

A/Prof. Adam P. Micolich

Employment History

2010-present	ARC Future Fellow/Associate Professor	School of Physics, University of NSW
2007-2009	Senior Lecturer	School of Physics, University of NSW
2005-2007	Lecturer	School of Physics, University of NSW
2003-2006	ARC Australian Postdoctoral Fellow	School of Physics, University of NSW
2002-2003	Senior Research Associate	School of Physics, University of NSW
2000-2002	Research Associate	Physics Dept., University of Oregon, USA
1995-1996	Summer Vacation Scholar	Accelerator Mass Spectrometry, ANSTO

Educational Qualifications

1997-2000	Ph.D. in Physics	School of Physics, University of NSW
1993-1996	B.Sc. (Hons. I and University Medal)	School of Physics, University of NSW

Professional Appointments

2011-present	Member, Editorial Advisory Board	Journal of Physics: Condensed Matter
2004-present	Member, Management Committee	Australian Research Council Nanotechnology Network (ARCNN)

Awards and Honours

2010-2013	ARC Future Fellowship
2008	NSW Royal Society Edgeworth David Medal
2006	NSW/ACT Young Tall Poppy Science Award (Aust. Inst. for Policy & Science)
2003-2006	ARC Australian Postdoctoral Fellowship
1999	Australian Institute of Physics Award for Postgraduate Excellence
1999	Best Student Poster Prize, Australian and New Zealand Institutes of Physics Annual Condensed Matter Meeting, Wagga Wagga.
1997	UNSW University Medal (outstanding undergraduate performance)
1995	Physics Staff Prize for Physics Honours (overall top mark in honours course)
1996	Head of School's Prize in Physics (best honours thesis)
1995	Australian Institute of Physics Prize (overall top mark physics III courses)
1995	Spectra Physics Prize in Experimental Physics (top mark experimental physics III)
1995	The B.L. Turtle Memorial Astrophysics Prize (top mark astrophysics III)

Research Summary

I have produced 108 publications in the last 12 years including **1 book chapter and 80 papers in Refereed Journals** and **over 400 citations**. My career publication record includes papers in **Nature** (2), **Nature Physics** (1), **Physics World** (1), **Physical Review Letters** (5), **Applied Physics Letters** (8), and **Physical Review** (13). I have given 18 talks and 13 posters at international/national conferences including 10 invited talks at conferences in the U.S., Japan, N.Z and Australia. My research has been presented in a 30 minute *Quantum* episode aired on ABC-TV in 1998, scientific magazines including *Nature*, *Nature Physics*, *Physics World* and *Scientific American* and numerous major newspapers including the *New York Times*, *The Guardian* and *The Sydney Morning Herald*. I was listed among the top 50 nanotechnology researchers in Australia (based on publication rate) in the recent "Nanotechnology Benchmarking Project" report published by the Australian Academy of Science (See <http://www.science.org.au/policy/nanotech.htm>). In 2006 I was awarded a Young Tall Poppy award by the Australian Institute of Policy and Science for my contributions to Australian physics research and work on semiconductor billiards. In 2008 I was awarded the NSW Royal Society's Edgeworth David Medal, which is awarded each year to an Australian researcher under 35 years of age for outstanding contributions to science – this award is open across *all* fields of research.

I commenced my Ph.D. studies on the electronic properties of semiconductor billiards in 1997. My work resulted in the discovery of statistically self-similar fractal conductance fluctuations in these devices in 1998. I went on to demonstrate that this was a universal effect in semiconductor billiards and quantum dots in a seminal paper published in *Physical Review Letters* in 2000. During my Ph.D. research, I played a key role in work demonstrating that the famous drip-paintings of American abstract artist Jackson Pollock were fractal, developing the mathematical analysis techniques involved in analyzing Pollock's works. This work was published in *Nature* in 1999, and received significant attention from the science and art communities, as well as the public at large.

On completion of my Ph.D. research, I worked as a Research Associate at the University of Oregon, U.S.A., before returning to UNSW in 2002. In 2003, I was awarded an Australian Postdoctoral Fellowship by the Australian Research Council to undertake a new research project on plastic electronics. This led to my discovery of superconductivity in ion-implanted plastic films. This was the first observation of a true zero resistance state in a plastic-superconductor hybrid material, something of significant interest for possible future technological applications.

