required tunneling parameters, gate voltages & timescales.

Bachelor of Technology (Electronics & Communication) **July 2004 – May 2008**
National Institute of Technology (NIT) Calicut, India

- High distinction cumulative grade point average of 8.94/10.
- **Thesis:** Proposed a novel technique to improve the slew rate (100 V/ μ s) of an operational amplifier with minimal static power consumption.

WORK EXPERIENCE

- **Postdoctoral Research Associate at Oak Ridge National Laboratory, USA** **May 2016 onwards**
Summary: Developing a unified computational platform for designing silicon quantum computing devices with electrostatic, electronic structure and spin dynamics solvers.
- **Postdoctoral Research Associate at University of New South Wales, Australia** **Nov 2014 – Apr 2016**
Summary: Semiconductor modeling of nano-devices to couple distant quantum bits in silicon.
 - Designed and patented a novel technique to couple distant (several hundred nanometers apart) donor spins in silicon. This radical technique, which is compatible with current fabrication techniques, aids the experimental realization of a crucial building block (2-qubit logic gate) of a donor based quantum computer.
 - Served as the technical design house expert for TCAD semiconductor modeling at the Australian Nanofabrication facility, thereby providing technical support with TCAD for researchers all around Australia.

WORK EXPERIENCE (CONTINUED)

- **Part time Product Development Engineer at Allripe Pty. Ltd., Australia** **Dec 2012 - Apr 2014**
Summary: Firmware development (in C) on microcontrollers for food assessment.
 - Designed and developed the on-chip microcontroller software to (a) measure food sample characteristics (ripeness/infestation) with sensors, and (b) transfer measured information from the chip to a remote server, via WiFi/USB and TCP/IP, for post-measurement analysis.
- **Industrial Experience Engineer at Canon Information Systems Research Australia** **Dec 2009 – Feb 2010**
Summary: Development of algorithms for image indexing.
 - Java based algorithms were developed for decoding the Hexacode, Golay codes and Leech Lattices - specific encoding schemes for image indexing.
 - Leech lattice and Golay decoders were 3 and 16 times faster than existing decoders, while the Hexacode decoder was the first of its kind at Canon.
- **Software Engineer at Cypress Semiconductors, India** **Jun 2008 – July 2009**
Summary: Firmware development (in C) and validation on a company manufactured chip (West Bridge USB peripheral controllers) for high speed USB data transfer between a mobile phone and PC.
 - Designed the software architecture for various functional modules (I2C, I2S, UART & SPI) of West Bridge.
 - Developed a validation application for the media transfer functionality (the main success behind West Bridge), where the phone communicates with Windows Media Player, and synchronizes audio, video and picture files.
 - Customized software for West Bridge to act as a wireless presentation tool, to meet the requirement of a client company (Primax Electronics).

AWARDS & RECOGNITIONS

- **Best Paper Award**, COMSOL Conference 2017, Boston, USA (2017)
- **Best Poster Award**, IEEE Technologies of the Future Poster Competition, Sydney, Australia, November (2013)
- **Best Poster Award**, Annual Workshop of Centre for Quantum Computation & Communication Technology, Sunshine Coast, Australia, May (2013)
- **International Tuition Fee Remission Scholarship** at UNSW
- Finalist in **Faculty of Engineering Dean's Awards for Excellence in Post-Graduate Research** (2013)
- Selected by NTT Basic Research Labs (among 30 students worldwide) to attend 6th NTT BRL School (2013)

