

BOTTOM-UP NANOWIRES AS ULTRA-SENSITIVE FORCE TRANSDUCERS

Prof. Martino Poggio (Department of Physics, University of Basel)
Prof. Richard Warburton (Department of Physics, University of Basel)

We will set up polarization-enhanced interferometers for the measurement thermal motion of cantilevers made from semiconductor nanowires (NWs). These measurements will be carried out in vacuum both at room temperature and temperatures below 1 K. Our initial goal will be to produce sensors based on NW cantilevers with force resolutions well below the $\text{aN}/(\text{Hz})^{1/2}$ level and perhaps into the tens of $\text{zN}/(\text{Hz})^{1/2}$ range. Once such NW force sensors have been realized, we aim to integrate them into a low-temperature SPM apparatus. This task will require the construction of scanning probe microscope customized for NW cantilevers. The ability to scan such force sensors will open the door to AFM and MFM with unprecedented sensitivity. The foremost SPM application of the scanning NWs will be their use as force transducers in the next generation of force-detected nano-MRI.

CURRICULUM VITAE

Name Martino Poggio
Host Institution Department of Physics, University of Basel
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EDUCATION

10 Dec. 2005 Ph.D. in Physics, University of California, Santa Barbara
10 Dec. 2003 M.A. in Physics, University of California, Santa Barbara
08 Jun. 2000 A.B. magna cum laude in Physics, Harvard University

EXPERIENCE

Jan. 2009 - Present Assistant Professor of Physics (tenure track)
Department of Physics, University of Basel
Argovia Assistant Professor of Nanotechnology

Jan. 2006 - Dec. 2008 Post Doctoral Researcher
IBM Almaden Research Center / Stanford University
Manager: Dr. Dan Rugar

Sep. 2000 - Dec. 2005 Graduate Research Assistant
Department of Physics, University of California, Santa Barbara
Thesis advisor: Prof. David Awschalom

SUPERVISION AND TEACHING

Jan. 2009 - Present I currently supervise **3 post-docs** and **6 Ph.D. students**. I supervised **2 Masters students** to completion. I designed and taught **3 Masters level courses**: “Introduction to Nanomechanics” (Fall 2009, 2010, Spring 2012); “Optics of Solid-state Nanostructures” (Spring 2010, 2011); and “Fundamental Electronics” (Fall 2011, 2012).

GRANTS AWARDED AS PRINCIPAL APPLICANT

Apr. 2012 - Mar. 2015 “Spin, Quantum Electronics, and Nanomechanics”
Source: *Swiss National Science Foundation*
Value: **405,000 € over 3 years**

Apr. 2012 - Mar. 2015 “Application of Mechanically-detected Spin Resonance to Solid-state Nanostructures”
Source: *Sino Swiss Science and Technology Cooperation*
Partner: Prof. Jiangfeng Du, University of Science & Technology of China (USTC)
Value: **190,000 € over 3 years**

Apr. 2009 - Mar. 2012 “Spin, Quantum Electronics, and Nanomechanics”
Source: *Swiss National Science Foundation*
Value: **497,000 € over 3 years**

PROFESSIONAL ORGANIZATIONS AND ACTIVITIES

I am a member of the *American Physical Society*; a referee for *Physical Review Letters*, *Physical Review A*, *Physical Review B*, *Applied Physics Letters*, *Nature Photonics*, and *New Journal of Physics*; and a reviewer for the *Israel Science Foundation* and the *Swiss National Science Foundation*.

Curriculum Vitae: Richard J. Warburton

Education

2000 Habilitation (Ludwig-Maximilians-University, Munich, Germany)
1991 MA and DPhil (Clarendon Laboratory, University of Oxford, UK)
1987 Physics BA (Hons) 1st Class, St. Catherine's College, Oxford

Employment

2010– Professor (Ordinarius), Department of Physics, University of Basel
2000 – 2009 Lecturer/Reader/Professor, Heriot-Watt University, Edinburgh
1993 – 1999 Research Fellow/Assistant Professor, Ludwig-Maximilians University, Munich
1990 – 1993 Junior Research Fellow, Christ Church, University of Oxford, UK

Research Interests and Expertise

Quantum physics/quantum optics of semiconductor nanostructures and heterostructures; micro-cavities; spin qubit; superconducting nanowires for single photon detection; biological imaging

Honours and Awards

Fellow of the Institute of Physics, 2012; Fellow of the Royal Society of Edinburgh, 2009

Publication Record

180 papers including 4 Nature (2000, 2004, 2008, 2008); 1 Science (2009); 14 Physical Review Letters (1993 – 2012); 1 Nature Physics (2007); 1 Nature Photonics (2008); 27 Applied Physics Letters; 27 Physical Review B. Citation rate ca. 400/year; total citations 4,100; *h*-index 32

Management activities

Chair of Department from September 2012; Co-Leader of NCCR Quantum Science and Technologies (2010–); Co-Founder and Board Member, Scottish Doctoral Training Centre in Condensed Matter Physics (2007 – 2009)

Invited conference presentations

Over 40 invitations to international conferences 2000 – 2012 including 3 plenary talks: ICPS (Korea, 2010); Quantum Dots (UK, 2010); Narrow Gap Semiconductors (Japan, 2009)

Supervision and teaching

Supervision of 14 PhD students to completion; supervision of 7 post-docs, 6 of whom have a permanent academic job. Experienced university teacher.

Third-party funded projects

Research grant income 2000 – 2012 totals €8.0M, from EPSRC (UK), SNF and EU in the areas of semiconductor nanostructures and single photon science

Selected Publications

1. *A coherent single-hole spin in a semiconductor* D. Brunner *et al.*, Science **325**, 70 (2009)
2. *Optical pumping of a single hole spin in a quantum dot* B. D. Gerardot *et al.*, Nature **451**, 441 (2008)
3. *The nonlinear Fano effect* M. Kroner *et al.*, Nature **451**, 311 (2008)
4. *Optical emission from a charge-tunable quantum ring* R. J. Warburton *et al.*, Nature **405**, 926 – 929 (2000)