凝縮系物理学ゼミナール

Condensed Matter Seminar

Location: **Room 413**, School of Science Bldg. 5 (理学 5 号館 413 号室)

Date: **13:30-15:00**, Wednesday, 22 May 2019

“Doublon bound states in the Kondo Lattice Model”

Speaker:

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Abstract:

The doublon is a repulsively bound state of two electrons on the same site, well known from the strong-*U* limit of the Hubbard model. We show that, surprisingly, it also exists in the strong-*J* limit of Kondo limit, even though there is no direct interaction between the electrons and the picture of a lower and an upper Hubbard band does not hold.

The best way to observe it in the experiment would be Appearance Potential Spectroscopy (APS), but it can be seen as a satellite in inverse photoemission as well.

Furthermore, this "magnetic doublon" has a notable difference to its Hubbard counterpart: When there are magnons available, it in fact becomes a bound state of two electrons and one magnon, which is a $1/J$ effect. When there are no magnons, a virtual must be created in a $1/J^3$ process, resulting in a strong suppression of the bandwidth. In an antiferromagnet, the bandwidth only weakly depends on *J*. Thus, one has is a kind of "inverse CMR effect" (single electrons behave in the opposite way and are scattered more strongly on an antiferromagnet).

The existence of the doublon has the consequence that all related effects of the Hubbard model can be replicated in the Kondo model as well. For example, we show that one can perform quantum distillation in an ultracold lattice. It is also likely to affect nonequlibrium relaxation and transport properties of a Kondo system.

We present an investigation of the exact eigenstates of the Kondo Lattice Model in the low-density limit, supported by an effective model of doublon propagation derived by the Schrieffer-Wolff transformation. Spectral functions and a real-time simulation of quantum distillation are calculated using the dynamic Density Matrix Renormalization Group (DMRG).