Quasi-2D to 3D Fermi Surface Topology Change in $Ce_{1-x}Nd_xCoIn_5$

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Heavy fermion systems are well-known for exhibiting exotic quantum phenomena. One such system, $CeCoIn_5$, is perhaps most famous for the *Q* phase, an exotic high-field state with intertwined magnetic and superconducting orders. A scattering *Q* vector was observed in neutron scattering at zero applied magnetic field in $Ce_{0.95}Nd_{0.05}CoIn_5$ and it was theorized that Fermi surface nesting was responsible providing the motivation for our experiment.

Scientists from the European High Magnetic Field Laboratory (EMFL) and NHMFL collaborated to perform de Haas-van Alphen measurements on a doping series of high-quality crystals of $Ce_{1-x}Nd_xCoIn_5$ grown at Brookhaven National Lab. Due to the high level of electron-electron interaction (i.e. enhanced effective masses), magnetic fields up to 35 T and temperatures down to 40 mK were required to accurately measure the Fermi surface. *Corresponding band structure calculations and an observed topology change between Nd doping x = 0.02 and 0.05 revealed the origin of the Q phase as arising from a spin density wave quantum critical point.*

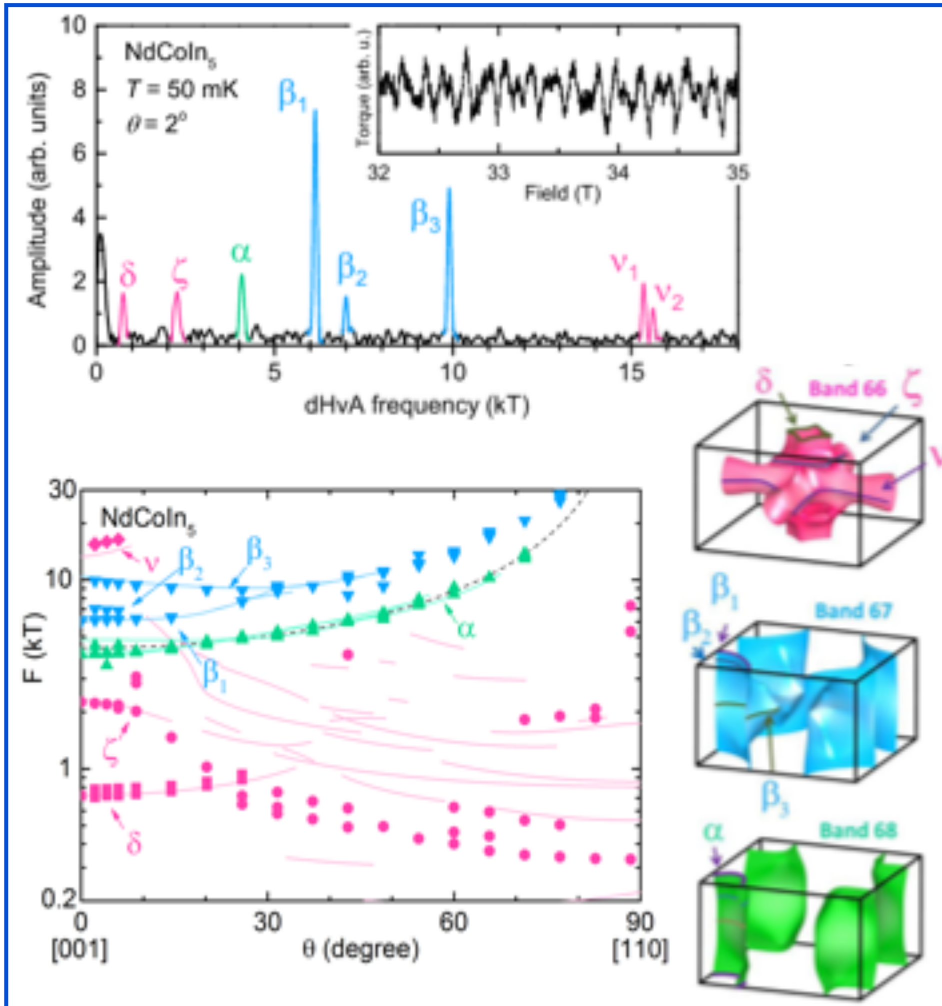

Figure: Example of one of the many datasets. ***(Top)*** Fourier transform of the torque magnetometry data shown in the inset, demonstrating the need for high magnetic fields and low temperatures to reveal the oscillations in their full detail. ***(Bottom)*** Angular dependence of the frequencies are in agreement with band structure calculations, where the colored lines correspond to the same-colored Fermi surfaces shown on the right.

Facilities used: DC Magnet User Facility: 35 Tesla, ^3He cryogenic system and ^3He / ^4He portable dilution refrigerator.

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