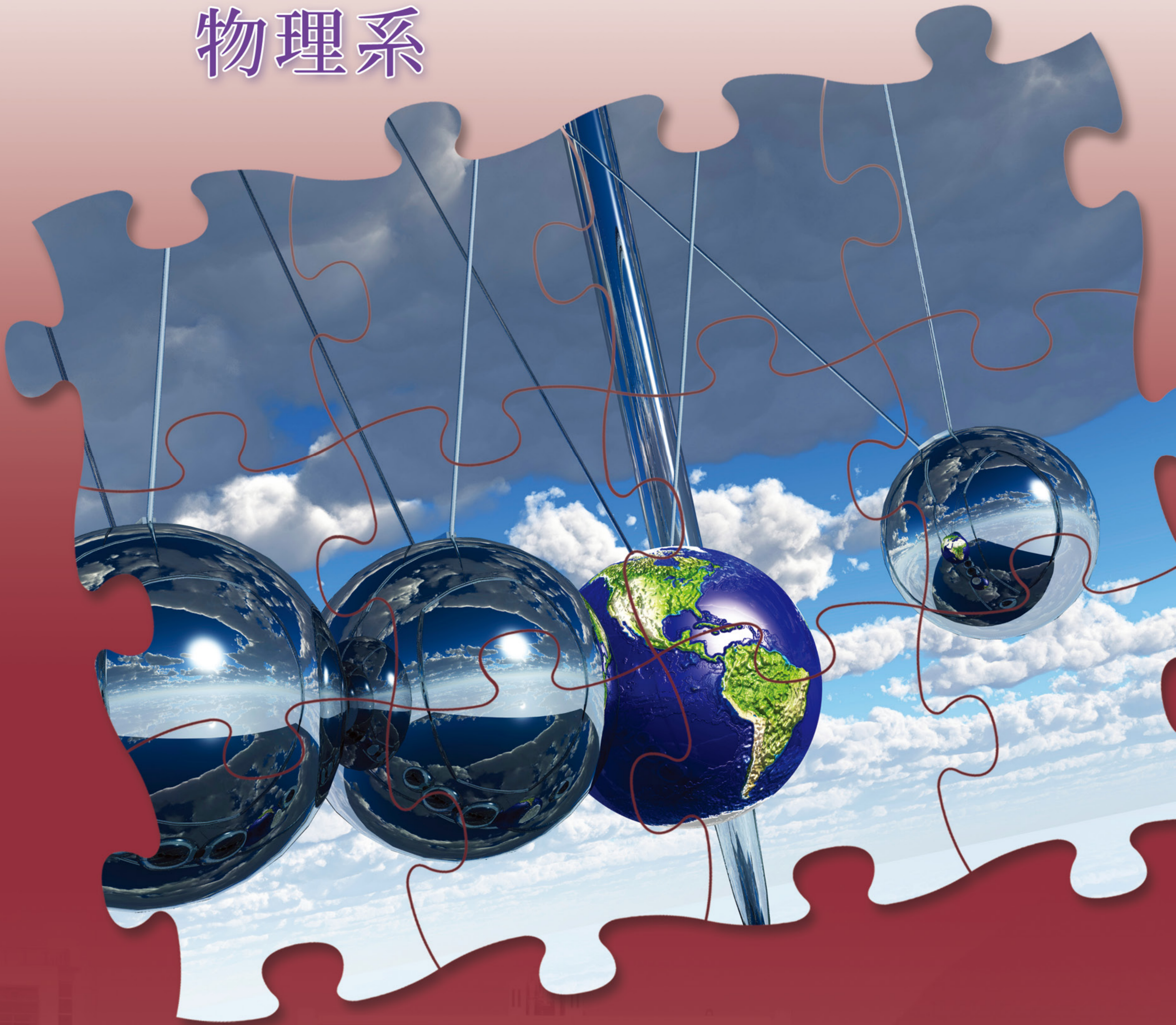


DEPARTMENT OF
PHYSICS

物理系



香港中文大學理學院
FACULTY OF SCIENCE
THE CHINESE UNIVERSITY OF HONG KONG



JS 4601 SCIENCE (Major in Physics)

