DHRUV SAXENA

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ACADEMIC QUALIFICATIONS:

2011-2017 **PhD (Physics)** – awarded 17th May 2017
The Australian National University, Canberra, Australia
Thesis title: 'Design and characterisation of III-V semiconductor nanowire lasers'

2007 **Honours (Applied Mathematics)**
University of Sydney, Sydney, Australia
First Class Honours

2004-2006 **Bachelor of Science (Advanced Mathematics)**
University of Sydney, Sydney, Australia
Majors: Applied/Pure Mathematics (Advanced) & Physics (Advanced)

EMPLOYMENT HISTORY

2017 Jul-present **Research Associate**
Department of Physics
Imperial College London, United Kingdom

2017 Apr-Jun **Research Associate**
Department of Physics
King's College London, United Kingdom

2009-2011 **Senior Research Officer** (APS 5), Analytical Services Branch,
Methodology and Data Management Division
Australian Bureau of Statistics, Canberra, Australia

2008-2009 **Research Officer** (APS 4), Statistical Services Branch,
Methodology and Data Management Division
Australian Bureau of Statistics, Canberra, Australia

2008 **Graduate** (APS 3), Statistical Services Branch,
Methodology and Data Management Division
Australian Bureau of Statistics, Canberra, Australia

2006-2007 **Vacation Research Student**
Defence Science and Technology Organisation, Adelaide, Australia

2005-2006 **Vacation Research Student**
Biophysics, School of Physics, University of Sydney, Sydney, Australia

AWARDS & ACHEIVEMENTS

2016 Royal Society Newton International Fellowship
2016 Australian Optical Society (AOS) Postgraduate Student Prize
2013 Distinction award for oral presentation at Research School of Physics and Engineering John Carver Seminar Series, The Australian National University

2012 Outstanding student oral presentation at 2012 Conference on Optoelectronic and Microelectronic Materials and Devices (COMMAD)

Australian Bureau Statistics

2008 Methodology & Data Management Division Achievement Award September Quarter for contribution to the methodological redesign of the Retail Survey (team award)

University of Sydney

2008 K.E. Bullen Memorial Prize for the greatest proficiency in Applied Mathematical Honours

2007 K.E. Bullen Scholarship No. I for student in Applied Mathematical Honours for the greatest proficiency in Senior Mathematics and Statistic courses

TEACHING EXPERIENCE

2012- **Tutor & lab demonstrator** - The Australian National University

2011 1st year undergraduate Physics and Mathematics courses (PHYS 1101, MATH 1013-1014)

2011 **Tutor** - The Australian National University

2nd year undergraduate Physics course on Electromagnetism (PHYS 2016)

RESEARCH INTERESTS

I am passionate about exploring the physics of nanomaterials, tailoring light-matter interactions and manipulating light at sub-wavelength scales for obtaining novel devices that would benefit humanity.

RESEARCH EXPERIENCE

2011- **PhD research**

2017 My PhD research was on the design and characterisation of III-V semiconductor nanowire lasers. Semiconductor lasers are an integral part of modern technology. Further miniaturisation of lasers will lead to novel laser-based technologies, such as on-chip photonic integrated circuits. III-V semiconductor nanowires are promising for such applications, as they provide both a gain medium and an optical cavity for lasing, and can be integrated on technologically important substrates like silicon. In my research, I investigated three different nanowire lasers with different gain materials: GaAs, InP and GaAs/AlGaAs quantum wells, respectively. For each of these nanowire lasers, I determined the optimal design to minimise threshold gain (based on which nanowires were grown) and demonstrated lasing from individual nanowires by optical pumping. I also showed that nanowire lasers could be designed to lase from specific photonic modes, and that the lasing modes could be experimentally characterised, by analysing the far-field emission pattern of the nanowire lasers.

