

**ABRIDGED CURRICULUM VITAE of
PROF. ANDREW FORBES [past ~10 years only]**



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TECHNICAL BIOGRAPHY:

Andrew studied Physics at the University of Natal and received his PhD in 1998 in lasers/optics while working at the Atomic Energy Corporation on laser-based Uranium Enrichment. From 1999 he spent several years working in a technology start-up, much of the time as Technical Director, where he helped build a private laser company from humble beginnings of just a few friends to an enterprise employing more than 70 staff. The products are now in use at blue chip institutes around the world, including Lockheed Martin (USA), BAE (UK), ENEA (Italy), NASA (USA) and Dassault (France). The company won many technology awards, attracted significant local and foreign investment, and was purchased outright by the USA enterprise Par Systems Inc.

In 2005 Andrew decided to return to more research orientated activities and joined the CSIR National Laser Centre where he started two new research groups: first the User Facility – a set of laboratories for advancing photonics in South Africa through engagement with local universities, and later in 2007 the Mathematical Optics group. During this time Andrew pioneered the use of digital holography for the creation and detection of optical modes, resulting in many high-profile journal papers, patents and commercialisation projects. In 2015 Andrew joined the University of the Witwatersrand on the Distinguished Professor programme and has started a new laboratory that focuses on Structured Light and its applications.

Andrew sits on several international conference committees and leadership panels (SPIE, OSA, IEEE), chaired the SPIE international conference on Laser Beam Shaping, served on the Advisory Board for the OSA's Siegman School on Lasers, Chaired the Editorial Board of the OSA periodical 'Optics and Photonics News' and is an Editorial Board member of the Journal of Optics and Optics Express. Andrew is an elected member of the Academy of Science of South Africa, a founding member of the Photonics Initiative of South Africa, initiated the Quantum Roadmap for South Africa and a Fellow of both SPIE and the OSA. He is reviewer for all the major physics and optics journals, including Nature and Science, for several national and international funding agencies, and is an active member of various science outreach and public awareness initiatives. Andrew holds honorary professorship positions at Stellenbosch University (South Africa), Huazhong University of Science and Technology (China) and Chiba University (Japan).

Andrew has edited and/or contributed to several books, proceedings and patents, published numerous scientific papers, and together with his students has presented over 500 orals or posters at conferences. He is an active populariser of science through numerous popular articles, television shows and radio contributions. Andrew and his students have won over 80 awards for outstanding contributions to science. In 2015 Andrew won the special NSTF Photonics award for his contribution to the field over the past decade, and in 2018 he was awarded an "A rating" from the South African National Research Foundation.

RESEARCH HIGHLIGHTS:

- Demonstrated a digital laser with an intracavity spatial light modulator for real-time laser mode control;
- Demonstrated the use of geometric phase for controlling laser cavity modes;
- Developed a complete toolkit for modal decomposition of unknown laser beams using digital holograms;
- Demonstrated high-dimensional QKD, HOM interference, teleportation and entanglement swapping;
- Demonstrated the equivalence of classical and quantum states for various quantum information processing tasks.

INNOVATION HIGHLIGHTS:

- Developed high-performance custom gas lasers for non-destructive testing of the Joint Strike Fighter (Lockheed Martin);
- Development of a complete range of CO₂ lasers to a commercial readiness state. These lasers have been sold worldwide at such prestigious institutes as Lockheed Martin (US), BAE Systems (UK), Dassault (France), NASA (US), John Hopkins University (USA), Brookhaven National Laboratories (USA), and the EADS (Germany);
- Development of a high brightness laser resonator for Airbus;
- New product development for a laser diagnostic.

RESEARCH EXPERIENCE and INTEREST:

I have extensive experience in optical and laser design, as well as experimentation on, and theoretical analysis of, optical processes. I have also been active in the past in applications of lasers, optics and spectroscopy to the generation and analysis of new materials, particularly those with photonic applications, such as nano-structures of WO_x and VO_x and solar energy materials.

My main research interests today include:

lasers and laser resonators,
structured light and its applications,
vortex beams and orbital angular momentum,
digital holography with spatial light modulators,
vector beams and classical entanglement,
quantum entanglement in high dimensions,
quantum devices.

EDUCATION:

Numerous additional courses in optics, mathematics, programming and wine. Main degrees:

PhD (Lasers/Optics)	-	University of Natal, Durban (1998)
MSc (Lasers/Optics)*	-	University of Natal, Durban (1995)
Higher Diploma in Education	-	University of Natal, Durban (1992)
BSc Hons (Physics)	-	University of Natal, Durban (1991)
BSc (Physics/Mathematics)	-	University of Natal, Durban (1990)

* Resubmitted as a Doctoral thesis on examiner's recommendation.

RECENT LEADERSHIP ROLES:

In addition to the list below, I have also acted periodically as a book reviewer for the *Optical Society of America*, as a grant reviewer and Panel Chair for the *South African National Research Foundation (NRF)* and the *African Laser Centre (ALC)*, and as a referee for the journals *Nature*, *Science*, *Nature Photonics*, *Nature Physics*, *Nature Communications*, *Light: Science and Applications*, *Scientific Reports*, *Science Advances*, *Optica*, *Phys. Rev. Lett.*, *Phys. Rev. A*, *Optics Express*, *Optics Letters*, *Optics Communications*, *JOSA A*, *JOSA B*, *Applied Optics*, *J. Applied Physics*, *Applied Physics Letters*, *New Journal of Physics*, *South African Journal of Science*, *Laser and Photonics Reviews*, *Optical Engineering*, *Optics and Laser technology*, *Journal of Optics*, *Materials Characterisation*, *European Journal of Physics*, *Advanced Materials*, *ACS Photonics* etc. and abstract/manuscript reviewer for OSA, SPIE, IEEE and other international conferences.

1. Research Manager: Laser Division, SDI (Pty) Ltd	-	2003 – 2004
2. Technical Director: SDI (Pty) Ltd	-	2000 – 2004
3. National Laser Centre Research Group Leader: Mathematical Optics	-	2005 – 2015
4. National Laser Centre Research Group Leader: User Facility/Photonic Materials	-	2005 – 2011
5. NLC Strategic Research Panel Member	-	2005 – 2012
6. Member of the CSIR Strategic Research Panel	-	2009 – 2013
7. Chief Researcher, CSIR	-	2009 – 2015
8. Advisory Board of the CSIR Knowledge Commons	-	2010 – 2013
9. Editorial Board of the CSIR ScienceScope magazine	-	2011 – 2013
10. Member of Council of the <i>South African Institute of Physics</i>	-	2008 – 2011
11. Chair of the Education Group of the Photonics Initiative of South Africa's co-ordinating committee	-	2007 – 2010
12. Faculty Advisor for the OSA and SPIE CSIR Student Chapters	-	2008 – 2015
13. Steering Committee of the <i>Photonics Initiative of South Africa</i>	-	2009 – 2016
14. Member of the SPIE <i>Membership Committee</i>	-	2010 – 2013