JS 4690 ENRICHMENT STREAM IN THEORETICAL PHYSICS

 <http://www.phy.cuhk.edu.hk/>

 ugadm@phy.cuhk.edu.hk

 3943 6154

For 2022 Entry

P hysics Curriculum



- **Physics [Declare Physics as major programme after admission into CUHK Science]**
 - ◆ A solid grasp of fundamental concepts, analytic, numerical, computational, and research skills, as well as basic experimental skills
 - ◆ A balanced mix of lectures, tutorials, problem-solving sessions, seminars, group discussions, projects and undergraduate research opportunities
 - ◆ Compulsory courses provide an all-round foundation, supplemented by a pool of elective courses
 - ◆ Students may focus on the following Streams: (i) Astrophysics and Particle Physics, (ii) Computational and Data Physics, and (iii) Quantum Science and Technology
 - ◆ A number of special academic and extracurricular experiential learning programmes.
- **Enrichment Stream in Theoretical Physics**
 - ◆ For students who have a good foundation in secondary school physics and mathematics
 - ◆ Emphasis on early small-group discussion classes with an academic advisor and on research component
 - ◆ Better opportunities to engage in research at an earlier stage and build up research capabilities
 - ◆ Help students explore their research potential and bridge the gap from undergraduate physics to postgraduate studies
 - ◆ Students may opt for an additional Stream by completing stream-specific electives from: (i) Astrophysics and Particle Physics, (ii) Computational and Data Physics, or (iii) Quantum Science and Technology
 - ◆ A number of special academic and extracurricular experiential learning programmes



