Darren Ng

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Personal Profile

An analytical and numerically strong student with proven computational and technical skills looking for graduate studies in quantum computing, specifically in randomised benchmarking (RB), fault-tolerance and quantum error correction. My strong quantum mechanics skills and experience in RB coupled with my theoretical project background will allow me to excel in working with your research group, and thrive within a challenging and interdisciplinary environment.

Education

- **University of Bristol** — Bristol, UK
  MSci Theoretical Physics; On track for a first-class honours — *09/16 - 06/20*
  Including: Quantum Mechanics 202 (73%); Quantum Physics 301 (76%); Computational Physics 301 (70%)
- **Drayton Manor Sixth Form** — London, UK
  A-Levels, Mathematics (A) Further Mathematics (A*) Physics (B)* — *09/14 - 07/16*
  Including 100% in Edexcel Core 1, Core 3 and Further Pure 1.

Technical and Personal Skills

- **Programming:** Proficient in: Python 3(Numpy, mpi4py), LaTeX, Wolfram *Mathematica*.
  Basic ability with: Matlab, C++, Qiskit.
- **Industry Software:** Origin and most MS Office products.
- **Languages:** Native fluency in: English, Mandarin Chinese, Cantonese Chinese.
  Also limited-working proficiency in: Malay, French.

Research Experience

- **EPSRC Funded Summer Research Internship (06/19 - 08/19):**
  'Benchmarking non-Clifford gates for a single qubit in quantum computation'

  Supervisor: Dr. Peter Turner
  - The project built on prior work of the supervisor who had identified infinite families of unitary ensembles (t-designs), as new gate sets of interest to the quantum computing community as potential non-Clifford logic operations.
  - Simulated the behaviour of these new gate sets in otherwise standard RB protocol with realistic noise models aimed at current experiments.
- **Summer Research Internship (07 - 11/18, 02 - 03/19):**
  'The Correspondence Principle for hydrogen - a wavepacket in a Rydberg atom'

  Supervisor: Dr. Martin Gradhand
  - Constructed a localised Gaussian wave packet by superimposing the eigenfunctions of a Hydrogen atom, in order to solve for the time-evolution of the wave packet and hence solve the TDSE for the system.
  - Computed the time-evolution of the Gaussian wave packet to model the Kepler Motion of an electron around a nucleus with Mathematica, in order to analyse the quantum to classical transition behaviour, and hence to visualise the Correspondence Principle.

Summer schools

- **UCLQ Summer School in Quantum Technologies** — London, UK
  Summer student — *02 – 06/09/19*
  Achieved a place on a competitive summer programme to attend series of lab experiments on optomechanics, atomic magnetometers and photolithography, as well as lectures on quantum everything (computations, algorithms, architectures, cryptography etc).
- **Quantum Information, Computing and Control (QUICC) Summer School** — Leeds, UK
  Summer student — *19 – 23/08/19*
  Attended the competitive annual summer school of 2019. It included lectures on state of the art theoretical and experimental research in quantum optics, quantum metrology, measurement-based quantum computation and more, with speakers such as Terry Rudolph, Winfried Hensinger, Sir Peter Knight etc.

Notable University Project Experience

- **Group Work 301 (10/18 - 12/18):** *'The Aharonov-Bohm effect - topology and Berry curvature'*

  Project tutor: Dr. Martin Gradhand
  - Produced a review article in a team of seven which provided the basic understanding of theoretical ideas behind the experiments and analyses of the various attempts to verify the observation, as well as the different contributions of all the leading figures of this discovery.
  - Responsible for the section connecting the observation to topology and the Berry curvature, as well as laying down the explicit derivation of the Berry phase and Berry connection, demonstrated my ability to summarise scientific papers and condense it to a level that is accessible to my peers.
  - Volunteered as the editor of the group; responsible for combining all the different contributions from teammates into one coherent review article and delegating tasks to team members according to their key abilities.

- **Practical Physics 301 - Theory Lab (10/18 - 11/18):** *'The wetting transition - exploring liquids at an interface'* (Unit Result: 72%, first-class)

  Project tutor: Dr. Stephen Clark
  - Employed classical density functional theory to determine the density profile of a fluid in the presence of an external potential, and subsequently derived a mean-field density functional theory for an inhomogeneous lattice-gas fluid model in order to explain the physics of the theory.
  - Explored the wetting transition of a boundary by modelling the interfacial interaction and absorption of a liquid drop on a surface using MATLAB.

- **Python Computational Modelling (09/17 - present):**
  - Obtained a wide range of experiences in Python simulation from my undergraduate computational courses, with methods including but not limited to Monte Carlo, Gauss-Seidel, Jacobi, 4-th order Runge-Kutte, Modified Euler and parallelised Metropolis-Hasting algorithm.

Notable Individual Project Experience

- **Python Computational Modelling:**
  Randomised benchmarking
  - Implemented the RB protocol for a set of non-Clifford gates in Python, a method which efficiently characterises the error profile of random quantum gate operations under long sequences of computation.
  - Implemented the algorithm separately with Kraus and Pauli-Liouville representations, parallelised using Python's mpi4py module.

  Solving PDEs with finite difference methods
  - Solved the heat equation for a specific boundary condition using the Crank-Nicholson algorithm via a tridiagonal reduction, and applied the von Neumann stability analysis for numerical error investigation.

Positions of Responsibility

- **Peer Assisted Study Sessions** — Bristol, UK
  PASS Leader — *10/18 – present*
  - Organise, publicise and facilitate weekly student-to-student support sessions to a group of ten second year Physics students in order to help them enhance their understanding of the subject matter of their course, through group discussion; demonstrated ability to present complex theories in a simpler way.

- **Chaos - University of Bristol Physics Society** — Bristol, UK
  Sports Representative — *06/18 – 07/19*
  - Organised the running of society sports teams - football, netball, basketball and badminton - for the intramural sport leagues, and ensure the union sports fees are paid by members, which totalled over £1000.
  - Being part of Chaos' committee who have won the UK's Best Society award at the National Society Awards (NSA) of 2019.

  Trips Representative — *05/17 – 05/18*
  - Organised academic and non-academic trips which were an integral part of leading Chaos to win the Best Academic and Careers Society award at the NSA of 2018, and also the Good Times award 2018 of the Bristol Student Union.
  - Personally planned, organised and led a trip of 47 people to visit the facilities of CERN for three days, demonstrating exemplary leadership skills, reliability as well as group management skills.

References

References available on request.