15. Chair of the South African Institute of Physics <i>Lasers, Optics and Spectroscopy</i> subgroup	-	2008 – 2010
16. Chair of the SPIE <i>Laser Beam Shaping</i> conference (San Diego)	-	2008 – 2017
17. Program Committee member for the SPIE <i>Laser Beam Shaping</i> conference (USA)	-	2002 – 2007
18. Program Committee member for the SPIE <i>Optical Technologies for Arming, Safing, Fuzing, and Firing</i> conference (USA)	-	2006 – 2011
19. Program Committee member for the SPIE <i>Laser Resonators and Beam Control</i> Conference (USA)	-	2009 –
20. Program Committee member for the <i>LAPAMs 2010</i> conference (Algeria)	-	2010
21. Program Committee member for the <i>Adaptive Optics 2009</i> conference (Russia)	-	2009
22. Program Committee member for the <i>ONT4MLS 2010</i> conference (Belarus)	-	2010
23. Technical Committee member for the OSA <i>Frontiers in Optics</i> conference (USA)	-	2011 – 2015
24. Secretary of the South African Institute of Physics <i>Lasers, Optics and Spectroscopy</i> subgroup	-	1999 – 2008
25. Elected <i>Senior Member</i> of SPIE	-	2008 – 2012
26. Elected <i>Senior Member</i> of OSA	-	2012
27. Honorary Researcher: School of Physics, University of KwaZulu-Natal	-	2007 – 2009
28. Honorary Professorship: School of Physics, University of KwaZulu-Natal	-	2009 – 2015
29. Honorary Extraordinary Professorship: School of Physics, University of Stellenbosch	-	2012 –
30. DST representative on bilateral co-operation visits	-	2005 – 2010
31. SPIE Membership Committee member	-	2010 – 2013
32. SPIE Reviewer for Student Grants and Senior Members	-	2010 – 2015
33. Chair of the Photonics Symposium, <i>International Conference on Frontiers in Polymers and Advanced Materials</i> (South Africa)	-	2011
34. Chair-elect of OSA's <i>Digital Holography and Diffractive Optics</i> technical group	-	2011 – 2012
35. Honorary Professorship: School of Physics, University of the Witwatersrand	-	2011 – 2015
36. Chair of the 9 th <i>International Workshop on Adaptive Optics in Industry and Medicine</i>	-	2013
37. NRF Rating of B2 [Internationally recognised expert]	-	2013
38. Elected <i>Fellow</i> of SPIE	-	2013
39. Chair of OSA's <i>Diffractive Optics and Holography</i> technical group	-	2013 – 2015
40. Program Committee member for the OSA <i>Optics in the Life Sciences</i> Conference (USA)	-	2013 – 2016
41. Program Committee member for the SPIE <i>Complex Light and Optical Forces</i> Conference (USA)	-	2013 –
42. Advisory Board member for the OSA's <i>Siegman International School on Lasers</i>	-	2013 – 2016
43. Editorial Advisory Board for the OSA's <i>Optics and Photonics News</i> magazine	-	2013 – 2017
44. Elected a member of the Academy of Science of South Africa	-	2013
45. National Key Point for the International Year of Light	-	2014 – 2016
46. Programme Committee member of the 10 th <i>International Workshop on Adaptive Optics in Industry and Medicine</i>	-	2014
47. Member of the OSA's Publication Committee	-	2015 – 2017
48. Member of the Editorial Board for the <i>Journal of Optics</i> (UK)	-	2015 –
49. South African delegate at the UNESCO opening of the IYL 2015 and session facilitator	-	2015
50. Elected Chair of the OPN Advisory Board	-	2016 – 2017
51. Associate Editor for <i>Optics Express</i>	-	2016 –
52. Programme committee member for the ETOP conference	-	2016
53. Guest Editor: <i>Chinese Optics Letters</i>	-	2016
54. Chair of the Photonics Division of the South African Institute of Physics	-	2016 – 2018
55. Elected Fellow of the OSA	-	2016
56. Member of the SPIE Scholarships committee	-	2016
57. Member of the OSA Publications committee	-	2015 – 2016
58. OSA Search committee for new Editor in Chief	-	2018
59. CLEO Pacific Rim organising committee	-	2018
60. DST BRICS photonics representative	-	2018
61. SA's Quantum Roadmap lead	-	2018
62. OSA Fellows Committee	-	2018 –
63. OSA FiO organising committee	-	2019
64. ICOAM organising committee	-	2019
65. ETOP organising committee	-	2019
66. Quantum Africa 5 organising committee	-	2019
67. ICOL organising committee	-	2019
68. Guest editor: <i>Optical Engineering</i>	-	2019

RECENT AWARDS and RECOGNITION:

My students have excelled by winning numerous awards, including: MSc presentation awards at the South African Institute of Physics conference (2005: Tshepiso Baisitse, 2006: Angela van Rensburg, 2007: Edward Bernhardt, 2008: Melanie McLaren, 2010: Yaseera Ismail, Darryl Naidoo, 2011: Darryl Naidoo, Malcolm Govender, Humairah Bassa, 2012: Thandeka Mhlanga, 2013: Thandeka Mhlanga, 2014: Thandeka Mhlanga), PhD presentation awards at the South African Institute of Physics conference (2006: Igor Litvin, 2008: Angela Dudley, 2009: Angela Dudley, 2010: Angela Dudley, 2012: Melanie McLaren, Darryl Naidoo, 2013: Sandile Ngcobo, Melanie McLaren, Darryl Naidoo, 2014: Melanie McLaren, Darryl Naidoo, Dirk Spangenberg), several National Laser Centre awards (2007: Igor Litvin, Tshepiso Baisitse and Liesl Burger, 2008: Edward

Bernhardi, 2009: Bathusile Masina and Igor Litvin, 2011: Angela Dudley), as well as awards by other bodies: ALC: Angela Dudley, Yaseera Ismail, Ronald Rop; WITS: Melanie McLaren; CSIR: Angela Dudley; These also include many international conference awards: Thomas Godin, Bonex Mwakikunga, Brian Yalisi, Angela Dudley and Malcolm Govender; 2012: Angela Dudley and Darryl Naidoo (best student awards at CSIR and NLC), Igor Litvin (best emerging researcher). 2013: Melanie McLaren (SAIP), Thandeka Mhlanga (SAIP), Darryl Naidoo (SAIP), Sandile Ngcobo (SAIP), Alpha Ibrahim (ICTP: Singular Optics), Angela Dudley (SAIP Entrepreneurship workshop), Angela Dudley (IoP: ICOAM), Melanie McLaren (CIOMP-OSA, China), 2013: CSIR awards for Alpha Ibrahim, Melanie McLaren and Thandeka Mhlanga; 2014: Liesl Burger (SPIE 3rd place award).

More recently from my new laboratory at Wits University: Best MSc poster at SAIP 2015 (Bienvenu Ndagano), Best PhD poster at SAIP 2015 (Benjamin Perez), SAIP Silver Jubilee medal 2015 (Angela Dudley), Best Honours project 2014 (Bienvenu Ndagano), Best MSc student at the ALC Student Workshop (Bienvenu Ndagano), best poster by a student at SPIE Photonics West 2016 (Bienvenu Ndagano), best Honours project 2015 (David Gossman), SAIP 2016 awards for Bienvenu Ndagano, David Gossman, Mitch Cox, and Bereneice Septhon; Quantum Africa 4 2017 award for Isaac Nape. I best Hons project 2016 (Jason Webster), best student in the Faculty of Science (Jason Webster). SAIP 2017 awards for Bienvenu Ndagano (PhD), Jason Webster (Hons), Mitch Cox (PhD), Hend Sroor (PhD), Isaac Nape (MSc) and Bereneice Septhon (MSc). Siegman School 2017 top award for Hend Sroor, ALC award for Nkosi Bhebhe (2017), SAIP 2018 awards for Bienvenu Ndagano (PhD) and Nokwazi Mputhi (PhD); IONS 2018 award for Isaac Nape (PhD) and ALC 2018 award for Bereneice Septhon (PhD); 2019 National Women in Science award for Nokwazi Mputhi (PhD).

The above summary means that Andrew and his students have won awards at the annual South African Institute of Physics conference covering the following divisions: photonics, material science and condensed matter, applied physics, theoretical physics, educational physics, and nuclear physics. To present across so many disciplines is very rare but to win is unprecedented.

