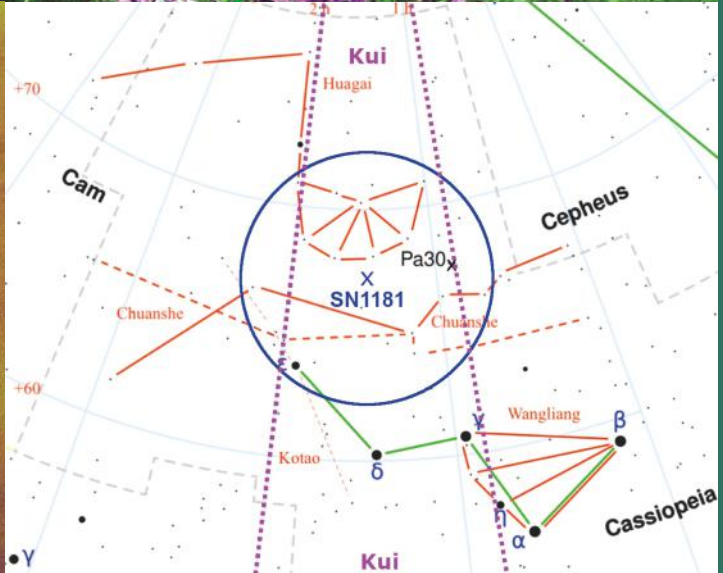
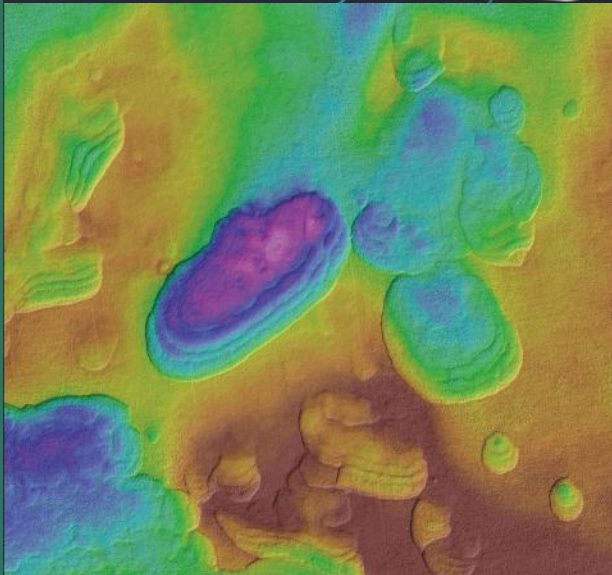
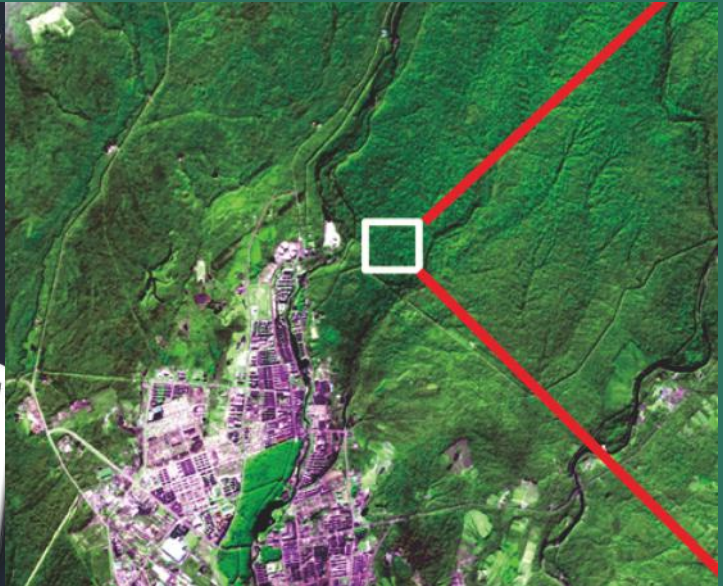
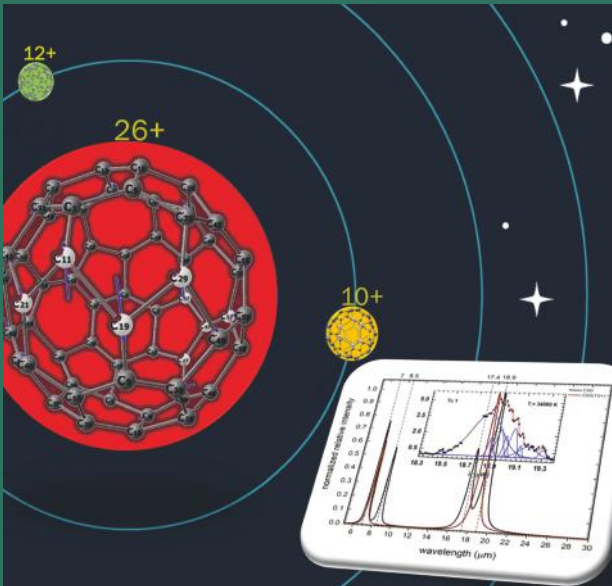