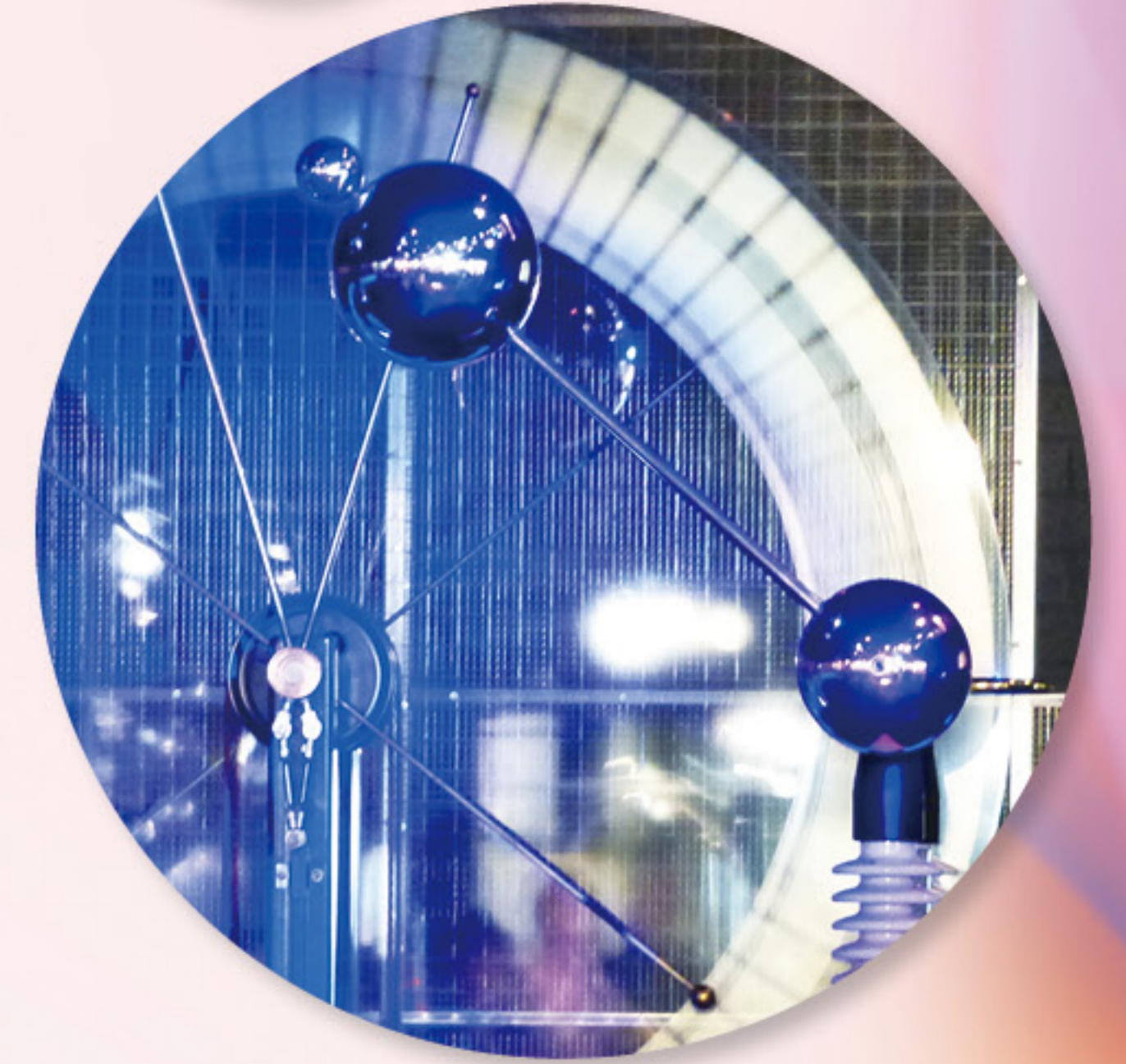
S treams of Study



- Department of Physics offers the following Streams:
 - ◆ *Astrophysics and Particle Physics Stream*
 - ◆ *Computational and Data Physics Stream*
 - ◆ *Quantum Science and Technology Stream*
 - ◆ *Enrichment Stream in Theoretical Physics (JS4690)*
- Streams guide students to use 12-15 elective units on focused sets of electives for attaining a certain depth in concepts and skills for which students will find useful in research in future studies and valuable in the workplace.
- Students who
 - ◆ *have developed an interest in the theme of a Stream by the time they do electives;*
 - ◆ *plan to pursue research opportunities in the theme of a Stream in postgraduate studies;*
 - ◆ *want to acquire the skill set in a Stream for future employment;*will find the Stream a useful guidance in their electives selection.
- A student could do up to two Streams. Students should consider their all-round training as an undergraduate besides their major subject before deciding. Stream selection will be shown in the transcript.
- It is useful to think and plan earlier, and also useful to discuss with your academic advisor. If there is a Stream that fits you, start taking Stream-specific required courses.



D ouble Majors



- The newly introduced **Physics-X Streamlined Path** provides a way for students to pursue a double major in Physics and a second discipline in either Mathematics or Earth System Science within the nominal period of study while maintaining academic rigor.
- The **Physics-X Streamlined Path** maintains academic rigor through careful merging of major requirements and partial removal of courses which are common to both majors.
- The **Physics-X Streamlined Path** prepares students to carry out cutting edge research at the interface of two closely related disciplines.
- **Physics-X Streamlined Path** is especially suitable for academically-strong students who want to have an intellectually stimulating and rewarding undergraduate experience.
- **Highlights of the Physics-X Streamlined Path**
 - ◆ *Rigorous foundation in physics and one more scientific discipline*
 - ◆ *Opportunity to engage in knowledge transfer through interdisciplinary research projects*
 - ◆ *Flexibility in future research directions*



Experiential Learning Opportunities

CUHK Physics Department has put much effort in developing effective experiential learning activities, which form an integral part of a high quality education. Many of these activities are unique among physics programs in Hong Kong. Examples of such extra-curricular learning opportunities include:

	Cumulative number of participating students
● Summer Undergraduate Research Exchange (SURE)	145 (since 2000)
● Summer Teacher AppRenticeship (STAR)	144 (since 2002)
● Overseas Program for Undergraduate students (OPUS)	62 (since 2006)
● Internship Program with Hong Kong Observatory	55 (since 2005)
● Summer Study Tour	55 (since 2017)
● Summer Internship Program	182 (since 2016)

These efforts, together with the final year research projects, of involving undergraduates into research activities have led to publications of research papers in international journals with undergraduates as co-authors. The Department also supports students to report their research results in local and international conferences.



