



# 量子材料科学中心 International Center for Quantum Materials

## Informal Seminar

### Recent breakthroughs in superconductivity and discovery of type-1.5 superconductors



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**Time:** 4:00 pm, Sept.25 2012 (Tuesday)

2012 9 25

4:00

**Venue:** Conference Room A (607), No. 5 Science Building  
607

### Abstract

Till recently, all superconductors have been classified either as type-1 or type-2 materials. Here the existence of the novel superconducting state is demonstrated in two-band high quality MgB<sub>2</sub> single crystals where a unique combination of both type-1 and type-2 conditions is realized in a single material at the same time:  $\lambda_1/\xi_1 < 1/\sqrt{2}$  for the first sub-component of the order parameter and  $\lambda_2/\xi_2 > 1/\sqrt{2}$  for the second one. Such two-band materials are, in fact, type-1.5 superconductors, since they combine simultaneously both type-1 and type-2 superconductivity in the same material. This leads to a drastic change in the vortex-vortex interaction, which results in the appearance of stable vortex stripes, clusters and gossamer-like vortex patterns. These novel patterns have been directly visualized by using Bitter decoration, scanning SQUID and scanning Hall probe microscopy. The observed patterns are in an excellent agreement with the molecular dynamics simulations using the vortex-vortex interaction corresponding to the type-1.5 superconductivity.

### About the Speaker

Prof. Moshchalkov has been actively working on different research fields of superconductivity. Recently his research interests include superconducting, magnetic and hybrid nanostructures, vortex matter in superconductors, pulsed magnetic fields, nanoplasmonics, metamaterials. He has Over 850 publications in international journals with referee system - more than 11000 citations. He gave invited talks at 106 international conferences and workshops. He is the founder of the new series of International Conferences "*Vortex Matter in Nanostructured Superconductors*" and Member of an international advisory committee of 39 International Conferences. Due to his outstanding research, he received ISI Thomson Scientific Award "Top Cited Paper in Flanders", 2000; Laureate of the Belgian FWO Dr. A.De Leeuw-Damry-Bourlart Prize for Exact Sciences, 2005; Finalist for the EU Descartes Research Prize, 2006; Methusalem Research Award, 2009. He is currently the chairman of the Section "*Low Temperature Physics*" of the ESF, 1992 – 1998; Co-Editor of "*Europhysics Letters*", 1998 – 2003; "*Superlattices and Microstructures*", 2003- 2007; Co-editor of "*Superconductor Science and Technology*", 2007-2009; Editor of "*Physica C*", 2007-...; "*Advances in Condensed Matter Physics*", 2010-...