Laboratory for Space Research Annual Report 2022

Faculty of Science
The University of Hong Kong



From 1st September 2021 to 31st August 2022

Prof. Quentin Parker
Director LSR

Dr. Joe Michalski
Deputy Director LSR

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2022 LSR Annual Report

From 1st September 2021 to 31st August 2022
Foreword by the LSR director, Prof. Quentin Parker



It gives me great pleasure to present the third annual report for the Laboratory for Space Research. Once more the year has been badly affected by the global Covid pandemic but some of us, myself included, have finally, after more than two and a half years, been able to get away for much needed re-connect to collaborators, research programs, conferences and field trips as the situation slowly eases in Hong Kong. Despite the ongoing global pandemic I can report this has been another successful year for the LSR, notwithstanding some headwinds and the loss of some key personnel. None of the content

reported here would be possible without the support and contributions from all members! The LSR is nothing without this and it remains a free and open association of like-minded scientists, technologists and engineers. I am grateful for the privilege to have served the LSR and Faculty of Science at HKU over the last few years in this capacity.

I would like to express thanks to our Laboratory manager Ms. Birry Zhu for her outstanding support, including with helping with the previous annual reports and I wish her all the best in her new longer-term position as we recruit her replacement. I also want to express my deep gratitude to my deputy director Dr. Joe Michalski whose support and wise counsel have been invaluable. Finally, I want to mention the departure of my friend and colleague Dr. Pablo Saz Parkinson who left HKU after 9 years to return to UC Santa Cruz in California in August 2022 on Stanford funding. He leaves an enormous hole behind. I hope you appreciate this report and the value the LSR has brought to HKU over the last few years. Who knows what the future will bring.

With my best wishes,



Professor Quentin Parker
柏坤霆教授

September 1st 2022

1. Executive Summary of LSR activity 2021-2022 by the numbers

- 72 LSR members across 5 departments and 2 faculties (c.f. 15 in 2017 and 64 in 2021 - a further 11% growth over the reporting period)
- \$9.1 Million in Grants: 5 GRF, 1 CRF LSR (c.f. \$6.4 Million last year so a 41% increase)
- 2 MoUs organized with Phoenix Space and the Genius development STEM organization (signing pending outcome of LSR review)
- 7 publications/reviews by LSR members in top journals: 1 in Science, 1 in Nature Geoscience, 1 in Nature Astronomy, 3 in ApJ letters, 1 in Earth & Planetary Science letters and a further 2 in press in Nature Communications & Nature Astronomy
- 135 refereed publications in total (9.6 ref. papers per faculty member)
- 6 press releases (same as last year) and many associated news stories
- 52 TV interviews, newspaper articles, radio/TV show contributions – a very strong record of activity (up from 44 last year) resulting from the growing Chinese Space scene and our robust research and related activities
- 5 major initiatives currently in-train:
 - First 4 HKU-LSR proposals approved to use the JCMT as part of our Associate membership of the East Asian Observatory (EAO)
 - First implementation of STEM initiative “BEST” completed for HK high schools with our OASA/HKU academy for the talented partners
 - Phoenix Space Kiron refugee university series of “LSR” lectures for refugee students completed (see Sec 9.3)
 - 6U MeV Cubesat program under RMGS funding (special focus)
 - LSR Quantum Cube computing made available to members
- 5 Key LSR achievements over the reporting period:
 - Excellent GRF/CRF grant results obtained
 - Robust research publication record maintained
 - Outstanding BEST program successfully delivered
 - Hosted 21 LSR interns over the summer– another record
 - Significant progress with 6U CubeSat MeV Telescope project

