CITATIONS OF WINNERS

YOUNG SCIENTIST AWARD 2017

Physical, Information & Engineering Sciences Category

Dr Justin C.W. Song

Scientist and National Research Foundation Fellow, Institute of High Performance Computing, A*STAR

Nanyang Assistant Professor, Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University

"For his research unveiling novel electronic properties of quantum materials"

Dr Justin Song's work in quantum electronics has revealed a host of unconventional properties native to quantum materials that can guide the design and development of quantum materials and devices. He envisions harnessing these quantum features to steer electrons in new ways and transcend traditional electronic device concepts.

The study of quantum materials has recently intensified, focusing on unusual quantum behaviour in systems that include topological insulators and two-dimensional materials such as graphene. These novel materials and nanoscale systems may provide new functionalities and routes to overcome the physical limitations of current electronic devices, as well as the means to enable next-generation electronics.

Dr Song discovered hot electrons dominate the photocurrent of graphene and triggered a subfield focused on exploiting and harvesting hot carriers in graphene for the development of two-dimensional opto-electronics. His sustained work in elucidating the mechanisms of graphene photoexcitation and relaxation, as well as the tools he developed, are still used as a framework for parsing and characterising graphene's photoresponse.

He also proposed and demonstrated a system for detecting topological valley currents in graphene heterostructures, thus providing a readily accessible platform for harnessing their dynamics. This work has inspired a range of activities that span from electronically manipulating the internal valley degree of freedom – valleytronics – to channelling its unconventional quantum transport. Recently, he pioneered new types of quantum plasmonics hosted in topological materials with unconventional attributes.

The theoretical work of Dr Song connects closely to experiment and spans the range of optical, electronic, and thermal properties of materials. Through this work he has developed distinctive theory-experiment collaborative efforts that have enabled a richer

exposition of new physical phenomena. This serves to amplify the impact of his work on the field and hasten the translation of new concepts into new devices.

Dr Song was a recipient of the National Research Foundation Fellowship and grant (2016), Nanyang Assistant Professorship (2016) at the Nanyang Technological University, and Sherman Fairchild Prize Fellowship at the California Institute of Technology (2014).