

T_cSAM Bi-Weekly Brown Bag Seminar

Texas Center for Superconductivity and Advanced Materials

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“Magneto-Optical Imaging of Vortices and Flux Avalanches in Superconductors”

Thursday, November 18, 2004

Room 102, University of Houston Science Center
12:00 Noon – 1:00 p.m.

Abstract

Magneto-optical imaging (MOI) is a technique which is based on the large Faraday effect in Bi:YIG films, and is now becoming widely used to study space and time-resolved magnetic behavior of superconductors. Recently, we succeeded to bring MOI to a level where individual Abrikosov vortices can be observed and their motion visualized in real-time. I will report on this latest development, and illustrate by VIDEO clips how MOI can reveal the detailed dynamical behavior of vortex matter. An interesting side effect of using the Bi:YIG sensor is that Bloch walls, commonly present in such films, can be used to actively manipulate vortices. It is shown that such a wall, which basically is a movable nanoscopic bar magnet, can act either as a “vortex brush” or “vortex shovel”.

On a larger scale, MOI recently discovered that flux penetration in thin film superconductors often occurs in abrupt bursts of sample spanning (and beautiful!) dendritic flux structures. Various aspects of this avalanche behavior, which manifests also in large noise in M-H loops, will be reported for the cases of MgB₂, YBCO and NbN films. It will also be shown that coexisting with the flux dendrites (typically involving 10⁶-10⁷ vortices), one finds well-defined mesoscopic avalanches where 20-10000 vortices participate. Avalanche distributions, their morphology, and their origin will be discussed.

Bio

Professor Tom H. Johansen, Visiting Scientist at TcSAM during Fall of 2004, received the Ph.D. degree from the University of Oslo in 1988. He became Assistant Professor at the University of Oslo in 1989, where he initiated and built a laboratory for studies of magnetic levitation with superconductors. In 1993, he established a laboratory for Magneto Optical Imaging, the core activity in his present research. Johansen became full professor in 1997.

Prof. Johansen has previously been Visiting Scientist at Institute for Solid State Physics, Russian Academy of Sciences, Chernologovka, Russia (1994), The University of Mining and Metallurgy, AGH, Cracow, Poland (1998), The University of Houston, TcSUH, USA (2000), and he received in 2002 a Dozor Visiting Fellowship at Ben Gurion University of the Negev, Israel.

Prof. Johansen has since 1989 been the head of the Superconductor Laboratory at The University of Oslo. For an overview of present activities, see the website; <http://www.fys.uio.no/super/>, (cited by The Royal Swedish Academy as primary “further reading” reference to the work of the 2003 Nobel Laureate, A.A. Abrikosov). In 1993 he was awarded the IBM/NFS Prize in Solid State Physics.

Prof. Johansen has published 200 papers, presented 125 invited talks at conferences, and he is editor of 2 books, including Magneto-Optical Imaging (2004).

Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8210 as soon as possible.

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