RESEARCH HIGHLIGHTS & NEWS

- *Energy-Quantum Computing Efficiency*, Story tips from DOE's Oak Ridge National Laboratory **EurekaAlert** (2018)
- *Top 7 Success Stories from the COMSOL Conference*, Blog on **Engineering.com** (2017)
- *Radical New Quantum Computing Design Invented*, Science Articles in **R & D Magazine & Phys.org** (2017)
- *Quantum Data Storage in a Single Atom Brings New Computing Era Closer to Reality*, Article in **Seeker** (2017)
- *Quantum Computers: 10-fold boost in stability achieved*, Science Articles in **EurekaAlert & Science Daily** (2016)
- *Electrical Control of Quantum Bit in Silicon Paves the Way to Large Quantum Computers*, Science Articles in **Phys.org & Science Daily** (2015)
- *Coherent Control of a Single ²⁹Si Nuclear Spin Qubit*, Editors Suggestion in **Physical Review Letters** (2014)
- *Quantum Electrodynamics in a Semiconductor Vacuum*, Physics Update in **Physics Today** (2014)
- *Nanoelectronic Modeling for Noninvasive Spatial Metrology*, Technology Spotlight in **Nanowerk** (2013)

TECHNICAL PROFICIENCY

- **Areas of Expertise in Research & Development:** Nanoelectronic Design & Modelling, Quantum Mechanics, Firmware & Algorithm Development, Integrated Circuit Design.
- **Semiconductor Design Platforms:** TCAD, NEMO-3D, COMSOL, Nextnano 3, Cadence, Spice & Fastcap.
- **Programming Languages:** C, C++, Java, MATLAB & Assembly Language - 8086.
- **Software Development Tools:** MS Visual Studio, Eclipse, Keil, Clearcase & AVR Studio.
- **Firmware Modules Programmed:** 8051, ARM 9, ATMEGA-1280, STM 32, SD Cards & USB.

PUBLICATIONS

JOURNAL PUBLICATIONS

- G.Tosi, **F. A. Mohiyaddin** et al. *Silicon Quantum Processor with Robust Long-Distance Qubit Couplings*, **Nature Communications**, 8, 450 (2017).
- S. Freer, S. Simmons, A. Laucht, J. T. Muhonen, J. P. Dehollain, R. Kalra, **F. A. Mohiyaddin** et al. *A Single-atom Quantum Memory in Silicon*, **Quantum Science & Technology**, 2, 1 (2017).
- A. Laucht, R. Kalra, S. Simmons, J. P. Dehollain, J. T. Muhonen, **F. A. Mohiyaddin** et al. *A Dressed Spin Qubit in Silicon*, **Nature Nanotechnology** 12, 61-66 (2017).
- T. S. Humble, M. N. Ericson, J. Jakowski, J. Huang, C. Britton, F. G. Curtis, E. Dumitrescu, **F. A. Mohiyaddin** & B. G. Sumpter, *A Computational Design Workflow for Silicon Donor Qubits*, **Nanotechnology** 27, 42 (2016).
- **F. A. Mohiyaddin** et al. *Transport of Spin Qubits with Donor Chains under Realistic Experimental Conditions*, **Physical Review B**, 94, 045314 (2016).
- A. Laucht, J. T. Muhonen, **F. A. Mohiyaddin** et al. *Electrically Controlling Single Spin Qubits in a Continuous Microwave Field*, **Science Advances** 1, 3 (2015).
- J. J. Pla, **F. A. Mohiyaddin** et al. *Coherent Control of a Single Silicon-29 Nuclear Spin Qubit*, **Physical Review Letters**, 113, 246801 (2014).
- G. Tosi, **F. A. Mohiyaddin** et al. *Circuit Quantum Electrodynamics with Direct Magnetic Coupling to Single-Atom Spin Qubits in Isotopically Enriched ^{28}Si* , **AIP Advances**, 4, 087122 (2014).
- A. Laucht, R. Kalra, J. T. Muhonen, J. P. Dehollain, **F. A. Mohiyaddin** et al. *High-fidelity Adiabatic Inversion of a ^{31}P Electron Spin Qubit in Natural Silicon*, **Applied Physics Letters**, 104, 092115 (2014).
- C. H. Yang, A. Rossi, R. Ruskov, N.S. Lai, **F. A. Mohiyaddin** et al. *Spin Valley Lifetimes in a Silicon Quantum Dot with Tuneable Valley Splitting*, **Nature Communications**, 4, 2069 (2013).
- **F. A. Mohiyaddin**, et al. *Non Invasive Spatial Metrology of Single Atom Devices*, **Nano Letters**, 13, 1903-1909 (2013).
- J. J. Pla, A. Bienfait, G. Pica, J. Mansir, **F. A. Mohiyaddin** et al. *Strain-induced Spin Resonance Shifts in Silicon Devices*, submitted (<http://arxiv.org/abs/1608.07346>).
- G.Tosi, **F. A. Mohiyaddin** et al. *Robust Electric Dipole Transition at Microwave Frequencies for Nuclear Spin Qubits in Silicon*, submitted (<http://arxiv.org/abs/1706.08095>).