In addition, I have been recognised with the following awards in recent years:

National Laser Centre Researcher of the Year	-	2006
CSIR Best Research Paper	-	2006
National Laser Centre Mentor of the Year	-	2007
National Laser Centre Research Team of the Year	-	2007
National Laser Centre Researcher of the Year	-	2008
CSIR Mentor of the Year	-	2008
Top Twenty (3 papers in top twenty at CSIR)	-	2009
CSIR Best Established Researcher Award	-	2010
National Laser Centre Researcher of the Year	-	2010
National Laser Centre Mentor of the Year	-	2010
CSIR Best Research Paper (Industry)	-	2010
National Laser Centre Established Researcher	-	2012
Fellow of SPIE	-	2013
NRF Rating of B2 (internationally recognised expert)	-	2013
Member of the Academy of Science of South Africa	-	2013
OPN Optics Highlights of 2013	-	2013
NSTF Finalist for Innovation	-	2014
National Laser Centre Research Team Award	-	2014
National Laser Centre Career Achievement Award	-	2014
CSIR Research Team Award	-	2014
CSIR Career Achievement Award	-	2014
NSTF National Photonics Award	-	2015
Ventures Africa top 40 Innovators	-	2015
Fellow of OSA	-	2016
Top cited paper in the Faculty of Science	-	2017
Top 10 South African Inventions	-	2017
OPN Optics Highlights of 2017	-	2017
"A rated" scientist by the NRF	-	2018
Honorary Professorship: Huazhong University of Science and Technology (China)	-	2018
Honorary Professorship: Chiba University (Japan)	-	2018
Top paper in JOSA A for 2018	-	2019

EMPLOYMENT HISTORY:

Position: Distinguished Professor
Employer: School of Physics, University of the Witwatersrand
Duration: March 2015 – present (seems like just yesterday, probably because it was)
Responsibilities:

I joined Wits as a Distinguished Professor and have started a new laboratory that focuses on Structured Light:
www.structuredlight.org

Position: Chief Researcher and Research Group Leader
Employer: National Laser Centre (CSIR)
Duration: 2004 – 2015 (loved my time at the CSIR)
Responsibilities:

Originally scientific management and guidance of the Rental Pool Programme (loaning lasers to universities); running of the User Facility (a system of in-house laboratories for university use); mentorship/supervision of young researchers and students studying for postgraduate degrees. Later Research Group Leader for Mathematical Optics, a new group that I started. This was a research position, and my role was to build and lead the research group, strengthen the NLC's science base through various collaborations both locally and abroad, engage industry in our endeavours, and set strategic goals for the group as well as ensure financial sustainability. Further details of my work can be found at www.csir.co.za/lasers/mathematical_optics.html

Position: Technical Director
Employer: Scientific Development and Integration (latter *Klydon*, and now *Par Systems Inc.*)
Duration: 1999 – 2004 (5 years, but took years off my life)
Responsibilities:

As a young Director I was responsible for the laser development and development of new markets through exploration of new applications. When I left, the company employed 70 staff members and had attracted external investors who bought me out. In a small company everyone does everything. I have led and managed large R&D projects, both financially and technically, established an applications laboratory, web site, new products, marketing material and secured investor funding to grow the company beyond just a handful of friends. I was at various times the technician, engineer, secretary, manager, janitor, sales rep, marketing guru, web developer and occasionally a scientist. Building a company is a life changing experience.

Position: Systems Engineer
Employer: Skelton and Plummer Project Engineering
Duration: 1998 – 1999 (1 year)
Responsibilities:

Dabbled in custom software design for process control and instrument interfacing. Wrote software-hardware solutions for SAP systems to communicate with large industrial plant systems, which are now used worldwide. Excellent experience, but not my cup of tea. Did this while we were sorting out the details of the company.

Position: Research and Development Scientist
Employer: Atomic Energy Corporation: MLIS Programme
Duration: 1996 – 1998 (2 years, felt like a few months)
Responsibilities:

I was tasked with the design, engineering and commissioning of a complete optical delivery system, including diagnostics and special elements, for part of the MLIS pilot plant facility, and ended my stint here as the youngest Project Leader, for optical delivery systems. Main tasks included optical modelling of thermal effects, beam propagation and wavefront control.

Position: Mathematics and Physical Science Teacher
Employer: Springs Boys High
Duration: 1995 (1 year, although it felt like 10)
Responsibilities:

I love teaching, and spent one year teaching Mathematics and Physical Science at secondary school level. I think I was too young, and not mature enough to face a class full of angry testosterone driven boys. I would have put this phase down as a failure, but then I heard a story of a young chap doing an MSc, who indicated it was because of my classes that he eventually went into science! Maybe when I retire I will return to teaching.

PUBLICATION RECORD:

Book chapters/editorials/patents

1. Forbes A., Botha L.R. (2005). [Isotope separation with infrared laser beams](#), in *Laser Beam Shaping Applications*, Ch. 5, eds. F.M. Dickey, S.C. Holswade and D.L. Shealy. CRC Taylor & Francis Group (New York).
2. Forbes A., and Lizzotte T. (Eds.), (2008). [Laser Beam Shaping IX](#), *Proceedings of SPIE*, Vol. **7062**.

3. Forbes A., (2009). [The State of Science in South Africa](#), Contributing author to Ch 3: Physics and Astronomy, eds. R. Diab and W. Gevers, ASSAf.
4. Forbes A., and Litvin I.A. (2009). [A laser and a method of generating a laser beam inside an optical resonator](#), patent **2011/07587**
5. Forbes A., and Litvin I.A. (2009). [Resonator with intracavity transformation of a Gaussian into a top-hat beam](#), PCT patent **PCT/IB2010/051880** and **10720032.1 (EPO)** and **9031113 (USA)**
6. Katumba G., Olumekor L., Forbes A., and Makiwa G. (2009). [Solar collector](#), South African patent **2008/05291**
7. Forbes A., and Lizzotte T. (Eds.), (2009). [Laser Beam Shaping X](#), *Proceedings of SPIE*, Vol. **7430**.
8. Forbes A., and Lizzotte T. (Eds.), (2010). [Laser Beam Shaping XI](#), *Proceedings of SPIE*, Vol. **7789**.
9. Mwakikunga B.W., Sideras-Haddad E., Forbes A., Katumba G., Ray S.S., Arendse C.J. (2010). [Metal to insulator transitions and the thermo-chromism of VO₂ at the nano-scale](#), in *Chromic Materials, Phenomena and their Technological Applications, Ch. 8*, ed. P.R. Somani. Applied Science Innovations (India), ISBN: 978-81-906027-1-6.
10. Forbes A., and Lizzotte T. (Eds.), (2011). [Laser Beam Shaping XII](#), *Proceedings of SPIE*, Vol. **8130**.
11. Mafusire C., and Forbes A. (2012). [Aero-optics: controlling light with air](#), in *Fluid Dynamics Computational Modeling and Applications, Ch. 29*, pp. 631–650, ed. L. Hector Juarez. InTech Open Access Publisher (Croatia), ISBN: 978-953-51-0052-2.
12. Forbes A., and Lizzotte T. (Eds.), (2012). [Laser Beam Shaping XIII](#), *Proceedings of SPIE*, Vol. **8490**.
13. Forbes A., Ngcobo S., Schultz C. and Duparre M. (2012). [Modal decomposition of a laser beam](#), patent **20 150 292 941**
14. Forbes A., and Lizzotte T. (Eds.), (2013). [Laser Beam Shaping XIV](#), *Proceedings of SPIE*, Vol. **8490**.
15. Forbes A. (Ed.), (2014). [Laser Beam Propagation: Generation and Propagation of Customized Light](#), CRC Taylor & Francis Group (New York), ISBN 978-1-4665-5439-9
16. Forbes A. (2014). [Flat-Top Beams](#), in *Laser Beam Propagation: Generation and Propagation of Customized Light, Ch 7*, ed. A. Forbes CRC Taylor & Francis Group (New York).
17. Forbes A., and Lizzotte T. (Eds.), (2014). [Laser Beam Shaping XV](#), *Proceedings of SPIE*, Vol. **9194**.
18. Forbes A., and McLaren M.G., (2015). [Optical Angular Momentum](#), *The Optics Encyclopedia: Basic Foundations and Practical Applications*, Online © Wiley-VCH Verlag GmbH & Co DOI: 10.1002/9783527600441.oe1019.
19. Forbes A., and Lizzotte T. (Eds.), (2015). [Laser Beam Shaping XVI](#), *Proceedings of SPIE*, Vol. **9581**.
20. Forbes A., and Lizzotte T. (Eds.), (2016). [Laser Beam Shaping XVII](#), *Proceedings of SPIE*, Vol. **9950**.
21. Forbes A. and Botha L. (2017). [Isotope separation with shaped light](#), in *Laser Beam Shaping Applications (2nd Edition)*, Ch. 7, eds. F.M. Dickey and T. Lizotte. CRC Taylor & Francis Group (New York).
22. Rosales Guzman C. and Forbes A. (2017). [How to shape light with spatial light modulators](#), SPIE Spotlight Series (SPIE, Bellingham).
23. Forbes A., Dudley A. and Rosales-Guzman C. (on-going). [Optical Communication Method and System](#), PCT patent **PCT/IB2016/054738**.
24. Forbes A., et. al., (on-going). [A Method and System for Hybrid Classical-Quantum Communication](#), PCT patent **PCT/IB2018/050397**.
25. Forbes A. (on-going). [Beam Quality Measure for Vector Beams](#), PCT patent **PCT/IB2017/053624**.
26. Forbes A., Aiello A. and Ndagano B. (2018). [Classically Entangled Light](#), *Progress in Optics* (invited contribution) vol. **64**, pp. 99-144.

