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Learning at warp speed

Students under the SUTD-NUS Joint PhD Programme can tap the expertise of faculty members from both universities

Mr Halim is passionate about a career in research as it may lead to discovering something that could change the world. PHOTO: CHONG JUN LIANG

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SPACE is the direction in which Mr Abdul Halim Ali Bakar's thesis is heading.

He is currently researching micro-thrusters for small satellites using 2D materials, under the supervision of Professor Ricky Ang from the Singapore University of Technology and Design (SUTD) and Professor Low Kay Soon from the National University of Singapore (NUS).

The 27-year-old is in the midst of his four-year SUTD-NUS Joint Doctor of Philosophy (PhD) Programme and hopes to graduate in 2020.

Realising his dreams

Mr Halim is passionate about being at the forefront of research and technological development.

To him, a research career is rewarding and exciting as there is the possibility of discovering something novel that can potentially change the world.

With a background in aeronautical engineering, he selected SUTD as he felt the institution would enable him to realise his research dreams.

He says: "I share SUTD's research philosophy — to conduct research via an interdisciplinary approach.

"I also identify with SUTD's aim to advance knowledge and nurture technically grounded leaders and innovators to serve Singapore's societal needs, with a focus on improving the world via technology and design."

The SUTD-NUS Joint PhD Programme combines SUTD's innovative, flexible curriculum that has a Big-Design perspective with NUS' established graduate programmes and research track record.

The Big-Design perspective focuses on technologically aided design to transform research into market-ready products and services.

Students under the programme are jointly supervised by, and can tap the expertise of, faculty members from both universities.

Mr Halim's research explores the use of graphene and other single-layer materials as both a microwave emitter and as a passive propulsion system for small satellites.

The current propulsion technologies for small satellites to orbit and manoeuvre in formation in space are inefficient due to scaling issues, he explains.

He is looking into generating renewable, sustainable energy via a "swarm", or formation of small satellites orbiting the Earth.

These would collect sunlight in outer space, convert it to electrical energy and transmit it to Earth in the form of microwaves.

This is considerably more efficient than terrestrial solar panels that typically receive only 40 per cent of the solar energy due to the Earth's atmosphere.

This would take Singapore closer towards the goal of energy self-reliance and becoming a Smart Nation, he says.

Relevant exposure

As a PhD student, Mr Halim is given many opportunities to explore self-driven research collaboration with other students.

He can augment his current research on plasma propulsion for space applications with input from other researchers and graduate students who have deep technical knowledge on single-layer materials, optics and even robotics.

"SUTD also has strong research links to world-class universities such as the Massachusetts Institute of Technology in the United States, and Zhejiang University in China," he notes.

PhD students in SUTD can either collaborate with external parties via overseas research attachments at hosting institutions or take up an industry internship for up to six months.

Beyond catering to students' academic interests, the joint PhD programme also promotes industry-related applications of its students' research.

They have access to professional development short courses that cover topics like intellectual property, entrepreneurship, scientific and grant writing, leadership and equity funding.

"The courses are very helpful in providing both 'soft' and 'hard' skills to prepare us for our future career," he says.

There is also good exposure to key industry players and opportunities for networking and to showcase research projects, such as through the annual Fostering Industrial Research Success Together (FIRST) Industry Workshop.

Industry-oriented focus

Other postgraduate programmes that SUTD offers include the Industrial Postgraduate Programme (IPP) and the Engineering Doctorate (EngD), which was launched in May this year.

The IPP is an initiative by the Singapore Economic Development Board that partners with Singapore-based companies and Autonomous Universities.

The EngD expects students to demonstrate a high level of expertise in both theoretical scientific principles and the implementation of said theories on realistic, industry-relevant needs.

Those keen to conduct innovative, groundbreaking research can tap the numerous research centres in SUTD, says Mr Halim.

He adds that SUTD also assists its PhD students in opening their own technologically oriented start-ups, and that the professors are open to new and, sometimes unorthodox, ideas.