On completion of my Fellowship, I accepted a continuing academic position in the School of Physics at UNSW, where I am currently a Senior Lecturer. I currently lead the Quantum Electronic Devices Group with my colleague Prof. Alex Hamilton. Our recent work on developing hole quantum wires has led to a string of high-impact papers in *Physical Review Letters* and *Applied Physics Letters*. I am currently working on the development of hole billiard devices where spins can be manipulated via their interaction with the billiard geometry, in a sense creating the equivalent of spin-optic devices such as prisms and lenses, and have recently been awarded an ARC Future Fellowship (2010-2014) to study the spin properties of self-assembled semiconductor nanowires.

Most Significant Publications (2006-2010) [31 peer reviewed research papers in this period]

1. K. Storm, G. Nylund, L. Samuelson and A.P. Micolich, *Realizing lateral wrap-gated nanowire FETs: Controlling gate length with chemistry rather than lithography*, **NanoLetters** DOI: 10.1021/nl104403g (In press, scheduled for cover of Jan 2012 issue). ERA A* tier journal with impact factor 10
This article was highlighted in News Articles in Materials Today, PhysOrg, and ZeitNews.
2. A.P. Stephenson, A.P. Micolich, K.H. Lee, P. Meredith and B.J. Powell, *A tunable metal-organic resistance thermometer*, **ChemPhysChem** **12**, 116 (2011). ERA A tier journal with impact factor 3.5
This article was highlighted in News Articles in Materials Today, Wired, TCE Today, PhysOrg, and ChemistryViews.
3. O. Klochan, J.C.H. Chen, A.P. Micolich, A.R. Hamilton, K. Muraki and Y. Hirayama, *Fabrication and characterization of an induced GaAs single hole transistor*, **Applied Physics Letters** **96**, 092103 (2010). ERA A* tier journal with impact factor 3.6
4. O. Klochan, A.P. Micolich, L.H. Ho, A.R. Hamilton, K. Muraki and Y. Hirayama, *Interplay between one-dimensional confinement and crystallographic anisotropy in ballistic hole quantum wires*, **New Journal of Physics** **11**, 043018 (2009). ERA A tier journal with impact factor 3.4
5. R. Danneau, O. Klochan, W.R. Clarke, L.H. Ho, A.P. Micolich, M.Y. Simmons, A.R. Hamilton, M. Pepper and D.A. Ritchie, *0.7 Structure and zero bias anomaly in ballistic hole quantum wires*, **Physical Review Letters** **100**, 016403 (2008). ERA A* tier journal with impact factor 6.9
6. W.R. Clarke, C.E. Yasin, A.R. Hamilton, A.P. Micolich, M.Y. Simmons, K. Muraki, Y. Hirayama, M. Pepper and D.A. Ritchie, *Impact of long- and short-range disorder on the metallic behaviour in two-dimensional systems*, **Nature Physics** **4**, 55 (2007). ERA A* tier journal with impact factor 14.6

7. A.P. Micolich, E. Tavenner, B.J. Powell, A.R. Hamilton, M.T. Curry, R.E. Giedd and P. Meredith, *Superconductivity in Metal-mixed Ion-implanted Polymer Films*, **Applied Physics Letters** **89**, 155203 (2006). ERA A* tier journal with impact factor 3.6
8. R.P. Taylor, A.P. Micolich and D. Jonas, *Reply to Jones-Smith and Mathur*, **Nature** **444**, E10-11 (2006). ERA A* tier journal with impact factor 28.7
9. O. Klochan, R. Danneau, W.R. Clarke, A.P. Micolich, L.-H. Ho, A.R. Hamilton, K. Muraki and Y. Hirayama, *Conductance Quantization in Induced One-Dimensional Hole Systems*, **Applied Physics Letters** **89**, 092105 (2006). ERA A* tier journal with impact factor 3.6
10. R. Danneau, O. Klochan, W.R. Clarke, L.-H. Ho, A.P. Micolich, A.R. Hamilton, M.Y. Simmons, M. Pepper, D.A. Ritchie and U. Zülicke, *Zeeman spin-splitting anisotropy in ballistic hole quantum wires*, **Physical Review Letters** **97**, 026403 (2006). ERA A* tier journal with impact factor 6.9