Journals articles:

1. Michaelis M.M. and Forbes A. (1994). [Vacuum vessels in tension](#), *Vacuum* **45** (1), pp. 57–60.
2. Michaelis M.M., Kuppen M., Forbes A., Viranna N., Lisi N. (1996). [Progress with gas lenses](#), *Laser and Particle Beams* **14** (3), pp. 473–485.
3. Michaelis M.M., and Forbes A. (2006). [Laser Propulsion: a review](#), *South African Journal of Science*, **102**, pp. 289–295.
4. Michaelis M.M., Forbes A., et al. (2006). [Laser propulsion experiments in South Africa](#), *South African Journal of Science*, **102**, pp. 296–300.
5. Forbes A., Botha L.R., du Preez N., Drake T.E. (2006). [Design and optimisation of a pulsed CO₂ laser for laser ultrasonic applications](#), *South African Journal of Science*, **102**, pp. 330–334.
6. Mathuthu M.M., Raseleka R., Forbes A. and West N. (2006). [Radial variation of refractive index, plasma frequency and phase velocity in laser induced air plasma](#), *IEEE Transactions on Plasma Science* **34** (6), pp. 2554–2560.
7. Litvin I.A., Burger L., and Forbes A. (2007). [Petal-like modes in Porro prism resonators](#), *Optics Express* **15** (21), pp. 14065–14077.
8. Bollig C., Forbes A., and Dlamini T. (2007). [Photonics in South Africa](#), *Nature Photonics* **1**, pp. 673–675.
9. Mwakikunga B.W., Sideras-Haddad E., Forbes A., Arendse C. (2008). [Raman spectroscopy of WO₃ nanowires and thermo-chromism study of VO₂ belts produced by ultrasonic spray and laser pyrolysis techniques](#), *Physica status solidi (a)* **205** (1), pp. 150–154.
10. Katumba G., Makiwa G., Baisitse T.R., Olumekor L., Forbes A., and Wäckelgård E. (2008). [Solar selective absorber functionality of carbon nanoparticles embedded in SiO₂, ZnO and NiO matrices](#), *Physica status solidi (c)* **5** (2), pp. 549–551.
11. Baisitse T.R., Forbes A., Katumba G., Botha J.R. and Engelbrecht J.A.A. (2008). [Characterisation of InAs-based epilayers by FTIR spectroscopy](#), *Physica status solidi (c)* **5** (2), pp. 573–576.
12. Litvin I.A. and Forbes A. (2008). [Bessel–Gauss resonator with internal amplitude filter](#), *Optics Communications* **281**, pp. 2385–2392.
13. Burger L., Litvin I.A. and Forbes A. (2008). [Simulating atmospheric turbulence using a phase-only spatial light modulator](#), *South African Journal of Science* **104** (2), pp. 129–134. **Featured on the front cover of the journal*

14. Mafusire C., Forbes A., Michaelis M.M. and Snedden G. (2008). [Optical aberrations in a spinning pipe gas lens](#), *Optics Express* **16** (13), pp. 9850–9856. **Featured on the front page of the on-line journal*
15. Bernhardt E.H., Forbes A., Bollig C., and Esser M.J.D. (2008). [Estimation of thermal fracture limits in quasi-continuous-wave end-pumped lasers through a time-dependent analytical model](#), *Optics Express* **16** (15), pp. 11115–11123.
16. Burger L., and Forbes A. (2008). [Kaleidoscope modes in large aperture Porro prism resonators](#), *Optics Express* **16** (17), pp. 12707–12714. **Featured on the front page of the on-line journal*
17. Katumba G., Olumekor L., Forbes A., Makiwa G., Mwakikunga B., Lu J., and Wackelgard E. (2008). [Optical, thermal and structural characteristics of carbon nano-particles embedded in ZnO and NiO as selective solar absorbers](#), *Solar Energy Materials and Solar Cells* **92** (10), pp. 1285–1292.
18. von Bergmann H.M., Forbes A., Roberts T., and Botha L.R. (2008). [Acoustic waves in transversely excited atmospheric CO₂ laser discharges: effect on performance and reduction techniques](#), *Optical Engineering* **47** (8), pp. 084202-1.
19. Mwakikunga B.W., Forbes A., Sideras-Haddad E., Arendse C. (2008). [Optimisation, yield studies and morphology of WO₃ nano-wires synthesised by laser pyrolysis in C₂H₂ and O₂ ambients – validated of a new growth mechanism](#), *Nanoscale Research Letters* **3** (10), pp. 372–380.
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26. Forbes A., (2013). [An invention resonates with a local laser manufacturer](#), *Science Scope* **6**(3), pp. 46–47.
27. Forbes A. (contributed) (2013). [Breaking into Academia: One size doesn't fit all](#), *Optics and Photonics News* pp. 20-21 (May issue)
28. Schulze C., Flamm D., Duparre M., and Forbes A. (2013). [Using spatial light modulators to measure laser beam quality](#), *SPIE Newsroom: Lasers and Sources* <http://spie.org/x93732.xml> (May)
29. Dudley A., Lavery M., Padgett M., and Forbes A. (2013). [Unraveling Bessel Beams](#), *Optics and Photonics News* **24** (6), pp. 22-29 (June issue) ***on front cover of magazine**
30. Ngcobo S., Litvin I., Burger L., and Forbes A. (2013). [Demonstrating a rewritable digital laser](#), *Optics and Photonics News* **24** (12), pp. 28 (December issue)
31. Key stories: News and Views, *Nature Photonics* **7**, pp. 592 (2013); News and Views, *Nature Physics* **10**, pp. 188 (2014).
32. McLaren M., and Forbes A. (2015). [Exploiting quantum entanglement with photons](#), *Quest* **11** (1), pp. 12-13 (March issue)
33. Forbes A. (2015). [Laser light](#), *Quest* **11** (1), pp. 10-11 (March issue) ***on front cover of magazine**
34. Forbes A. (2015). [Structured light from laser resonators](#), *SPIE Newsroom* **11 March 2015**
35. Forbes A. (2015). [Photonics for a brighter future](#), *EngineeringIT* **26 August 2015**
36. Key stories (2015): several podcasts, newspaper articles and interviews to promote the International Year of Light in South Africa and Africa.
37. Forbes A. and Klose K. (2016). [The message in the pattern](#), *Popular Mechanics* pp. 50-53 (May issue).
38. Key stories (2016): newspaper articles and interviews in relation to quantum and laser work, see for example Phys.org, Eureka Alert, Popular Mechanics, Nature Photonics News and Views, Nature Middle East, Photonics.com, OPN etc.
39. Septhon B., Dudley A. and Forbes A. (2017). [Quantum walks](#), *Quest* **13** (4), pp. 15-18 (October issue)

