



Thursday, 13st July 2023, 17.15 h
Lecture Hall III, Department of Physics, Garching

Strong uniaxial pressure effects and low-energy magnon
excitations in 2D van-der-Waals ferromagnets

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Abstract:

The evolution of long-range ferromagnetic order in quasi-2D semiconducting van der Waals ferromagnets such as $\text{Cr}_2\text{Ge}_2\text{Te}_6$ and CrI_3 down to the bi- and single-layer limit raises fundamental questions of ordering phenomena in reduced dimensions but also promises potential spintronics applications. Engineering the critical temperature to achieve room temperature devices is one of the critical next steps on the path to future technologies. Hence, quantitative determination of uniaxial pressure effects, of magnetic anisotropy and of magnetic correlations are crucial to further exploit this material. Here, we report high-resolution capacitance dilatometry data, ferromagnetic resonance in a broad frequency regime of 30 - 330 GHz and in magnetic fields up to 18 T, and determine the short-range correlation lengths above T_C [1-6]. Our data prove significant magnetoelastic coupling and provide the uniaxial pressure dependencies of the ordering phenomena. From the magnon branches we infer the microscopic parameters describing the magnetic excitations and derive the unusual evolution of the anisotropy gap. Our results show how the combination of macroscopic and local probes elucidates the relevance of anisotropy in 2D materials, and – in the example of $\text{Cr}_2\text{Ge}_2\text{Te}_6$ – evidences a tricritical point as well as gigantic uniaxial pressure effects in the vicinity of T_C [1,5].

- [1] S. Spachmann et al., Phys. Rev. B 107, 184421 (2023)
- [2] K. Synnatschke et al., 2D Materials 10, 024003 (2023)
- [3] J. Arneth et al., Phys. Rev. B 105, L060404 (2022)
- [4] A. Ghosh et al., Phys. Rev. B 105, L081104 (2022)
- [5] S. Spachmann et al., Phys. Rev. Research 4, L022040 (2022)
- [6] M. Jonak et al., Phys. Rev. B 106, L214412 (2022)

There will be coffee, tea, and cookies in front of the lecture hall at 17.00 h