

# Physics Colloquium Mainz

**July 16, 2024 at 16 c.t.**

Lecture room KPH,  
Johann-Joachim-Becher-Weg 45, JGU

I will talk about the problems in correlated electron systems that occupied us in the early days of the KOMET 7 research group headed by Peter van Dongen. These problems include quantum impurity problems as well as the dynamical mean field theory (DMFT), i.e., correlated electrons in the infinite-dimensional limit. At first glance, these two problems are very different because the impurity problem is in a sense zero-dimensional, whereas the DMFT is formally infinite-dimensional. However, the effective problems and solution methods of these two problems are closely related, and both approaches can be used to describe the behavior of real three-dimensional materials. In addition, a major activity of group members has been to develop and use matrix-product-state and tensor-network methods, especially the density matrix renormalization group. These methods are ideally suited to study quasi-one-dimensional and two-dimensional strongly correlated systems. They can be applied to a variety of systems ranging from transition-metal compounds such as the cuprates to organometallic materials such as Bechgaard salts as well as to quantum simulators formed from cold atomic gases on optical lattices.

**Correlated Electrons from Zero to  
Infinite Dimensions:  
Early Days of KOMET 7 in Mainz  
Prof. Dr. Reinhard Noack**

**Philipps University, Marburg**

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