40. Key stories (2017): newspaper articles and interviews in relation to quantum and laser work, see for example Phys.org, Eureka Alert, Photonics.com, OPN, Business Day etc.
41. Forbes A. (2017). [Blurring the classical quantum divide](#), *OPN* **17** (12), pp. 36 (December issue)
42. Mouton S. (2018). [Quantum communications for truly secure cryptography](#), *EngineeringIT January issue*, 37-38.
43. Forbes A. (2019). [New research proves the long-held theory that lasers can create fractals](#), *The Conversation* **1 Feb 2019** <https://theconversation.com/new-research-proves-the-long-held-theory-that-lasers-can-create-fractals-110906>
44. Forbes A. (2019). [Engineering structured light from lasers](#), *IEEE Photonics Society Newsletter* **33**(1), pp.4-6 (February issue) *on front cover of magazine

Example news stories (over 100 on the web in various languages):

1. Euronews: <http://www.euronews.com/2013/12/02/south-africa-launches-new-digital-laser/>
2. News24: <http://www.news24.com/Technology/News/CSIR-releases-world-first-digital-laser-20130917>
3. BBC News: <http://www.bbc.com/news/science-environment-24331926>
4. Photonics Spectra: <http://www.photonics.com/Article.aspx?AID=55449>
5. Photonics.com: <http://www.photonics.com/Article.aspx?AID=57367>
6. Popular Mechanics: <http://www.popularmechanics.co.za/science/vortex-beams/>
7. Popular Mechanics: <http://www.popularmechanics.co.za/science/laser-with-a-twist-holds-potential-for-communication-machining-and-medicine/>
8. Mail and Guardian: <http://mg.co.za/article/2015-07-10-00-moving-south-africa-into-the-light-fantastic>
9. OPN: http://www.osa-opn.org/home/newsroom/2015/april/a_new_twist_on_structured_light_angular_accelerati/
10. SCIENCE/Eureka: https://www.eurekalert.org/pub_releases/2016-03/uotw-lbw031516.php
11. Nature: <http://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2016.104>
12. Nature: <http://www.nature.com/nphoton/journal/v7/n8/full/nphoton.2013.186.html>
13. Nature: <http://www.nature.com/nphys/journal/v10/n3/full/nphys2912.html>
14. Nature: <http://www.nature.com/nphoton/journal/v10/n5/full/nphoton.2016.82.html>
15. Times Live: <http://www.timeslive.co.za/scitech/2016/06/10/WATCH-Future-of-faster-internet-is-so-bright-Wits-team-are-wearing-shades>
16. ScienceDaily: <https://www.sciencedaily.com/releases/2018/11/181127111031.htm>
17. Phys.org: <https://phys.org/news/2018-11-physicists-device-tiny.html>
18. SPIE Newsroom: <http://spie.org/newsroom/champion-of-future-champions-andrew-forbes-SSO=1>
19. Photonics.com: https://www.photonics.com/Articles/Researchers_Demonstrate_Fractal_Light_from_Lasers/a64349
20. ScienceAlert: <https://www.sciencealert.com/for-the-first-time-scientists-have-produced-fractal-light-from-lasers>

National/Regional conferences:

About ~300 talks/posters at national and continental events. List available on request.

OTHER INVOLVEMENT:

In addition to the list below, I deliver numerous seminars and colloquia at various universities both locally and abroad.

1. **Keynote Address:** Forbes A., Strydom H.J., Botha L.R., and Ronander E. (2002). [Beam delivery for stable isotope separation](#), *Laser Beam Shaping* (Seattle, US).
2. **Invited Talk:** M.M. Michaelis, A. Forbes, A. Conti, N. Nativel, H. Bencherif, R. Bingham, B. Kellett and K. Govender. (2006). [Non-solid, non-rigid optics for high power laser systems](#), *High Power Laser Ablation* (Taos, US).
3. **Invited Talk:** Michaelis M.M., Forbes A., Bingham R., Kellet B.J., and Mathye A. (2008). [Lasers in space](#), *High Power Laser Ablation* (Taos, US).
4. **Invited Talk:** Forbes A., (2003). [Diffractive Optics](#), SAIP Winter School for Lasers and Optics, Stellenbosch.
5. **Invited Talk:** Forbes A., (2005). [Lasers, and what Einstein saw in light](#), SAIP Centenary Lecture Series to celebrate the Year of Physics, Pretoria.
6. **Invited Talk:** Forbes A., (2005). [Lasers: from Einstein's vision to today's reality](#), *PRISE* (Addis Ababa, Ethiopia).
7. **Invited Talk:** Forbes A., (2005). [The African Laser Centre](#), *PRISE* (Addis Ababa, Ethiopia).
8. **Invited Talk:** Forbes A., (2009). [Photonics from the micro to the macro](#), *German-SA Research lecture Series/DAAD* (Pretoria, South Africa).
9. **Invited Talk:** Forbes A., (2010). [Shaping light in a box: recent developments in laser resonators](#), *55th Annual Conference of the South African Institute of Physics* LOS Spring School.
10. **Invited Talk:** Forbes A., (2010). [New paradigms for old problems: some \(small\) advances in laser resonator research at the CSIR](#), *Photonics West* (San Francisco, USA).
11. **Invited Talk:** Forbes A., (2010). [Novel intra-cavity laser beam shaping for high power materials processing](#), *LAPAMs* (Algiers, Algeria).
12. **Invited Talk:** B. Mwakikunga, A Mudau, C. Willers, A Forbes, C. Brink, L. Shikwambana, M. Govender, S. Nkosi, B. Masina, (2010). [Non-destructive temperature determination and imaging of invisible flames in the laser pyrolysis by IR thermography](#), *Optical Nano-Tools for Materials and Life Sciences*, 13th- 20th July, Minsk (Belarus).
13. **Invited Talk:** A. Forbes, (2011). [Phun with Phase](#) *International conference on laser applications (ICLA)*, 1-5 May, Cairo (Egypt), pp. 63.

