ARC funded research projects 2017

Discovery Project

DP170103537	Professor Simon Fleming; Associate Professor Maryanne Large; Professor Dr Raman Kashyap	**Metal dielectric microstructures: Tuneable metamaterials to medical devices.** This project aims to demonstrate tuneable metamaterials fabricated economically and in volume. Tuneability is sought after and difficult to realise. This project will switch a metamaterial from metallic to dielectric behaviour, and dynamically vary the magnification of a hyperlens. To do this, it will create a micro/nanofabrication technology platform with potential widespread uses in high technology manufacturing. It expects to improve multi-modal neural interfaces for optogenetic research and implantable biomedical devices such as cochlear implants.	The University of Sydney	$370,500.00
DP170101775	Professor Min Gu; Associate Professor XIAOGANG LIU; Professor Xiangping Li	**Optically-activatable nanolithography for ultralow energy long data storage.** This project aims to investigate greenphotonic long data storage. Optically-activated nanolithography that adopts earth abundant lanthanide-doped nanoparticles and vectorial holography could enable the development of ultra-long lifetime, ultra-low energy consumption, and ultra-fast access speed technology platforms for exabyte big data centres. The research discoveries from this project will enable the greenphotonic long data storage technology, reducing energy consumption. Such a breakthrough would provide a key platform for the emerging industry revolution 4.0 and build Australia’s international leadership in green and smart digital economies in the big data era.	RMIT University	$391,000.00
DP170103778	Dr Andrey Miroshnichenko; Dr Mohsen Rahmani; Dr Isabelle Staude; Professor Dr Stefan Maier	**Nonlinear near-field nanophotonics.** This project aims to develop nanostructures which employ both high intrinsic nonlinearities and high indices of refraction to create nanophotonic devices. Silicon photonics promises a technological leap forward through efficient photon-photon interactions within lossless dielectric nanoparticles. Light-controlling-light devices open new ways to control light-matter interaction at the nanoscale, which form the basis for many applications from all-optical information processing to biomedical sensing. The expected outcomes will provide Australia with advanced technologies of integrated optical circuits with applications in optical communication networks, bioimaging, solar cells and quantum information technologies.	The Australian National University	$371,000.00

DP170104644	Professor Michael Withford; Dr Simon Gross	**Controlling atomic species migration in laser irradiated glasses.** This project aims to determine the role of common glass constituents on desired optical properties. More than 50 major research groups and numerous commercial start-ups worldwide are pursuing ultrafast laser inscription, an enabling manufacturing platform used to create complex three-dimensional optical circuits inside transparent blocks of glass. However, although successfully used, we still don't understand why similar glass types react differently, and we are limited to using generic glasses tailor-made for other purposes. This project will guide future choice of glasses and reveal how to engineer materials that complement this fabrication platform.	Macquarie University	$362,000.00

Discovery Early Career Researcher Award (DECRA)

DE17010058	Dr Amol Choudhary	**On-chip generation and processing of high-power multi-GHz frequency combs.** The project aims to deliver a chip-scale stable optical frequency comb technology with high-power and multi-GHz frequency spacing. The lack of this technology has prevented fundamental advances in wide-ranging applications that require high signal-to-noise-ratio (SNR) combs. The project seeks to demonstrate combs using waveguide laser technology and to integrate it with a reconfigurable optical filter to select and process individual comb lines. Key advantages of this technology, including high SNR, reconfigurability, high stability, small footprint and low-cost, are expected to improve astronomy's ability to detect Earth-like planets, telecommunications to increase the overall internet capacity, and global positioning systems (GPS).	The University of Sydney	$365,000.00
DE17010025	Dr Mohsen Rahmani	**Opto-acoustic metasurfaces.** This project aims to develop efficient nanoscale light and sound sources and merge them on an extra-thin surface. Interactions between light and sound waves at the macroscopic scale are used every day, such as in non-destructive testing and contact-less imaging. However, research into nanoscale light-sound interactions is new and has not realised its full potential. This project intends to develop ultra-compact sources of light and sound, tune them effectively, harness them simultaneously, and convert one to another efficiently, all crucial for real-world applications. This research is expected to improve technologies that use light and sound, including microscopy and spectroscopy.	The Australian National University	$360,000.00

Linkage Infrastructure, Equipment and Facilities (LIEF)

LE170100072	Professor Michael Fuhrer; Professor Paul Stoddart; Associate Professor Elena Ostrovskaya; Dr Haroldo Hattori; Professor Dragomir Neshev; Associate Professor Jeffrey Davis; Professor Kourosh Kalantar-zadeh; Dr Agustin Schiffrin; Professor Yuri Kivshar; Professor Vipul Bansal; Professor Saulius Juodkazis; Professor Leone Spiccia; Professor Udo Bach; Professor Min Gu	**Facility for exploring light-matter interactions in space, time and energy.** This project aims to create a readily accessible facility consisting of a suite of tools to study light-matter interactions in materials, molecules and biological systems. Understanding light-matter interactions offers insight into the properties of nano- and biomaterials. The project intends to combine local probes and pump-probe spectroscopy methods for studying nanoscale femtosecond dynamics. It will be accessible to a broad user base, cementing Australia's leadership in ultrafast spectroscopy techniques and nano/bio-materials. The facility will provide a window to the quantum nanoworld, with potential for developing new energy efficient light sources, light-harvesting systems and sensors.	Monash University	$600,000.00
LE170100140	Dr Stefano Palomba; Professor Simon Ringer; Professor Julie Cairney; Associate Professor Ilya Shadrivov; Professor Milos Toth; Professor Stephen Simpson; Professor Matthew Phillips; Professor Darren Bagnall; Associate Professor Jodie Bradby; Professor Vicki Chen; Professor David James; Professor Gordon Wallace	**A multiple ion beam facility for microscopy and nanofabrication.** This project aims to establish a powerful multiple ion beam system for nanoscience research. The demand for customised therapies, secure communication and efficient energy harvesting prompts the development of nanoscale devices that can interface and interact with the environment: nanotechnology systems with fully functional sensors, detectors, energy and data processing modules. This project would increase the ability to observe and manipulate the structure of materials at the nanometre length-scale. This project is expected to boost Australia's research capacity in nanoscience and develop materials for nanoelectronics, energy and the environment, and structural materials. These outcomes will benefit Australia's capacity to develop advanced manufacturing industries.	The University of Sydney	$1,050,000.00
LE170100160	Dr Jochen Schröder; Dr William Corcoran; Professor William Shieh; Professor Arthur Lowery; Professor Arnan Mitchell; Mr Timothy Rayner	**Distributed ultra-fast optical clocks for terabit/s communications.** The project aims to enable experiments with full spectrum occupation for transmission over field-deployed optical fibre. Future optical communication systems will have to use the full available spectral bandwidth and advanced multiplexing and modulation to achieve ultimate data capacity over a fibre link. To realistically test such links, experiments must be performed over "real-world" fibre links. By linking three telecoms research laboratories, the project will create a close collaboration optical network that enables this research. Anticipated outcomes are the opportunity to conduct research over field-deployed fibre links and to prototype and test communication technology over real-world links, creating a simplified path to commercialisation.	RMIT University	$250,000.00