The most significant achievement in my PhD was the demonstration of GaAs nanowire lasers that could operate at room-temperature. While GaAs is the most studied and used III-V semiconductor material for optoelectronic devices in planar geometry, its applications had been very limited in the nanowire geometry due to the large number of surface states in GaAs. Our achievement of room-temperature GaAs nanowire lasers was an important milestone for the research community, which was only possible because of proper cavity design and improvements in the surface passivation of GaAs nanowires. Later in my PhD research, I demonstrated room-temperature GaAs-based nanowire lasers with significantly lower thresholds by using quantum confined active regions. My current research interests are in designing nanowire lasers with directional emission properties and architectures for effective out-coupling light from nanolasers.

PUBLICATION LIST

2017 Alanis J A, **Saxena D**, Mokkapati S, Jiang N, Peng K, Tang X, Fu L, Tan H, Jagadish C, Parkinson P
Large-scale statistics for threshold optimization of optically pumped nanowire lasers
Nano Letters 17, 8 4860-4865 (2017)

2017 Yuan X, **Saxena D**, Caroff P, Wang F, Lockrey M, Mokkapati S, Tan H, Jagadish C
Strong amplified spontaneous emission from high quality $GaAs_{1-x}Sb_x$ single quantum well nanowires
The Journal of Physical Chemistry C 121, 8636-8644 (2017)

2016 **Saxena D**, Jiang N, Yuan X, Mokkapati S, Guo Y, Tan H, Jagadish C
Design and room-temperature operation of GaAs/AlGaAs multiple quantum well nanowire lasers
Nano Letters 16, 8 5080-5086 (2016)

2016 Burgess T, **Saxena D**, Mokkapati S, Li Z, Hall C, Davis J, Wang Y, Smith L, Fu L, Caroff P, Tan H, Jagadish C
Doping-enhanced radiative efficiency enables lasing in unpassivated GaAs nanowires
Nature Communications 7, 11927 (2016)

2016 Mokkapati S, **Saxena D**, Tan H and Jagadish C
Semiconductor Nanowire Optoelectronic Devices
In: Dayeh S A, Fontcuberta i Morral A and Jagadish C, editors
Semiconductors and Semimetals 94, Burlington: Academic Press, 1-15 (2016)

2015 Mokkapati S, **Saxena D**, Tan H, Jagadish C
Optical design of nanowire absorbers for wavelength selective photodetectors
Scientific Reports 5, 15339 (2015)

2015 **Saxena D**, Wang F, Gao Q, Mokkapati S, Tan H, Jagadish C
Mode profiling of semiconductor nanowire lasers
Nano Letters 15, 5342-5348 (2015)

2015 Mokkapati S, **Saxena D**, Jiang N, Li L, Tan H, Jagadish C
An order of magnitude increase in the quantum efficiency of (Al)GaAs nanowires using hybrid photonic-plasmonic modes
Nano Letters 15, 1 307-312 (2015)

2014 Gao Q, **Saxena D**, Wang F, Fu L, Mokkapati S, Guo Y, Li L, Wong-Leung J, Caroff P, Tan H, Jagadish C
Selective-Area Epitaxy of Pure Wurtzite InP Nanowires: High Quantum Efficiency and Room-Temperature Lasing
Nano Letters 14, 9 5206-5211 (2014)

2013 Mokkapati S, **Saxena D**, Tan H, Jagadish C
Design considerations for semiconductor nanowire-plasmonic nanoparticle coupled systems for high quantum efficiency nanowires
Small 9, 23 3964-3969 (2013)

2013 **Saxena D**, Mokkapati S, Parkinson P, Jiang N, Gao Q, Tan H, Jagadish C
Optically pumped room-temperature GaAs nanowire lasers
Nature Photonics 7, 12 963-968 (2013)

2012 Mokkapati S, **Saxena D**, Jiang N, Parkinson P, Wong-Leung J, Gao Q, Tan H, Jagadish C *Polarization Tunable, Multicolor Emission from Core-Shell Photonic III-V Semiconductor Nanowires*
Nano Letters 12, 12 6428-6431 (2012)

2012 **Saxena D**, Mokkapati S, Jagadish C
Semiconductor Nanolasers
IEEE Photonics Journal 4, 2 582-585 (2012)