14. **Invited Talk:** A. Forbes, (2011). [Shaping Light with Spatial Light Modulators](#) *International workshop on Adaptive Optics for Industry and Medicine*, 1-5 June, Murcia (Spain), pp. 62.
15. **Invited Talk:** A. Forbes, (2011). [Digital Holography](#) *African Laser Centre Student Workshop*, November, Stellenbosch (South Africa).
16. **Invited Talk:** A. Forbes, (2012). [Digital Holography](#) *South African Institute of Physics Non-specialist lecture*, July, Pretoria (South Africa).
17. **Invited Talk:** A. Forbes, (2012). [Introduction to lasers](#) *The South African Raman Workshop*, November, Pretoria (South Africa).
18. **Invited Talk:** A. Forbes, (2013). [Digitally controlling light](#), *Photonics West* (San Francisco, USA).
19. **Invited Talk:** A. Forbes, (2013). [Controlling the handedness of laser resonators](#), *ICOAM* (Glasgow, UK).
20. **Invited Talk:** A. Dudley and A. Forbes (2013). [Sorting Bessel beams](#), *SPIE Optics and Photonics* (San Diego, USA)
21. **Invited Talk:** A. Forbes (2013). [High-dimensional quantum entanglement](#), *AFONR Window on Science* (Dayton (Ohio and Albuquerque New Mexico, USA)
22. **Public Talk:** A. Forbes (2013). [The world's first digital laser](#), *S2A3 Public lecture* (Pretoria, South Africa)
23. **Invited Talk:** A. Forbes (2013). [Towards the all-digital control of light](#), *African Laser Centre Student Workshop*, November, Stellenbosch (South Africa).
24. **Invited Talk:** A. Forbes (2013). [1,2,3, Infinity: High dimensional quantum entanglement made easy](#), *African Laser Centre Student Workshop*, November, Stellenbosch (South Africa).
25. **Invited Talk:** Forbes A., (2014). [Digitally controlling light](#), *LAM 10 Workshop*, 13-18 January, Dakar (Senegal), pp. 2.
26. **Invited Talk:** Forbes A., (2014). [Aero-optics: focussing light with air](#), *LAM 10 Workshop*, 13-18 January, Dakar (Senegal), pp. 4.
27. **Invited Talk:** A. Forbes, (2014). [The digital laser: on-demand laser modes with the click of a button](#), *Photonics West* (San Francisco, USA).
28. **Invited Talk:** A. Forbes, (2014). [Controlling light's handedness](#), *ICOL 2014* (Dehradun, India).
29. **Invited Talk:** A. Dudley and A. Forbes, (2014). [Digitally controlling the twist of light](#), *AOP 2014* (Porto, Portugal).
30. **Plenary Talk:** A. Forbes, (2014). [Tailoring light with digital holograms](#), *SAIP 2014* (Johannesburg, South Africa)
31. **Invited Talk:** A. Forbes, (2014). [The digital laser](#), *Laser Optics 2014* (St Petersburg, Russia)
32. **Invited Talk:** A. Forbes, (2014). [Customised laser modes by dynamic and geometric phase control](#), *European Optical Society Annual Meeting* (Berlin, Germany).
33. **Invited Talk:** Forbes A. and Naidoo D. (2014). [Controlling light's handedness inside laser resonators](#), *OSA Frontiers in Optics* (Tucson, USA).
34. **Invited Talk:** Forbes A. (2014). [Tailoring light with digital holograms](#), *7th African Laser Centre Annual Workshop* (Rabat, Morocco).
35. **Invited:** Session Facilitator at the UNESCO opening of the International Year of Light, Paris (2015).
36. **Invited Talk:** Forbes A. (2015). [Structured light from laser resonators](#), *Photonics West* (San Francisco, USA).
37. **Invited Talk:** Forbes A. (2015). [Controlling light's handedness by geometric and dynamic phase control](#), *Photonics West* (San Francisco, USA)
38. **Invited Talk:** Masina B., and Forbes A. (2015). [Structured light for enhanced light-matter interactions](#), *LAPAMs* (Chennai, India).
39. **Invited Talk:** Forbes A. (2015). [Tailoring light with digital holograms](#), *World Photonics Forum* (Duke U., Durham, USA).
40. **Invited Talk:** Forbes A. (2015). [High brightness lasers](#), *IYL2015 workshop* (Tunis, Tunisia).
41. **Invited Talk:** Forbes A. (2015). [Introduction to lasers](#), *IYL2015 workshop* (Tunis, Tunisia).
42. **Invited Talk:** Forbes A. (2015). [Structured light from laser resonators](#), *CLEO USA* (San Jose, USA).
43. **Invited Talk:** Forbes A. (2015). [Introduction to quantum optics](#), *AOIM 2015* (Padova, Italy).
44. **Plenary Talk:** Forbes A. (2015). [One, two, three, ... infinity](#), *SAIP 2015* (Port Elizabeth, South Africa).
45. **Invited Talk:** Forbes A. (2015). [Accelerating light](#), *SAIP 2015* (Port Elizabeth, South Africa).
46. **Invited Talk:** Forbes A. (2015). [Manipulating light](#), *SAIP 2015* (Port Elizabeth, South Africa).
47. **Public Talk:** Forbes A. (2015). [Let there be light](#), *SAIP 2015* (Port Elizabeth, South Africa).
48. **Public Talk:** Forbes A. (2015). [The power of light in the palm of your hand](#), *NSTF lecture series* (Durban, South Africa).
49. **Invited Talk:** Forbes A. (2015). [Photonics Innovations: from science to technology](#), *IEEE Africon 2015* (Addis Ababa, Ethiopia).
50. **Invited Talk:** Dudley A. and Forbes A. (2015). [Unravelling light](#), *ICOAM 2015* (New York, USA).
51. **Invited Talk:** McLaren M.G. and Forbes A. (2015). [Optical communication with LG beams](#), *ICOAM 2015* (New York, USA).
52. **Invited Talk:** Zhang Y. and Forbes A. (2015). [High-dimensional HOM interference](#), *ICOAM 2015* (New York, USA).
53. **Guest Editor:** OPN team (and Forbes A.) (2015). [Optics in 2015](#), OPN annual series
54. **Invited Talk:** Forbes A. (2016). [Photonics in Africa](#), *IYL Closing Ceremony* (Merida, Mexico).
55. **Invited Talk:** Forbes A. (2016). [Characterising vector vortex beams](#), *Photonics West* (San Francisco, USA).
56. **Invited Talk:** Forbes A. (2016). [Emerging photonics research at universities in South Africa](#), *NSTF Workshop on Photonics Innovation* (Pretoria, South Africa).
57. **Guest speaker:** Forbes A. (2016). [Science can be done anywhere](#), *University of the Witwatersrand Graduation ceremony* (Johannesburg, South Africa).
58. **Guest speaker:** Forbes A. (2016). [Identifying brilliance](#), *University of the Witwatersrand Prize Giving ceremony* (Johannesburg, South Africa).
59. **Keynote Address:** Forbes A. (2016). [History of laser research in South Africa](#), *SMEOS International Conference* (Skukuza, South Africa).
60. **Invited Talk:** Forbes A. (2016). [Controlling light's helicity at the source](#), *ICTP Workshop on Singular Optics* (Zanjan, Iran).
61. **Invited Talk:** Forbes A. (2016). [Quantum mechanics with pictures of light](#), *ICTP Workshop on Singular Optics* (Zanjan, Iran).