What Our Students Say

The Physics Department at CUHK has provided me with many opportunities of overseas learning activities, research and internship. When I was in year 1, I joined the study tour to the United States, where I visited world-class research institutes, such as Kitt Peak National Observatory and Caltech, and performed astronomical observation with my schoolmates. It has broadened my horizon and enriched my knowledge in Astronomy. I also had the chance to participate in research during the very early stages of my undergraduate studies, which has offered me more insights into physics and aided my career planning. I attended a conference in Korea last year, where I presented my work, interacted with leading researchers and scholars in the field, and had a closer look at the academic world.

Today, I am an undergraduate member of the CUHK LIGO (The Laser Interferometer Gravitational-Wave Observatory) team, and Prof. Li is now my advisor. During my three years of studies in CUHK Physics, I have transformed into a more mature person, both academically and vocationally. I am glad that I made a wise choice five years ago!



– CHOI On To Sonja, Year 4 student
(Awarded the Innovation and Technology Scholarship 2021)



Physics is one of the toughest majors and has a tight schedule at CUHK. These are probably the common first impression to most of the students, and how I would describe before I joined CUHK. Time flies and my experience here overthrows all the misunderstandings. The life here actually was so fruitful, filled with all kinds of challenges and experiences. We were exposed to a more advanced view of physics, satisfying the unique interests of everyone, allowing one to create a fuller picture about the subject. All the professors in CUHK are so helpful and friendly that the boundary between professors and students is barely there. Even when they are faced with problematic students like me, who ask elementary questions way too often, they would still be patient and answer every single question in much detail.

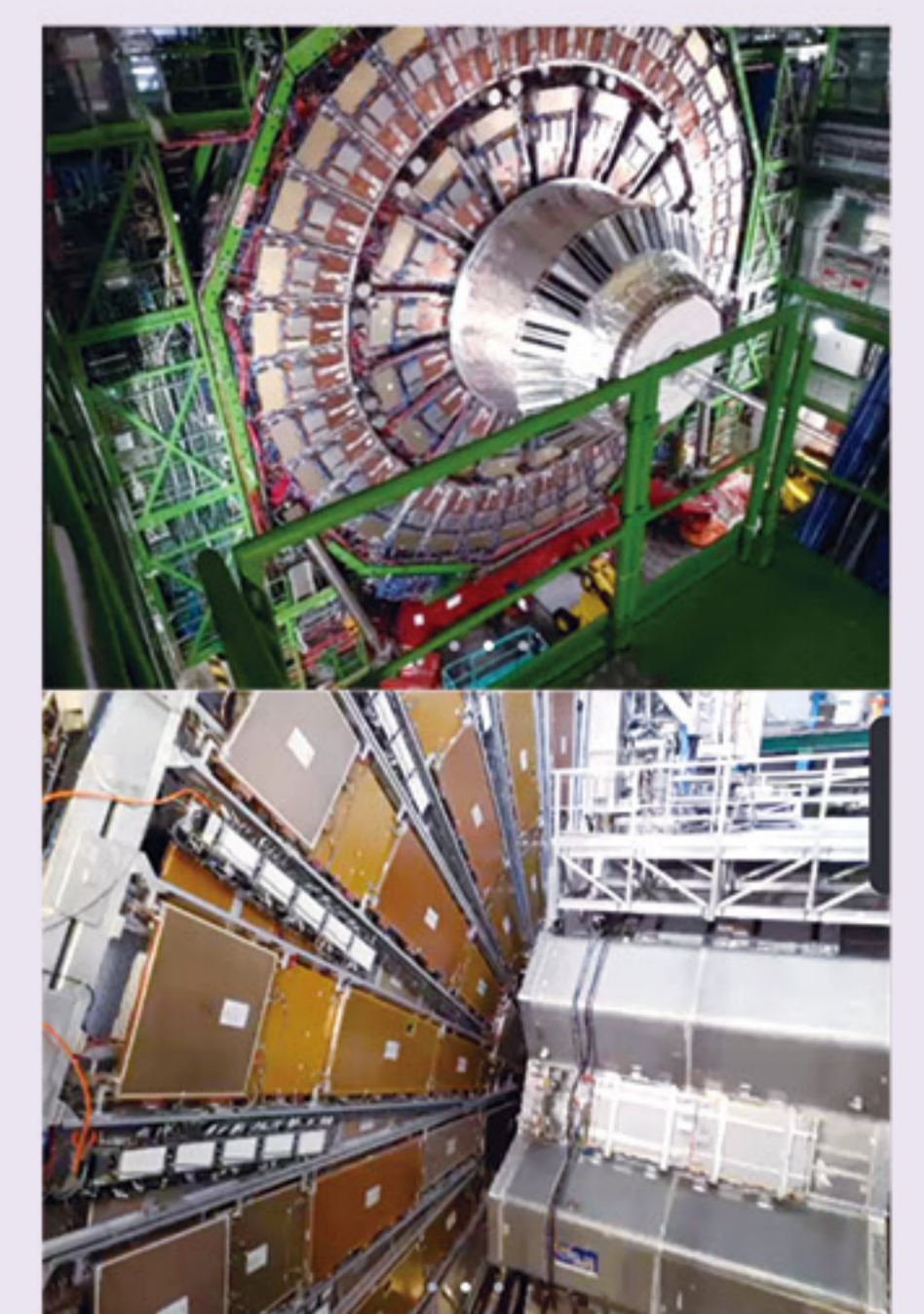
More importantly, I have met a group of great friends who share a common interest. Maybe it's because of the similar thinking style between all of us, I get along with them very well. I still remember the happiness that could not be compared when we play little pranks on each other. Meeting them is the biggest happiness in my university life..