Invited Talks (10 in total since 2000)

1. “*Putting a new spin on holes: Ballistic transport and spin-orbit coupling in p-type GaAs quantum wires*”, Invited talk at the 4th MacDiarmid Institute Conference on Advanced Materials and Nanotechnology, Dunedin N.Z., Feb. 2009.
2. “*New Routes to Organic Electronic Devices*”, Invited talk at the SPIE Conference on Device and Process Technologies for Microelectronics, MEMS, Photonics, and Nanotechnology (AU03), Canberra, Dec. 2007.
3. “*Wave-Particle Duality*”, Invited lecture at the VCE Physics Focus Day, Melbourne, Nov. 2007.
4. “*New Routes to Organic Electronic Devices*”, Keynote Talk at the 17th Australian Institute of Physics National Congress, Brisbane, Dec. 2006.
5. “*Superconductivity in Metal-mixed Ion-Implanted Polymer Films*”, Invited talk at the 6th International Symposium on Crystalline Organic Metals, Superconductors and Ferromagnets, Florida Keys, U.S.A, Sept. 2006.
6. “*Ballistic Transport and Spin-Orbit Coupling in Hole Quantum Wires*”, Invited talk at the 2007 International Conference on Nano- & Bionanotechnology, Quantum Transport and Quantum Functional Semiconductors, Wellington, N.Z., Feb. 2007.
7. “*Superconductivity in Ion-implanted Plastic Films*”, Invited talk at the Sir Mark Oliphant Conference on Quantum Nanoscience, Noosa, Jan. 2006.
8. “*Superconductivity in Ion-implanted Plastic Films*”, Invited talk at the Workshop on Quantum Materials, Heron Island, Jul. 2005.
9. “*Universal Scaling Behaviour of Electrical Currents in Nanostructure Devices*”, Invited talk at the International Workshop on Breakthroughs in New Quantum Transport Devices, Chiba, Japan, Jun. 2001.
10. “*Quantum Chaos in Nanostructured Semiconductor Devices*”, Invited talk at the International Workshop on Applications of Quantum Chaos, Advanced Telecommunications Research Institute, Nara, Japan, Nov. 2000.

External Research Funding Obtained (2006-2011) – Total = \$6.39M (\$2.43M from ARC-DP)

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| 2011-2013 | ARC Discovery: <i>Electron Transport in Semiconductor Nanowire Devices – Setting Two Top Nanoelectronics Problems on the Straight and Narrow</i> , A.P. Micolich (UNSW), H. Linke (Lund) & L. Samuelson (Lund), \$400k |
| 2010-2014 | ARC Future Fellowship: <i>Self-assembled Semiconductor Nanowires: A New Platform for Spintronic Devices</i> , A.P. Micolich (UNSW), \$688k |

- 2008-2010 ARC Discovery: *Nanospintronics – Spin Transport in Semiconductor Nanostructures*, A.P.Micolich (UNSW), U. Zülicke (Massey U.) & A.D. Wieck (Bochum), **\$380k**
- 2007-2012 ARC Discovery: *Engineering ultra-low disorder semiconductor quantum nanostructures*, A.P. Micolich (UNSW), A.R. Hamilton (UNSW), U. Zülicke (Massey U.), R.P. Taylor (U. Oregon) & Y. Hirayama (NTT Basic Research Labs, Japan), **\$1.31M**
- 2005-2007 ARC Discovery: *Ion implanted polymers as plastic electronic & superconducting materials*, P. Meredith (U. Queensland), B.J. Powell (UQ), A.P. Micolich (UNSW), R.E. Giedd (Missouri State University), **\$345k**
- 2004-2009 ARC Research Networks: *Australian Research Council Nanotechnology Network*, C. Jagadish (ANU), L. Faraone (UWA), P. Mulvaney (U. Melb), A.P. Micolich (UNSW) + 46 other authors, **\$1.9M**
- 2009 ARC LIEF: *Upgrading Australia’s highest magnetic field facility for high-speed measurements of quantum devices at cryogenic temperatures*, A.R. Hamilton, A.P. Micolich, R. Newbury, O.V. Klochan, T.P. Martin and L. Taskinen, **\$100k**
- 2008-2010 ARC Linkage International: *Nanoscale Electronic Devices: Bringing sample design, fabrication, test and theory together*, A.R. Hamilton (UNSW), A.P. Micolich (UNSW), R. Newbury (UNSW), T.P. Martin (UNSW), M. Pepper (U. Cambridge), A.D. Wieck (Bochum), M. Governale (Bochum), R.P. Taylor (U. Oregon) and U. Zülicke (Massey U.), **\$81k**
- 2008 ARC LIEF: *Vector Magnetic Field Facility for Nanoscale Spintronic Materials and Device Research*, A.R. Hamilton (UNSW), A.P. Micolich (UNSW), R. Newbury (UNSW), A. Fuhrer (UNSW), T. P. Martin (UNSW), P.C. Dastoor (U. Newc.), U.K. Divakar (UQ) and B.J. Powell (UQ), **\$440k**
- 2008 ARC LIEF: *Integrated Surface Fabrication and Characterisation Laboratory* P.C. Dastoor (U. Newc.), J. O’Connor (U. Newc.), B.V. King (U. Newc.), A. McCluskey (U. Newc.), W.J. Belcher (U. Newc.), C.M. Stampfl (U. Syd.), J.R. Reimers (U. Syd.), A.R. Hamilton (UNSW), A.P. Micolich (UNSW), C.J. Fell (CSIRO), S.E. Watkins (CSIRO), M. Bown (CSIRO), A.P. Stampfl (ANSTO) and P.J. Evans (ANSTO), **\$750k**