62. **Invited Talk:** Forbes A. and Sephton B. (2016). [Classical and quantum properties of vector modes](#), OSA *Frontiers in Optics* (Rochester, USA).
63. **Plenary Talk:** Forbes A. (2016). [Structured light with digital holograms](#), 3DIADT conference (Jinhua, China).
64. **Invited Talk:** Forbes A. (2016). [From structured light to structured waves](#), 9th African Laser Centre Annual Workshop (Stellenbosch, South Africa).
65. **Invited Talk:** Forbes A. (2016). [Teleporting quantum states](#), 9th African Laser Centre Annual Workshop (Stellenbosch, South Africa).
66. **Invited Talk:** Forbes A. (2016). [Introduction to Fourier Optics](#), *Imaging workshop* (Stellenbosch, South Africa).
67. **Invited Talk:** Forbes A. (2016). [Ghost imaging](#), *Imaging workshop* (Stellenbosch, South Africa).
68. **Guest Editor:** OPN team (and Forbes A.) (2016). [Optics in 2016](#), OPN annual series
69. **Invited Talk:** Forbes A. (2017). [Creating a quantum link for image transfer](#), PQE (Snowbird/Utah, USA).
70. **Invited Talk:** Rosales-Guzman C. and Forbes A. (2017). [Hybrid communication using OAM](#), PQE (Snowbird/Utah, USA).
71. **Invited Talk:** Forbes A. (2017). [Creation and detection of high-dimensional entangled states for quantum communication](#), SPIE Photonics West, Advances in Photonics of Quantum Computing, Memory, and Communication X (San Francisco, USA).
72. **Invited Talk:** Dudley A. and Forbes A. (2017). [Exploiting the spatial profiles of light](#), SPIE Photonics West, Complex Light (San Francisco, USA).
73. **Keynote Address:** Forbes A. (2017). [Photonics for a Brighter Future](#), IEB School Conference (Johannesburg, SA).
74. **Public Lecture:** Forbes A. (2017). [Lasers in Space](#), Moles Wars 6.02 am address (Port Elizabeth, SA).
75. **Public Lecture:** Forbes A. (2017). [Photonics for a Brighter Future](#), NMMU outreach address (Port Elizabeth, SA).
76. **Invited Talk:** Forbes A. (2017). [Creation, propagation and detection of vector modes for optical communication](#), OSA's OFC, paper Th4H.1 (Los Angeles, USA).
77. **Guest Editor:** Zhan Q. and Forbes A. (2017). [Complex light fields](#), Chinese Optics Letters
78. **Invited Talk:** Forbes A. and Nape I. (2017). [Creation and detection of high-dimensional quantum states for quantum communication](#), Quantum Africa 4 (Tunis, Tunisia)
79. **Invited Talk:** Forbes A. (2017). [Classical and quantum properties of vector vortex light fields](#), Siegman School for Lasers (Leon, Mexico)
80. **Invited Talk:** Forbes A. (2017). [Teleportation of ghost images](#), ICO Conference, (Tokyo, Japan)
81. **Invited Talk:** Forbes A. (2017). [Manipulating higher-order Poincare sphere beams for classical and quantum applications](#), Summer School at the Max Planck Institute for the Science of Light, (Erlangen, Germany).
82. **Invited Talk:** Naidoo D and Forbes A. (2017). [Higher-order Poincare sphere beams](#), ICOAM, (Capri, Italy).
83. **Invited Talk:** Leach J and Forbes A. (2017). [Teleportation of OAM states](#), ICOAM, (Capri, Italy).
84. **Keynote Address:** Forbes A. (2017). [Science can be done anywhere?](#), UKZN PG Research Day, (Durban).
85. **Invited Talk:** Forbes A. (2017). [Structured light from lasers](#), KOALA IONS (Brisbane, Australia)
86. **Invited Talk:** Forbes A. (2018). [Structured light from lasers](#), Japanese Society for Applied Physics (Tokyo, Japan)
87. **Invited Talk:** Forbes A. (2018). [Blurring the classical-quantum divide](#), Chiba workshop on Structured Light (Tokyo, Japan)
88. **Invited Talk:** Forbes A. (2018). [Structured matter waves](#), St. Petersburg SPIE Student Chapter (St. Petersburg, Russia)
89. **Public Lecture:** Forbes A. (2018). [Our quirky quantum world](#), International Day of Light (Stellenbosch, South Africa)
90. **Invited Talk:** Forbes A. (2018). [A modern toolbox for classical and quantum communication with vector vortex beams](#), OECC (Jeju, Korea)
91. **Invited Talk:** Forbes A, Cox M. and Cheng L. (2018). [Bridging the digital divide with sustainable photonics](#), OSA Networks (Zurich, Switzerland)
92. **Invited Talk:** Forbes A. and Valles A. (2018). [Devices for the creation and detection of vector states based on optical angular momentum](#), SPIE Optics and Photonics (San Diego, USA).
93. **Invited Talk:** Forbes A. and Valles A. (2018). [Quantum mechanics with patterns of light](#), SPIE Optics and Photonics (San Diego, USA).
94. **Invited Talk:** Forbes A. and Valles A. (2018). [Quantum state tomography made easy](#), SPIE Optics and Photonics (San Diego, USA).
95. **Invited Talk:** Forbes A. (2018). [Quantum imaging with structured photons](#), OSA CLEO Pacific Rim (Hong Kong, China).
96. **Invited Talk:** Forbes A. (2018). [From structured light to structured waves](#), OSA IONS (Hennops River, South Africa).
97. **Invited Talk:** Forbes A. (2018). [Wave Interference revisited](#), IUPAP Education Conference (Johannesburg, South Africa).
98. **Keynote Address:** Forbes A. (2018). [Quantum mechanics with pictures](#), POEM (Wuhan, China).
99. **Invited Talk:** Forbes A. (2019). [Structured Light](#) ColOpt (Munich, Germany).
100. **Invited Talk:** Forbes A. (2019). [Controlling the purity of scalar and vector OAM modes](#) ICOAM (Ottawa, Canada).
101. **Invited Talk:** Forbes A. (2019). [Structured Waves](#) Structured Light Workshop (Beijing, China).
102. **Invited Talk:** Forbes A. (2019). [High-dimensional entanglement with spatial modes of light](#) XVI International conference on Quantum Optics and Quantum Information (Minsk, Belarus).
103. **Invited Talk:** Forbes A. (2019). [Blurring the classical-quantum divide](#) Quantum Africa 5 (Stellenbosch, South Africa).
104. **Invited Talk:** Forbes A. (2019). [High-dimensional quantum cryptography](#) Ciphertech (Pretoria, South Africa).
105. **Invited Talk:** Forbes A. (2019). [Intelligent ghost imaging](#) SPIE Optics and Photonics (San Diego, USA).
106. **Invited Talk:** Forbes A. (2019). [Structured light in turbulence](#) POEM (Wuhan, China).
107. **Invited Talk:** Forbes A. (2019). [Quantum mechanics with classical light](#) OSA Webinar (on-line international).

STUDENT TRAINING RECORD:

Human capital development is a passion of mine. In addition to seeking out excellent students, I have also supervised

Postdoctoral fellows: Hencharl Strauss (2009-2010), Gift Katumba (2008-2009), Igor Litvin (2010-2014), Bonex Mwakikunga (2009-2011), Kittessa Roro (2009-2012); Angela Dudley (2012-2014), Yingwen Zhang (2013-2016), Melanie McLaren (2014-2017) Carmelo Rosales (2015-2018), Adam Valles (2017-2019), Valeria Rodrigues (2018-present), Najmeh Tabebordbar (2019-present) and >100 vacation students, >70 international exchange students, and >10 junior staff members.

Furthermore, given the drive for equity and redress in South Africa, it is telling that despite working in “hard-core” physics, my MSc and PhD student demographics presently are >90% black and/or female, similar to my graduated demographics (>80%).

