UNIVERSITÄT LEIPZIG

Fakultät für Physik und Geowissenschaften

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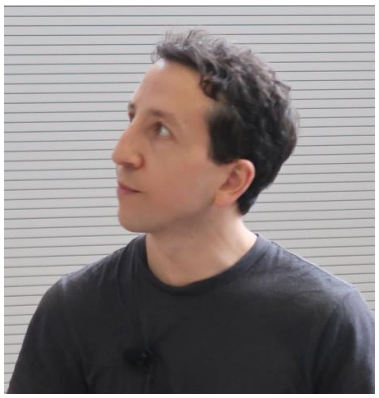
Physics Colloquium

Tuesday, 12 Dec 2023 at 16:30

Prof. Dr. Krzysztof Wohlfeld

University of Warsaw

Spinons or magnons? A quest for the correct quasiparticle description of quantum magnets



One of the main paradigms of quantum magnetism is that collective excitations in systems with long-range order, such as ferro/antiferro-magnets, are well described in terms of bosonic quasiparticles – magnons. This approach is extremely successful, since these magnons interact very weakly. On the other hand, once the long-range order collapses, for instance due to geometric frustration of spin couplings, magnons interact and such a description seems to fail. In contrast, the low-energy magnetic excitations are typically described in terms of fermionic spinons. Unfortunately, the latter quasiparticles are less intuitive, for they carry fractional quantum numbers and, most of the time, they also do interact.

In this talk I will discuss our recent efforts to describe magnetic systems without long-range order in terms of magnons. Although such an approach is rarely chosen, I will show that it can be of more use than the spinon language. First, we can explain this way the observed persistence of magnons in high temperature superconducting copper oxides [1]. Second, we can understand why fractionalisation of electron's spin and charge quantum numbers can only take place in strictly one-dimensional systems [2].

[1] W. Zhang et al., npj Quantum Mater. 7, 123 (2022). [2] K. Bieniasz et al., SciPost Phys. 7, 066 (2019); P. Wrzosek et al., arXiv: 2203.01846 [under review in SciPost Phys. (2023)].

Venue: Universität Leipzig, Faculty of Physics and Earth Sciences
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