QUANTUM MATERIALS SCIENCE AND ENGINEERING

Directors
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GRADUATE CERTIFICATE IN QUANTUM MATERIALS SCIENCE AND ENGINEERING

Quantum materials have played a key role in technologies with broad societal impacts (e.g., semiconductors, lasers, LEDs, and medical imaging). Their importance will increase with the growing research on harnessing quantum effects for computation and sensing (e.g., quantum computation and information research programs at leading technology companies). In addition, the role of data science and machine learning methods continue to grow in importance in all fields of science and engineering. The aim of this certificate is to train Ph.D. students in the multidisciplinary field of quantum materials and associated data science methods to allow them to be at the cutting edge of research and engineering on understanding and using quantum matter that can lead to scientific and engineering breakthroughs.

This certificate program is open to Ph.D. students in several graduate-degree granting programs in the Graduate School of Arts and Sciences, including the Departments of Applied Physics, Chemistry, Computer Science, Mechanical Engineering and Materials Science, and Physics. Students can either choose to participate in the certificate program during the application process to the Graduate School, or, if already enrolled in the graduate program of one of the above departments, apply to the certificate program by contacting its directors.

Requirements

In addition to the department-specific requirements for completing a Ph.D., this certificate program has the following requirements. For coursework, each student must successfully complete the six courses below (within the first two years of matriculating at Yale for students who choose the certificate program during the application process):

1. Quantum Materials Science and Engineering (will be first offered in fall 2024, co-taught by Ismail-Beigi and O'Hern)
2. Unsupervised Learning for Big Data, CPSC 553/CB&B 555/GENE 555
3. Sold State Physics I, APHY 448/PHYS 448/ENAS 850/PHYS 548
4. One of three choices for quantum mechanics: APHY 506, Basic Quantum Mechanics; PHYS 508, Quantum Mechanics I; or CHEM 570, Quantum Chemistry
5. An elective course in materials science and engineering, statistical and many-body physics, or machine learning and data science. Examples include PHYS 650, Theory of Solids I; ENAS 787, Forces on the Nanoscale; CPSC 552, Deep Learning Theory and Applications; and ENAS 752, Solidification and Phase Transitions
6. Responsible Conduct of Research course (offered by each home department)

Ph.D. students in the certificate program will meet with a mentoring committee convened by the directors at least once each year to monitor progress and provide career guidance for each student. Students will also present their research work in a public setting at least once a year based on the opportunities: e.g., by presenting a poster at symposia organized by departments or the certificate program, a talk as part of research progress seminars, or a chalk talk series organized by the directors.