2. LSR Mission, Vision, Structure and Value //

Our LSR Mission, Vision & Brand remains unchanged and undimmed:

- i) To emerge as a leading interdisciplinary research centre in Space and Planetary sciences across the Asian region with a strong identity
- ii) To maintain and grow the LSR to be an internationally recognised brand for research excellence in mainstream space science and related programs
- iii) To strengthen and develop our ties to the Mainland Space program and globally

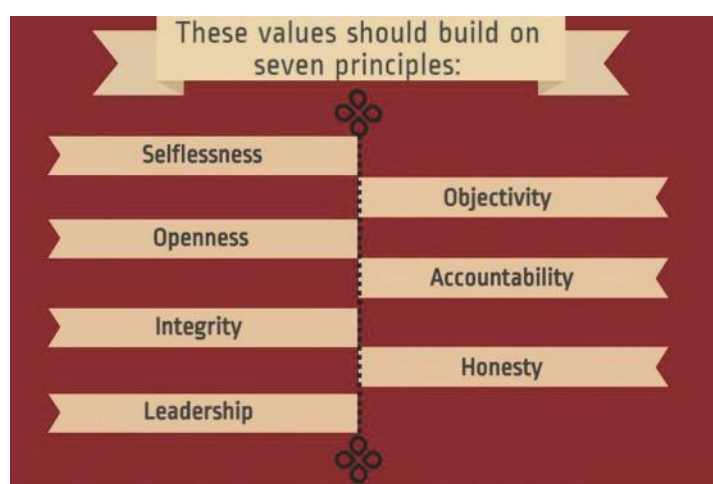
2.1. Curated LSR website with Chinese Language Version //

As part of our mission to broaden our reach and grow our profile in the Chinese Mainland, in the first half of 2021 we undertook a major revamp to our LSR web pages. This included the development of a parallel translated version in Chinese. Our web site is actively curated and updated on a regular basis and has a popular following (see web stats in Appendix II). An example page of the Chinese version of our LSR website is shown below.



2.2. Formal LSR Governance Structure (under review)

As of March 2022 we were informed that the current LSR governance structure, previously approved by the FoS in October 2020, is now under review by the Faculty with the appointment of interim Dean Yam in August 2021 (after the departure of Dean Evans). The only current operational effect of this has been that a formal hold was put on completions of two MoUs that have consequently remained unsigned since then. We hope we will be informed soon if any changes to the current robust governance structure as currently implemented are anticipated. This structure was established due to the expansion and emergence of the LSR as a strong, interdisciplinary HKU entity, with a burgeoning brand and profile as our regular press releases, research outputs and impacts show (see elsewhere in this report). Until instructed otherwise the LSR will continue to adopt the Good Governance principles based on the United Nations "Progressive Good Governance principles and guidelines" as below:



We currently adhere to good governance guidelines (creative commons graphics).

Current LSR operational parameters

The LSR is an interdisciplinary entity formally under the Faculty of Science and the following base-level operational parameters have been set.