Present students (with general theme listed):

1. Othmane Mouane (PhD, Wits) [co-supervisor]: [Nano-diamond by structured polarisation laser irradiation](#)
2. Mitch Cox (PhD-Eng, Wits): [Mode division multiplexing](#)
3. Nokwazi Nkosi (PhD, Wits): [Laser lunar ranging with structured light](#)
4. Nicholas Bornman (PhD, Wits): [Quantum information processing](#)
5. Isaac Nape (PhD, Wits): [Quantum key distribution](#)
6. Luthando Macqondo (MSc, Wits): [Modal decomposition](#)
7. Ravin Kara (MSc, Wits): [DMD beam control](#)
8. Jonathan Pinnel (MSc, Wits): [SPDC spectrum control](#)
9. Bereneice Septhon (PhD, Wits): [Quantum imaging](#)
10. Christopher Ayala (MSc, Wits): [Quantum imaging](#)
11. Michael DeOlivier (MSc, Wits): [Quantum random numbers](#)
12. Stirling Scholes (MSc, Wits): [Modal decomposition with DMDs](#)
13. Nikiwe Mashaba (MSc, Wits): [Simulating turbulence with DMDs](#)

Completed students:

1. Mafusire C. (2006), [Spinning pipe gas lenses](#), MSc Dissertation, (U. Zim).
2. Baisitse T.R. (2007), [Characterisation of InAs–based epilayers by FTIR spectroscopy](#), MSc Dissertation, (NMMU). (Mentor).
3. Masina B.M. (2008), [Optical system for the heating and temperature measurement of diamond](#), MSc Dissertation, (U. Zulu).
4. Bernhardt E.H. (2008), [Modelling diode-pumped solid-state lasers](#), MSc Dissertation, (UKZN). *Cum laude*
5. Melanie McLaren (2009), [Optical tweezing and trapping](#), MSc Dissertation, (Wits). *Noted as outstanding*
6. Liesl Burger (2009), [Transverse modes in Porro prism resonators](#), MSc Dissertation, (UKZN). *Cum laude*
7. Bonex Mwakikunga (2009), [Nano-size effects on opto-electronic, structural and vibrational properties of vanadium and tungsten oxides produced by laser and ultrasonic spray pyrolysis techniques](#), PhD Thesis, (Wits).
8. Mapula De Gama (2010), [Wavelength independent laser beam shaping](#), MSc Dissertation (UKZN)
9. Igor Litvin (2010): [Intracavity laser beam shaping](#), PhD Thesis (US) *Noted as outstanding*
10. Wayne Koen (2010), [End-pumped solid-state lasers](#), MSc Dissertation (UKZN) *Cum laude*
11. Malcolm Govender (2011), [Synthesis of tungsten oxide nanostructures by laser pyrolysis](#), MSc Dissertation, (Wits).
12. Lerato Shambawana (2011), [Optical properties of vanadium oxide nanostructures synthesized by laser pyrolysis](#), MSc Dissertation (Wits).
13. Yaseera Ismail (2011), [Novel laser beams for optical trapping and tweezing](#), MSc Dissertation (UKZN). *Cum laude*
14. Darryl Naidoo (2011), [Transverse modes in solid-state laser resonators](#), MSc Dissertation (UKZN). *Summa cum laude*
15. Humairah Bassa (2012), [One way quantum computing with orbital angular momentum](#), MSc Dissertation (UKZN). *Summa cum laude*
16. Cosmas Mafusire (2012), [Modelling and measurement of optical aberrations of lasers beams propagating through random media](#), PhD Thesis (UKZN)
17. Angela Dudley (2012), [Super-positions of light fields carrying OAM](#), PhD Thesis (UKZN) *Noted as outstanding*
18. Ngcali Tile (2012), [Fabrication of high efficacy selective solar absorbers](#), MSc Dissertation (UKZN)
19. Edzani Radsibi (2014): [Laser machining with Bessel beams](#), MSc Dissertation (UWC)
20. Melanie McLaren (2014): [Engineering quantum states with orbital angular momentum](#), PhD Thesis (US) *Noted as outstanding*
21. Sandile Ngcobo (2014), [Applications of digital holograms for the selection and detection of transverse laser modes](#), PhD Thesis (UKZN)
22. Kelachukwu Iheanetu (2014), [Selecting High-order modes in solid state laser resonators](#), MSc Dissertation (UFH)
23. Darryl Naidoo (2014), [High-brightness lasers](#), PhD Thesis (US)
24. Dirk Spanenberg (2014), [Time domain ptychography](#), PhD Thesis (US)
25. Yaseera Ismail (2014): [Quantum entanglement with polarization](#), PhD Thesis (UKZN)
26. Thandeka Mhlanga (2015), [Generation and detection of Bessel beams](#) MSc Dissertation (UKZN)
27. Liesl Burger (2016), [Novel implementation of a phase-only spatial light modulator for laser beam shaoing](#) PhD Thesis (UKZN)
28. Bathusile Masina (2016), [Synthesis of vanadium oxide nano-structures by plasma plume dynamics](#), PhD Thesis (UKZN)
29. Bienvenu Ndagano (2016), [Encoding information into spatial modes of light](#), MSc Dissertation (Wits)
30. Fakazi Nhachissambe (2017), [Holographic optical trapping and tweezing](#), MSc Dissertation (UKZN) [co-supervisor]
31. Bigboy Madlala (2017), [A low cost Q-switched DPSS laser](#), MSc Dissertation (Wits)
32. Daniel Morris (2017): [Fibre lasers](#), MSc Dissertation (Wits) *Cum laude* [co-supervisor]
33. Isaac Nape (2017): [Hyper-entangled states](#), MSc Dissertation (Wits) *Cum laude*
34. Lucas Galele (2018): [Long distance data transfer using spatial modes of light](#), MSc Dissertation (Wits)
35. Bereneice Septhon (2018): [Quantum walks with classically entangled light](#), MSc Dissertation (Wits) *Cum laude*

36. Mosima Kgomo (2018) [co-supervisor]: [Towards the Development of Thulium-doped All-fibre Laser](#), MSc Dissertation (Wits)
37. Hend Sroor (2019): [Higher-order Poincare beams from lasers](#) PhD Dissertation (Wits)
38. Nkosi Bhebhe (2019): [Creation and analysis of structured light fields for application in optical tweezers](#) PhD Dissertation (Wits)
39. Bienvenu Ndagano (2019): [Classical and quantum entanglement: applications to quantum communication with structured photons](#) PhD Dissertation (Wits)
40. Prince Mredlana (2019) [co-supervisor]: [Modal decomposition with Wigner functions](#) MSc Dissertation (Wits)
41. Chemist Mabena (2019) [co-supervisor]: [Distortion correction for free-space quantum communications](#) PhD Dissertation (Wits)

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Major competitive funding:

1. National Research Foundation Bilateral Fund (2008), Vortex beams, R425 000
2. CSIR Equipment Fund (2006), Equipment, R450 000
3. CSIR Equipment Fund (2009), Equipment, R494 000
4. Strategic Research Panel Thematic Fund (2007 – 2010), Micro-optical elements, ~R6 000 000
5. Strategic Research Panel Collaboration Fund (2008 – 2009), Entanglement, R100 000
6. African Laser Centre (2006 – 2007), Solar absorbers, ~R200 000
7. African Laser Centre (2008), Laser beams, R335 000
8. Department of Science and Technology (2007 – 2010), Rental Pool Programme, ~R18 000 000
9. Element 6 Research Programme (2008 – 2010), Diamond studies, R1 500 000
10. National Laser Centre PG (2004 –), User Facility and Mathematical Optics, ~R12 400 000
11. Various industrial contracts (2000 – 2009), Various, >R30 000 000
12. Strategic Research Panel Thematic Fund (2009 – 2012), Selective Solar Absorbers, ~R9 500 000
13. National Research Foundation Bilateral Fund (2009), Vortex beams, R505 000
14. African Laser Centre (2009 – 2011), Liquid crystals for optical tweezing, ~R145 000
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20. National Research Foundation CSUR (2012-14), Twisted Light, ~R750 000
21. PISA Flagship programme (2010), ~ R750 000
22. PISA HCD programme (2010-2012), ~ R1 800 000
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30. NRF CSRR (2015), R666 000 (over 3 years)
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34. PISA Industry collaboration grants (2015), R629 000
35. Airbus grant (2015), R1 000 000
36. TIA Seed Fund (2016), R500 000
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38. PISA Industry collaboration grant (2016), R456 000
39. URC Equipment grant (2016), R200 000
40. DST Bursary grant (2016), >R1 000 000
41. DST Bursary grant (2017), >R1 000 000
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43. TIA Seed Fund (2017), R500 000
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45. Rental Pool Programme (2018-2020), >R3 000 000
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49. NMISA (2019): ~R500 000

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