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High magnetic field measurements at central facilities: a physicist walks into a bar and says "Give me a 100 tesla shot please …"

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High magnetic field laboratories provide users with a wide range of sample environments that are difficult to set up in a conventional research laboratory: steady magnetic fields up to 45 tesla, pulsed fields up to 100 tesla, temperatures down to the low mK range, and high pressures up to 10's of GPa. Moreover, they offer a wide variety of measurement capabilities, including transport, magnetization, torque, specific heat, optics, etc.. Most importantly, they offer expertise, so that a user with comparatively little experience can travel to a magnet lab, participate in a technically difficult measurement, and produce first-rate results.

In this talk, I will give an overview of high magnetic field laboratories around the world, focusing on the specialized capabilities they offer, illustrated by examples of key results. I will follow this by discussing results that my research group has obtained at high field labs, including quantum oscillation measurements in strongly correlated electron systems, measurements of diamagnetic susceptibility in high temperature superconductors, and transport measurements at ultra-low temperatures.

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