Probing the stripe phase at filling factor 5/2 by NMR

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The appearance of periodic charge modulations as charge density waves is currently of strong interest in a variety of fields, such as high T_c superconductors and two dimensional electron systems in the quantum Hall regime. In the latter case electrons are believed to arrange into two dimensional "bubble" phases as well as unidirectional "stripe" phases for certain ratios of the electron density and magnetic field. A prominent example for such a potential stripe phase formation is the 5/2 state in tilted magnetic fields. As shown in Fig. 1, the 5/2 state disappears when tilting the sample with respect to the external magnetic field. This behavior had initially been interpreted to indicate an unpolarized 5/2 state [1], but in view of the strong transport anisotropy has later been revised as a signature of the emergence of a stripe-like phase [2]. However, beyond this indication by transport measurements alone, little is known about the stripe formation itself.

We have employed a technique called resistively detected NMR to probe the electron spin distribution at various filling factors between ν=2 and ν=3 when tilting the sample with respect to the external magnetic field. The resonance frequency of the nuclei has been shown to be a sensitive detector for changes in the electron spin polarization [3]. Starting from a single peak at ν=2 we observe the development of a prominent second peak, which ultimately evolves back into a single peak when approaching ν=3. Our measurements strongly suggest the emergence of separate regions with two different electron spin densities in the filling factor range displaying large transport anisotropy. In addition, by modeling the electron distribution as well as the corresponding NMR response across the filling factor range we are able to draw conclusions about the microscopic details of the stripe pattern.

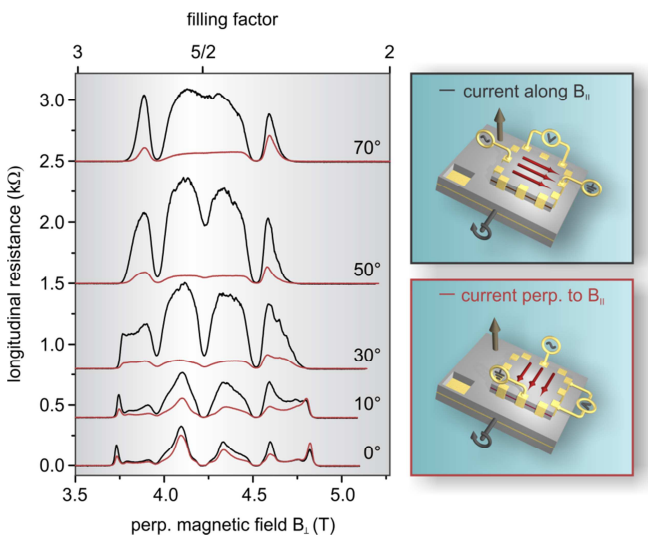

FIG. 1: Longitudinal resistance as a function of perpendicular magnetic field for different tilt angles (offset for clarity). Current flow along $B_{||}$ (black) and perpendicular to $B_{||}$ (red).

[1] J. P. Eisenstein *et al.*, Phys. Rev. Lett. **61**, 997 (1988).
[2] M. P. Lilly *et al.*, Phys. Rev. Lett. **83**, 824 (1999). W. Pan *et al.*, Phys. Rev. Lett. **83**, 820 (1999).
[3] L. Tiemann *et al.*, Science **335**, 828 (2012). O. Stern *et al.*, Phys. Rev. B **70**, 075318 (2004).