

Colloquium on Solid-State Physics

Date: Thursday, April 24, 2014

Time: Coffee, Tea and cookies: 17:00 h
Presentation: 17:15 h

Place: Hörsaal HS 3
Physik - Department
Technische Universität München



Seminar of the Collaborative Research Centre/Transregio TRR 80:

Emergent magnetic order: Artificial spin ice structures

Prof. Dr. Björgvin Hjörvarsson
Department of Physics and Astronomy
Uppsala University

Artificial spin ice arrays of micromagnetic islands are a means of engineering additional energy scales and frustration into magnetic materials. Despite much progress in elucidating the properties of such arrays, the 'spins' in the systems have only recently been shown to exhibit phase transitions and dynamic response. The criteria for obtaining such super-spin structures with intrinsic dynamics will be discussed and exemplified.

A phase transition of super-spins in strongly interacting Ising like islands will be demonstrated in patterned delta doped Pd(Fe), with an inherent ordering temperature near room temperature. By measuring the temperature dependent magnetization in different directions, we confirm a dynamical 'pre-melting' of the artificial spin ice structure at a temperature well below the intrinsic ordering temperature of the island material. We thereby create a spin ice array exhibiting real thermal dynamics of the artificial spins over an extended temperature range.

These results clearly demonstrate the possibility to design new energy and length-scales in materials, giving rise to new and intricate properties. The utilization of the emergent order is only rudimentarily explored and coupling between different physical properties are still unknown.