QM1: **Rafael Fernandes** (University of Illinois Urbana-Champaign) 3h

"Unconventional pairing and multi-component superconductivity"

In these lectures, I will introduce unconventional superconductivity that emerges when the gap function has multiple components that are enforced by crystalline symmetries. In these situations, the superconducting ground state spontaneously breaks additional symmetries of the system besides the usual U(1) gauge symmetry broken by every pairing state, such as time-reversal symmetry (resulting in so-called magnetic, or chiral, superconductors) and rotational symmetry (resulting in nematic superconductors). I will discuss their fluctuation spectra and show that these multi-component superconductors generally support the emergence of vestigial phases, in which composite order parameters condense before the onset of long-range superconductivity. Among the possible vestigial phases, an exotic charge-4e state emerges, in which electrons form bound quartets rather than bound pairs. Finally, I will overview material candidates that have been proposed to display multi-component pairing, such as twisted moiré systems and doped topological insulators.