– SO Hiu Ching, graduated in 2021

SURE (Summer Undergraduate Research Exchange Program)

Despite the pandemic, this summer I joined the CERN Summer Student Programme, which includes series of talks and lectures by experts in various topics of particle and detector physics, virtual visits to key facilities at the LHC, as well as workshops showcasing useful computational tools. I definitely learnt a lot from these activities, but more importantly, through the interaction with students from all over the world, I gained insight into different research topics that I have never imagined. Although the programme is held online this year, the virtual visits were very interactive, and Q&A sessions with lecturers were organized to help extend the ideas given in online lectures, which makes it a very complete and fruitful experience.

– AU YANG Ho Yin
2021 SURE: CERN



STAR (Summer Teacher AppRenticeship)

I am honored to be part of the summer internship program. It was a fruitful and rewarding experience and I gained valuable insight in different aspects of education. During the summer, I learnt much from my supervisors and had chances to hold summer supplementary classes and STEM activities, as well as to prepare various teaching materials. These experiences are precious and valuable as there are not many opportunities for us to work in a real classroom and to teach a class of high school students. I have learnt different teaching pedagogies and obtained useful guidance from experienced secondary school teachers to make progress and perform better in the future. Participating in this program strengthens my ability to teach students with diverse education backgrounds and enhance the quality of lessons.

I am glad that I seize the opportunity to join this program and take a glance at how teachers work, with full support from the Physics department, I am prepared for my future career as a secondary school teacher.



– **WONG Si Ching**
2021 STAR: Christ College

The STAR programme is a very fruitful and rewarding experience that allows me to utilize my knowledge to promote science education. In my 3 months at C&MA Sun Kee Secondary School (SKSS), I



worked on a STEM project called i-Marble Run, in which students from 17 schools, including SKSS, had to build a device that allows marbles to run through. Before the event, I had to teach students how to use CAD to design 3d models and use a 3d-printer to print the models out. Despite myself may not be the best teacher with 3d-printing, the students were all very nice and kind. Other than that, I also held several Physics remedial classes for S.4 and S.5 students. It was challenging as students in the same class do not generally have the same ability.

This program helps me to understand how to be a good teacher and it makes me realize the importance of good education. Being a good teacher is harder than I thought, and I am grateful for such opportunity.