Conference Organisation

- 2010 Member of the Organising Committee for the ARC Nanotechnology Network’s International Conference on Nanoscience and Nanotechnology (ICONN-2010) held in Sydney, Australia in February 2010.
- 2009 Chair of the Organising Committee for the ARC Nanotechnology Network’s Early Career Researcher and Postgraduate Student Symposium held in Canberra, Australia on the 19& 20th February 2009.
- 2008 Member of the Organising Committee and the Program Committee for Symposia C (Nanoelectronics) for the ARC Nanotechnology Network’s International Conference on Nanoscience and Nanotechnology (ICONN-2008) held in Melbourne, Australia across the 25-29th February 2008.
- 2008 Chair of the Organising Committee for the ARC Nanotechnology Network’s Early Career Researcher and Postgraduate Student Symposium held in Melbourne, Australia on the 23rd & 24th February 2008.

- 2006 Member of the Organising Committee for the ARC Nanotechnology Network's International Conference on Nanoscience and Nanotechnology (ICONN-2006) held in Brisbane, Australia across the 3rd – 6th July 2006.
- 2005 Chair of the Organising Committee for the ARC Nanotechnology Network's Early Career Researcher and Postgraduate Student Symposium held in Brisbane, Australia on the 8 & 9th December 2005.
- 2005 Chair of the Organising Committee for the ARC Nanotechnology Network's Early Career Researcher and Postgraduate Student Symposium held in Perth, Australia on the 21st & 22nd July 2005.
- 2003 Member of the Organising Committee for the Frontiers of Science and Technology Workshop on Soft Condensed Matter and Nanoscale Physics (funded by AATSE/DEST IAP programme) held at Coogee, Australia on the 1st – 3rd December 2003.
- 2003 Member of the Organising Committee for the 13th Gordon Godfrey Workshop on Recent Advances in Theoretical Physics held at Coogee, Australia on the 4th December 2003.

Journal Reviewing and Professional Contributions

I am a regular reviewer for *Physical Review Letters*, *Physical Review B* and *Physical Review E*. I have also reviewed papers for the *Journal of Applied Physics* and the *Journal of Mathematical Imaging and Vision*, two prospective textbooks for publishing company *Taylor and Francis*, and research grants for the ARC, DEST's Australia-India Strategic Research Fund and the U.S. Research Corporation's Cottrell Scholar Programme.

Since 2004, I have also played a significant role in the ARC Nanotechnology Network. My involvement began after I was awarded \$10k under the ARC Special Initiatives (Networks Seed Funding) program in 2004 to establish and act as Network Convenor of the “*Young investigators network for next generation electronic devices*”. At age 29, I was the youngest Network Convenor of any of the seed-funded networks. For the main ARC Research Networks round, I incorporated the Young Investigator's Network into the larger ARC Nanotechnology Network (ARCNN) bid. The ARCNN was one of 24 funded networks, receiving \$1.9M for 2005-2010. I worked with the other three lead authors (Network Convenor C. Jagadish (ANU), L. Faraone (U.W.A.) and P. Mulvaney (U. Melb)) to establish the network including the 14-person Management Committee, which I have served on since 2004.

