Research Assessment Exercise 2020
Impact Overview Statement

University: The University of Hong Kong
Unit of Assessment (UoA): 7 – Physics and Astronomy
Total number of eligible staff of the university in the UoA: 21

(1) Context

The Department of Physics (UoA) has been active in engaging with the general public through citizen science, liaising with government bodies, and fostering industrial partners in its efforts to translate basic and applied research into meaningful economic and societal impact. One area of the UoA's diverse research activities relates to light pollution in Hong Kong. This has led to several public consultations and the issuance of a Charter of External Lighting by the Environment Bureau of Hong Kong, SAR. Through contract research and specialist services to key industries, the UoA is able to support Hong Kong and Chinese manufacturers to develop and manufacture quality quantum-dot LED backlight devices, battery materials, and semiconductors. An HKU start-up company (*PhysonTech*) emerged from the research on device simulation during the census period.

(2) Approach to impact

The approach to impact within the UoA is based on leveraging its close connections with the relevant stakeholders (the general public, industrial partners, and government bodies). This includes securing relevant external research funding from the government, industry, and elsewhere (31 grants during the census period); obtaining strong backing from the University via technological transfer support; winning major HKU budget resource allocations and strategic funding from the Faculty of Science. The UoA is also active in seeking research impact by allocating separate resources (impact research seed funding). During the census period, the UoA hired an experienced industry advisor (Mr KH Ng, a seasoned project manager and advisor at CLP Holdings Limited and Arup) to help it adjust its applied research focus to be closer to industrial applications. In the following section, the detailed approach within the UoA is discussed.

A Knowledge Exchange (KE) committee within the UoA oversees and coordinates all relevant activities in relation to their potential and actual impact. An external stakeholder advisory board, consisting of representatives of the general public, industrial partners, and government bodies, has been set up to link UoA activities to appropriate outside bodies, to foster collaborations and to help ensure the UoA maximizes its economic and societal impact.

Engagement with government and policy impact. Members of the UoA have been active in serving on Hong Kong government committees and engaging in policy formulation. While promoting citizen science in Hong Kong, Dr Jason Pun's research on external light pollution in Hong Kong has led to significant improvements in the public's understanding of the impacts of light pollution on both flora and fauna as well as human activities. A second round of public consultation is now under way, with Dr Pun – a member of the government's Working Group on External Lighting – to decide whether a direct legislative outcome will proceed to draft stage (white paper) in the immediate future. Dr John Leung and Dr Jenny Lee, both UoA members in the nuclear physics group, have served on the governmental Radiological Protection Advisory Group (RPAG). Dr Leung helped formulate the Daya Bay nuclear power station emergency plan and acted as the responsible person and environmental team leader for the low-level radioactive waste storage facility at Siu A. Chau.

Engagement with industry and industrial impact. In alignment with the Faculty's strategic plan, the UoA has strengthened its applied research in device physics and battery development. Together with the HKU Technology Transfer Office (TTO), the UoA organized a visit to Korea in September 2018 and an industrial forum on display technology in January 2019. These activities stem from the UoA's

work on display and optoelectronic devices. For example, Dr Francis Ling is leading a project on a quantum-dot LED backlight module with the company *Tyanshine Photoelectric* and recently, a spin-off company (*Shi Jia Semiconductor Technology Ltd*) was formed. Part of the funding for Dr Ling's work in this area was supplied by the departmental KE committee. In the census period, Dr Ling also worked with the company *Alpha Power Solutions Ltd.* to optimize the SiC power devices via defect engineering. One of Dr Ling's postgraduate students worked in this company as an intern, with the studentship fully supported by the company.

Collaboration with Shenzhen Bak Battery Co. Ltd. and Shenzhen Tianjiao Technology Co. Ltd has led to the development of novel $Li_4Ti_5O_{12}$-based batteries (Xie). New materials are being developed with high lead absorption to replace current water supply facilities (Djurišić). J. Wang is leading "Atomistic-Technology Computer Aided Design" efforts, resulting in the formation of a start-up company (*PhysonTech*) located at HKU's Knowles Building. The Laboratory for Space Research (Parker) has signed agreements with the Beijing Institute of Space Mechanics and Electricity and the Shanghai Academy of Space Flight Technology to further improve collaborations on space sciences, while an MoU with the NAOC provides access to mainland China telescope facilities for all Hong Kong astronomers.

Engagement with public and societal impact. The department regularly conducts public outreach events and is active in STEM education and hosts many interns. Members of the department undertake school visits, and many of its citizen scientists are secondary school students. The UoA gives public lectures (a total of 72 during the census period), and generates news stories and magazine articles both in Hong Kong and mainland China. For example, research of broad public interest from the Laboratory for Space Research has attracted over 20 national and international media reports.

(3) Strategy and plans

To deliver maximal impact from a relatively small and diverse department, an agile strategy has been adopted for all applied research efforts. This includes aims to: i) foster stronger connections with industry in Hong Kong and mainland China; ii) be more proactive in identifying and supporting key research areas where impact is more likely; and, most importantly, iii) to cultivate an environment where impactful research is encouraged and rewarded. The following arrangements have been made within the UoA:

1. Provide more infrastructure support for identified, impactful research. For example, funding has been secured for the improvement of applied research in optoelectronics. A HKD10 million investment in space science is also now under way with joint-lab possibilities in Donnguan.
2. An impact champion (Dr Jason Pun) has been appointed to lead Departmental efforts in securing Knowledge Exchange funding, holding impact workshops and mentoring young researchers in how to recognize, conduct, and develop research that can be translated into impact.
3. An external stakeholder advisory board has been set up to build useful connections and identify key collaboration opportunities.
4. The Department is strengthening its marketing efforts and offering industry-oriented programmes based on its members' expertise, accumulated through applied research.

(4) Relationship to case studies

The UoA has submitted two impact case studies. Both exemplify the approach to impact described in section (2). Specifically, the project on "*A cultural, behavioural and regulation campaign against light pollution: from Hong Kong to the world*" relies on the Department and University KE funding support and long-term relations with government bodies, and it is partly through members of the external stakeholder advisory board that the project has achieved its considerable impact. The project on "*Optimizing devices' performance through defect engineering*" also relies on our connections with members of the external stakeholder advisory board through which collaboration and support from industries are secured.