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2016 SEMINAR SERIES PRESENTS

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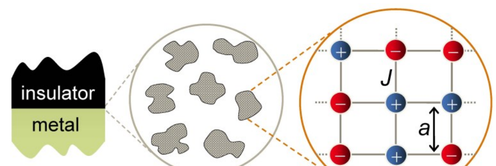
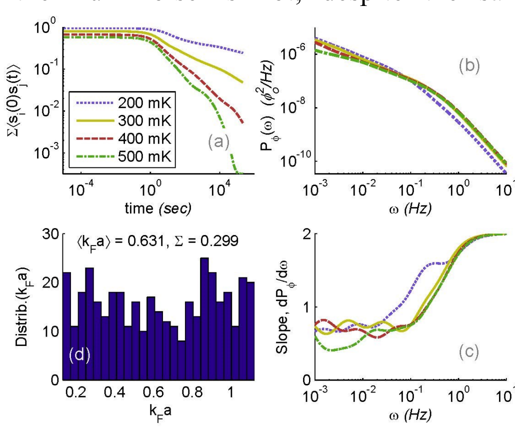
An Ising Glauber Spin Cluster Model for Temperature dependent Magnetization Noise in SQUIDS

Dr. Amrit De

Despite the occurrence of 1/f noise in all sort of physical systems, there is no single underlying universal mechanism that can explain the different manifestations. However it has been argued that 1/f noise will occur in spatially extended metastable systems near a critical point (PRL, 59,4, pp. 381, 1987). 1/f magnetic noise was observed in SQUIDs in the 1980's (IEEE Trans. Magn. 23, 1662 1987) and was never fully explained. The subject was forgotten up until the very recent interest in quantum computing.



Here (PRL 113, 217002, 2014) it is shown that clusters of interacting two-level-systems, likely due to color centers at the metal-insulator interface, self-consistently lead to 1/f magnetization noise in SQUIDs. Model calculations based on a new method, explains various puzzling experimental features. It is shown why the inductance noise is inherently temperature dependent while the flux noise is not, despite the same underlying microscopics. Magnetic ordering in these systems, established by three-point correlations, explains the observation of a magnetically ordered phase in these systems. Based on the temperature dependence of short-range- and long-range ferromagnetic RKKY interactions, it is argued that the time reversal symmetry of the clusters is not likely broken by the same mechanism which mediates surface ferromagnetism in nanoparticles and thin films of the same insulator materials.



Amrit De is an assistant project scientist at the University of California, Riverside. He earned his PhD in Physics from the University of Iowa in 2009, with his thesis titled, "Spin Dynamics and Opto-Electronic Properties of some Novel Semiconductor Systems." His theoretical and computational research involves extensive work with quantum information, quantum metrology, open quantum systems, semiconductor nanostructures and spintronics. He has also worked on various topics in photonics such as magneto-optics, thin-film polarization optics and ellipsometry.

Host:
Professor Alexey Kovalev

Department of Physics & Astronomy

Wednesday, January 20, 4:00 pm | 136 Jorgensen Hall
3:45 – refreshments in Jorgensen Atrium

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