My main contributions to ARCNN include convening four early career researcher and postgraduate student (ECR/PG) symposia held in Perth (July 2005), Brisbane (Dec. 2005), Melbourne (Feb. 2008) and Canberra (Feb. 2009). These events provide a forum for young researchers from across Australia to present their work, and meet other young researchers. I am also involved in subcommittees to review applications for early career researcher travel fellowships (both local and international) and distinguished lectureships.

Teaching

Since starting as an academic staff member in Physics in 2006, I have coordinated three courses: PHYS 2040 Quantum Physics (2007 - 2009), PHYS2060 Thermal Physics (2006 - 2008) and PHYS3080 Solid State Physics (2009). My role in these goes well beyond merely teaching an existing course – I have devoted much time towards producing more modern, interesting and useful courses for the students. This has resulted in some significant contributions towards improved methods in higher education – namely the use of video websites such as *YouTube* as educational resources. My contributions have included:

- Two peer reviewed papers on the potential for digital video in physics lectures

1. A.P. Micolich, *The latent potential of YouTube – Will it become the 21st Century Lecturer’s Film Archive?*, **CAL-laborate International** October 2008 Issue, p. 12-19 (ISSN 1836-0858). (Available at arXiv.org 0808.3441)
 2. A.P. Micolich, *Digital video as a resource for teaching physics – A preliminary evaluation of effectiveness and some tips on how to do it better*, Proceedings of 2008 National Uniserve Conference, ISBN 978-1-74210-062-3, p.193 (2008).
- Two opinion pieces *Video link to creative lectures* published in The Australian – Higher Education Supplement p. 28 (22/10/08), and *How I learned to stop worrying and love YouTube* published in the University World News (4/12/08).

I have also started my own *YouTube* channel (<http://www.youtube.com/user/micolich>) where I post videos of demonstrations that I use in lectures and interesting pieces of physics, since I believe that if I want to use YouTube as a resource in my teaching, I should be contributing as well. The attention this has received has been quite remarkable, to give two examples:

- **Guess the number of M&Ms:** (<http://www.youtube.com/watch?v=YtjD3mRrVT4>) This video relates to a demonstration on atomic packing in solids that I did for my PHYS3080 Solid State Physics course. It was highlighted on reddit.com, and has now been viewed over 132,000 times (enough that *YouTube* has offered to share advertising revenue for this clip with me).
- **Slinkies and Star Wars Sound Effects:** (<http://www.youtube.com/watch?v=aqtqiuSMJqM>) This video is a demonstration on dispersion that I used for the 2nd and 3rd year classes. It was the subject of a short invited article *Slinkies and Star Wars Sound Effects* published in **Acoustics Australia** 37, 22 (2009) (ISSN 0814-6039) and has over 57,000 views

The channel currently has over 500 subscribers, and was highlighted in a UNSW-TV *On the Couch* interview and article in the Jul/Aug09 edition of *Uniken*.

Further highlights of my teaching include:

Teaching teachers how to teach: I gave a 1 hour **invited lecture** on teaching wave-particle duality at the Victorian Certificate of Education (VCE) Physics Focus day held at the University of Melbourne in Nov. 2007. The lecture was attended by ~200 high-school physics teachers from across Victoria, and recorded to DVD as a resource for Victorian high schools.

Effectiveness of Teaching: My CATEI ratings are excellent and are summarised for my recent courses in the table below, where I show the results for Q10 on Forms A and B.

CATEI	Form A – Question 10							Form B – Question 10						
	SA	A	MA	MD	D	SD	Mean	SA	A	MA	MD	D	SD	Mean
PHYS2040 '07	50	47	–	–	3	0	3.47	79	21	–	–	0	0	3.79
PHYS2060 '07	26	71	–	–	3	0	3.23	63	37	–	–	0	0	3.63
PHYS2040 '08	40	47	13	0	0	0	5.27	73	20	0	7	0	0	5.6
PHYS2060 '08	53	32	16	0	0	0	5.37	78	17	6	0	0	0	5.72