Outline and policies for QIC 880 - Nanoelectronics for Quantum Information Processing / Phys 768 - Special Topics in Quantum Information Processing

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(Dated: Fall 2015)

Coordinates.—
Wed/Fri 08:30-09:50, QNC 1201

About the topic.—
In nanoscale systems quantum effects are important. In nanostructured superconductors, quantum effects can be tailored through design. The low loss enables the coherent manipulation of quantum states. These features make superconducting nanodevices one of the main candidates for applications in quantum information processing. This course introduces the fundamental concepts of this field.

The course will include the following:

- Electrodynamics of superconductors
- BCS theory and tunnel junctions
- The Josephson effect
- Flux and fluxoid quantization
- Quantization of electrical circuits
- The basic types of superconducting qubits
- Decoherence in the solid state
- Circuit quantum electrodynamics
- Readout of nanoscale qubits
- Fabrication of qubit devices
- Measurement techniques

Texts.—
Lecture notes will be available via LEARN. In some cases required or optional additional reading material will be indicated. This material will be either research papers or book chapters. Research papers can be downloaded via the UW library website. There is a course reserve for books useful for this course at the Davis Centre library.

LEARN.—
The course will make use of LEARN for distribution of notes, assignments, solutions, etc. Please check it regularly. You can only use LEARN if you are formally enrolled. So if you do not plan to take the course for credit, please enrol as audit.

Evaluation.—
There will be two components to your mark: five assignments, counting 10% each, and a final project, counting 50%.

Assignment schedule (tentative):

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There is a penalty of 10%/day of the obtained mark for late assignments. Assignments received after more than 4 days will not be taken into account. Week-end days and holidays do not count towards this penalty.

Final project topics will expand and/or build on the subjects treated in the course. They will be posted on LEARN and you can take them on a first come, first served basis. Please contact me directly if there are particular topics you are interested in. Your chosen project topic should not have a significant overlap with your past or current research. I will be available to discuss a relevant reading list as well as any questions you may have. Evaluation will be based on a presentation and an essay. The presentations, lasting 15 minutes, are to be given at a yet-to-be-determined date after December 7. Essays of at least 5 pages and less than 8 pages RevTeX two-column style will be due at a date to be determined, however separated from the presentation date by at least one week.

Getting in touch.—
My coordinates are: alupascu@uwaterloo.ca, phone extension 35468, QNC 2202 (main office) and RAC1 2112.

Office hours are kept on Tuesdays 16:00 - 17:00, in QNC 2202.

The RAC1 building is on the North Campus. Please look at http://iqc.uwaterloo.ca/ for details on how to get there. There is a shuttle service from the main campus that you can use if needed (the schedule is available at http://community.iqc.uwaterloo.ca/admin/schedule.html).

If you want to meet me at times other than the office hour, setting up an appointment (by email or phone) is preferable since it will save you time in case I am not available.

I usually read email once a day, typically in the morning.