CONFERENCE PUBLICATIONS

- K. A. Britt, **F. A. Mohiyaddin** & T. S. Humble, *Quantum Accelerators for High-Performance Computing Systems*, **IEEE International Conference on Rebooting Computing** (2017).
- **F. A. Mohiyaddin** et al. *Simulation of Silicon Nanodevices at Cryogenic Temperatures for Quantum Computing*. **COMSOL Conference** (2017).
- **F. A. Mohiyaddin** et al. *Designing a Large Scale Quantum Computer with Atomistic Simulations*. **IEEE Silicon Nanoelectronics Workshop**, 1-2 (2014).
- A. Morello, J. P. Dehollain, R. Kalra, A. Laucht, **F. A. Mohiyaddin** et al. *Single-atom spin qubits in silicon*. **Conference on Optoelectronic and Microelectronic Materials & Devices**, 198-199 (2014).

PATENT

- G. Tosi, **F. A. Mohiyaddin** & A. Morello, *A Quantum Processing Apparatus and a Method of Operating a Quantum Processing Apparatus*, Patent Filed in Australia, Patent Application No. 2015901980 (2015).

SELECTED CONFERENCE PRESENTATIONS

- **Oral Presentation:** *Significance of Accurate Electronic Structure Calculation Techniques for Designing Silicon Donor Qubits*. American Physical Society March Meeting, New Orleans, USA, March 14 (2017).
- **Oral Presentation:** *A Computational Workflow for Designing Silicon Donor Qubits*. South Eastern Regional Meeting of the American Chemical Society Columbia, USA, October 25 (2016).
- **Poster Presentation:** *Designing a Large-Scale Quantum Computer with Classical & Quantum Simulations*. 2015 International Workshop on Silicon Quantum Electronics, Takamatsu Japan, Aug 8-9 (2015).
- **Oral Presentation:** *Designing a Large-Scale Quantum Computer with Atomistic Simulations*. International Conference on Nanoscience & Nanotechnology, Adelaide Australia, February 3-6 (2014).
- **Oral Presentation:** *Spatial Metrology of Single Atom Devices*. Australian Institute of Physics Congress, Sydney Australia, December 10-14 (2012).
- **Oral Presentation:** *Advanced Simulation Methods for a Single Donor Spin Qubit Device*. Annual Workshop of Centre for Quantum Computation & Communication Technology, Sydney Australia, February 13-14 (2012).

TEACHING EXPERIENCE

- Supervised (in the lab) & graded undergraduate students for courses - Physics 1A, Fundamentals of Physics, Electronics & Analogue Electronics.
- Trained students at my former research centre (at UNSW) on semiconductor software such as TCAD, NEMO-3D & FASTCAP.

SPECIALIZED COURSES UNDERTAKEN

- Quantum Devices (UNSW)
- Microsystems Design & Technology (UNSW)
- VLSI Technology (UNSW)
- Mixed Signal Microelectronics (UNSW)
- Radio Frequency IC Design (UNSW)
- Biomedical Instrumentation & Informatics (UNSW)

REFERENCES

- **Dr. Travis Humble** (Postdoctoral Research Supervisor)
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- **Prof. Andrew Dzurak** (Ph.D. Co-Supervisor)
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