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The sound of the Q-phase in CeCoIn5 - an ultrasound investigation

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Strong correlations in intermetallic compounds containing f-electron elements give rise to a wide variety of ground states. Superconducting states found in heavy fermion materials are candidates for unconventional pairing with intertwined orders [1]. CeCoIn5 is an intriguing example among this class of materials, with a dx2-y2 order parameter. Superconductivity is Pauli limited and coexists with a spin density wave (SDW) at low temperatures and high magnetic fields, in the so called Q-phase [2]. Superconductivity and magnetism are suppressed simultaneously at a first order phase transition, suggesting an unusual cooperative interplay. Inelastic neutron scattering measurements indicate that the Q phase can be interpreted as a field tuned Bose condensation of spin excitons. Intriguingly, this incommensurate SDW order always emerges in a single domain state and the domain selection is hyper sensitive to the direction of the applied magnetic field [3]. The nature of the Q-phase and the mechanism for domain switching remain under debate. In all proposed scenarios, the appearance of the Q-phase will affect the electronic quasi-particle DOS. Since phonons couple to the electronic structure at high frequencies- MHz [4], ultrasound is a suitable technique to investigate the Q-phase and its translational symmetry breaking. Here we investigate the response of elastic constants and attenuation of different modes under rotating magnetic fields.

The ultrasound technique is currently under development at the Paul Scherrer Institute. Traditionally, ultrasound setups rely on analog circuit components. We present our route to establish the technique taking advantage of a commercially available data acquisition card and subsequent digital processing.

[1] M. Kenzelmann et al, Science 321, 186-197 (2008).
[2] T. Watanabe et al, Phys. Rev. B 70, 020506(R) (2004).
[3] S. Gerber et al, Nat. Phys. 10, 126-129 (2014).
[4] T. Watanabe et al, Phys. Rev. B 70, 020506(R) (2004).

Position

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