DAY 4 (26 June): 11:30 – 12:10

Novel properties of bismuth in high magnetic fields

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In sharp contrast to most three-dimensional metals, the carrier density in bulk bismuth is sufficiently low that lowest-Landau-level physics can be explored with laboratory fields. Very recent experiments probing this high-field regime have uncovered a number of surprising features which raise interesting new questions for this material. Specifically, observations of anomalies in the Hall resistance, Nerst effect, and magnetization measurements have led to the speculation that three-dimensional bismuth in the quantum limit may host correlated states, and possibly even electron fractionalization. In this talk I will discuss a recent analysis of an interacting low-energy theory for bismuth in a magnetic field, describing Dirac-like electrons coupled to holes, which allows one to begin shedding light on these phenomena. I will argue that an anomalous Zeeman effect that arises due to strong spin-orbit coupling, together with an instability to charge-density-wave order in the highest fields may account for some of the puzzling observations. Outstanding questions and interesting future experimental directions will also be discussed.