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EINLADUNG zum IFP-SEMINAR

Clearing the Gap: Magnetic Resonance Unmasks the Ground State of a Spin-Liquid Candidate

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Host: Karsten Held

Termin: Mittwoch, 25. November 2020, 16 Uhr

Ort: https://global.gotomeeting.com/join/120905213
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Abstract:

Geometrical frustration, quantum entanglement and disorder may prevent long-range order of localized spins with strong exchange interactions, resulting in novel states of matter such as resonating valence bonds suggested by Phil Anderson [1]. The layered Mott-insulating compound κ-(BEDT-TTF)$_2$Cu$_2$(CN)$_3$ with a half-filled triangular lattice is considered the best approximation of this elusive quantum-spin-liquid (QSL) state [2], but its ground-state properties remain puzzling. Here we present a multi-frequency electron-spin-resonance (ESR) study down to millikelvin temperatures, revealing a rapid drop of the spin susceptibility at T^* = 6 K [3]. This opening of a spin gap, accompanied by structural modifications, rules out the prevalent assumption of a gapless QSL phase [1,2] and rather suggests the enigmatic '6 K-anomaly' as the transition to a valence-bond-solid ground state. Our ESR spectra further identify an impurity contribution that becomes dominant when the intrinsic spins form singlets below T^*, in line with recent findings from field-dependent nuclear magnetic resonance [4]. Only by probing the electrons directly, we could unveil the low-energy properties of quantum-spin systems without magnetic order, manifesting the pivotal role of defects.

[1] Nature 464, 199-208 (2010)
[2] Phys. Rev. Lett. 91, 107001 (2003)
[3] arXiv:2010.16155
[4] Phys. Rev. B 101, 140401(R) (2020)