– **CHIU Chun Ho**
2021 STAR: C&MA Sun Kee Secondary School

SURIP (Summer Undergraduate Research Internship Program)

In SURIP, I worked on an astroparticle physics topic, which was about the solar atmospheric gamma-ray flux. Together with three other undergraduate students, we did a computational simulation on the motion of cosmic ray protons trajectory inside in solar magnetic field and used an analytical method to solve for particle interaction.

The experience I obtained during the programme is utterly valuable. First, we undergraduate students can work as researchers in the programme. This offered us an opportunity to be exposed to frontier physics research. In classroom, we never have such an experience to take part in an actual research study for three months and work with our classmates as a team. Second, in the last week of SURIP, all participants presented their results in a poster conference. The poster presentation gave professors and students from different fields in physics to discuss the physics behind those research studies. That was a pleasant experience for me.



– **WONG Wai Yin Henry**
2021 Summer Undergraduate Research Internship Programme

This summer, I had a chance to participate in the Summer Undergraduate Research Internship Program. Through this internship, I gained experience on how to do physics research.



My internship topic is about Low Mass White Dwarfs (LMWD). LMWD are white dwarfs with a mass lower than 0.4 solar mass. It is unexpected for the existence of LMWD under today's theories. The evolution process of these LMWDs requires a time longer than the age of the universe. In this project, I built up a Decaying Dark Matter (DDM) model to explain the formation of these LMWDs. Dark matter is a mysterious substance that accounts for most of the mass in the universe while we do not know its nature. As white dwarfs are objects with strong gravity, there would be a high chance for dark matter admixed in a white dwarf. Although more calculations are still required, my results showed that the DDM model could be a possible explanation for the existence of LMWD.

Throughout the internship, I changed my view on the personal ability required to do research. I thought that only physicists who know a lot about physics could handle it. It turned out that I could make some progress even though I was only a year one student. I could learn the physics behind it during the internship. It was not difficult to understand. It was a wonderful experience to participate in research.

– **KWAN Ngai Pok**
2021 Summer Undergraduate Research Internship Program

Internship & Placement Programs

I am pleased to be able to participate in the summer internship at Pearson. During the internship, I was assigned tasks such as editing, illustrating, formatting, and proofreading. I learned how to use latex to input the whole textbook. Although the internship only lasted for less than 2 months, I learned a lot about physics textbook production. I met many wonderful people who were willing to teach me about this workplace. It was a fruitful summer, and I gained a deeper understanding of the operation of this well-known publisher. I hope I could cherish everything that I've learned and contribute to the education industry.

– CHEUNG Pak Long
2021 Summer Internship in Pearson



I worked as a summer intern in the Hong Kong Space Museum in the summer of 2021. I was assigned with many duties, and they all broadened my horizon. For example, we planned the James Webb Space Telescope (JWST) as the topic of the special exhibition in November and I was assigned to write an essay to explain the goals of JWST. It was very challenging as the target audience is the public with zero physics background. In addition, we held a tour of summer night sky on YouTube, and I was assigned to share some of the ancient Greek stories of the summer constellations. This was my first time as a KOL on YouTube!

It is happy to see so many astronomy lovers working in the museum. My colleagues are happy to share their knowledge and passion with me. Although there are many difficulties encountered in organizing events, my teams are excellent problem solvers. They are very serious and focus, tackling the problems one by one.

– CHUNG On Ching
2021 Summer Internship in Hong Kong Space Museum

I worked as a student intern at Hong Kong Observatory (HKO). Throughout this year, I learned lots of things like using the Linux OS or writing the Fortran programming language for weather forecast. I also had a chance to work on a forecasting model that uses irregular polygons to form a centroidal voronoi tessellation on a sphere. My job on this was to generate the mesh using Fortran and Python and then quantified its quality. Other than the technical duties, I also learn how to get my job done effectively and I think this is the most importance to me. Unlike my previous research experience at CUHK where there is a lot of freedom to explore a topic, working in HKO requires you to have good judgement on getting the job done and then proceed to the next task. This time management skill is useful not only to research but also to all kinds of jobs as I learn how to narrow down the scope of a task and tell myself to manage my progress properly.

– KOK Tsz Fung
2021 One-year student placement in Hong Kong Observatory

