

# **Engineering Schools Study Abroad Program**

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**Host University/Laboratory:** Hitachi Cambridge Lab.

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## Debrief Report

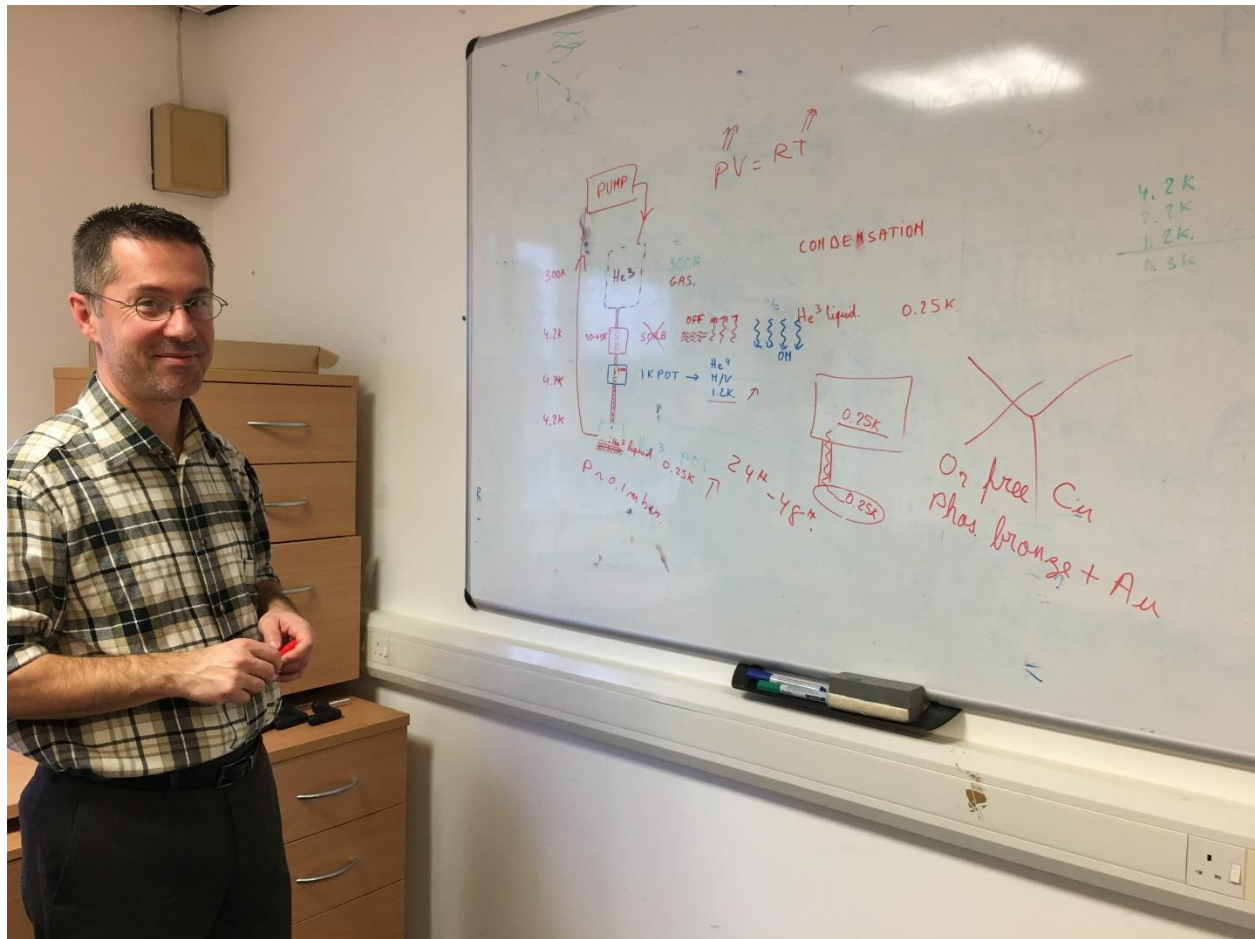
For spin-based quantum computation, read out of spin state is the first and the most important step. There are some techniques to be deployed: Charge sensor, radiofrequency quantum point contact (rf-QPC), radiofrequency single-electron transistor (rf-SET), dispersive read-out, and capacitive gate-based sensing.

A single quantum dot (QD) located nearby double quantum dot (DQD) is used as a charge sensor. This method is what my laboratory has mostly used for metal-oxide-semiconductor (MOS) DQD devices until last year. Although this technique gives reliable results, it is not as a fast measurement as radiofrequency single electron transistor (rf-SET) which is another technique for readout of spin state.

Hitachi Cambridge Laboratory (HCL) is a pioneer in radio frequency (RF) capacitive gate-based sensing technique. During my period of stay, I fulfilled what I have aimed before joining that group. First, I learned the theory of gate-based sensing both at the device level and at the circuit level. Second, I understand how to design a PCB compatible with gate-based sensing. Third, I tested superconducting inductor (classical inductors are not much suitable at cryogenic temperature). Finally, I contributed to current gate-based sensing measurements to learn the measurement set-up. During all these happened, I performed the experiment with David Ibberson who is a D3 student under the supervision of Dr. Fernando Gonzalez-Zalba.



During my stay, I conducted other researchers at HCL and deployed ties with them.



Out of research, I had the opportunity to enjoy my stay. I visited Oxford which is very close to Cambridge. And I hang out with my friends from the laboratory.



To put all in a nutshell, it was a great opportunity and experience for me.