- a. The LSR director reports directly to the Dean
- b. The LSR director is responsible for its management and for setting its strategic direction in consultation with LSR members
- c. The LSR director has the authority to negotiate agreements and MoUs on behalf of the LSR
- d. The Faculty is then responsible for approving research proposals and other LSR specific grant spending which concern the LSR as an entity
- e. The Faculty of Science is responsible for approving agreements, contracts, MoUs etc. following established procedures
 - i. This includes, where relevant, approval by the Faculty Board and/or involvement and checking by TTO and/or Research Services
 - ii. Copies of the approved agreements, contracts, etc. will be provided to the relevant people for their information and reference after the approval process has been completed

LSR Advisory Board

To assist with oversight and management a formal LSR advisory board was established in October 2020 as an official committee of the FoS. It has the following terms of reference. To:

1. Advise the Faculty of Science Board on all academic matters relating to the Laboratory for Space Research (LSR hereafter).
2. Report annually to the Faculty of Science Board on the activities of the LSR.
3. Advise on the program of activities and strategic development of the LSR.
4. Advise on suitable candidates for visiting research appointments in the LSR. Recommend appointment of the Director of the LSR.

Membership of the LSR Advisory Board

The Membership of the LSR Advisory Board is as follows:

1. Dean or Associate Dean (Research and Graduate Studies) of Faculty of Science (Chairperson).
2. The Director of the LSR or his/her delegate (to be one of the Deputy LSR Directors).
3. The Research Division Directors of Physics & Astronomy and Earth & Planetary Science (or his/her nominee(s)).
4. Three teachers of the Faculty of Science who work wholly or partly at the LSR, at least one each from the Divisions of Physics and Astronomy, and Earth and Planetary Science as appointed by the Board of the Faculty of Science (appointments 2 years, renewable).
5. At least one, and not more than three, reputable and relevant international scientists who are not members of the University staff, as nominated by the Dean of Science, and appointed by the Board of the Faculty of Science (appointments 2 years, renewable).
6. Not more than three other members, co-opted by the Advisory Board (appointments 2 years, renewable). To include at least one industry or government representative to represent views of non-academic stakeholders.

2.3. Who we are and what we offer

Advances in Astrophysics, Space and Planetary Science depend on research that is highly international and collaborative and inherently interdisciplinary. The HKU departments of Physics and Earth Sciences where most LSR members come from, are engaged in space science research via access to world-leading ground-based and space-based facilities. We are becoming involved in cross-disciplinary research related to developments in space science and technology which together provided the rationale and motivation to establish our Laboratory for Space Research (LSR) in 2017 under a previous Dean of Science Prof. Sun Kwok. Our future strategic directions depend on our continued success in grasping opportunities in HK SAR, Mainland China and elsewhere. The essential rationale for the LSR is to further collaboration with China to take advantage of the strongly emerging Chinese space programs and associated ground-based big science initiatives while remaining open and committed to a global footprint. LSR members already have close relationships with a number of senior and emerging Chinese leaders in this area. This mission fits perfectly into the desire of new VC Prof. Zhang Xiang to place HKU-China collaboration at the centre of HKU's plans. The LSR is formally a Faculty unit and an interdisciplinary entity.



Research

Home > Research > Interdisciplinary Research Units ▼

INTERDISCIPLINARY RESEARCH UNITS

HKU-TCL Joint Research Centre for Artificial Intelligence

[Click for more](#) →

HKU-UCAS Joint Institute of Theoretical and Computational Physics at Hong Kong

[Click for more](#) →

Institute of Mathematical Research (IMR)

[Click for more](#) →

Laboratory for Space Research (LSR)

[Click for more](#) →

The Swire Institute of Marine Science (SWIMS)

[Click for more](#) →

Apart from offering a strongly supportive collegiate environment in terms of practical help the LSR offers all its members the following real benefits:

- i) Dedicated administrative support for HR issues, travel, grants and other general administrative assistance as required
- ii) Travel and other financial support
- iii) Access to all Chinese Mainland Observing facilities as negotiated with the NAOC and enshrined in an MoU
- iv) Access to guaranteed time on the JCMT in Hawaii as part of our Associate Membership of the East Asian Observatory
- v) Access to all the opportunities, projects, collaborations and more from our international partners based on our strategic selection of MoUs
- vi) Use of the LSR's powerful Quantum computing System
- vii) Use of the LSR's "Overleaf" licence for helping with publications and sharing editable papers with collaborators
- viii) Dedicated mail exploder to share news, views, updates and opportunities with members
- ix) Excellent work spaces for student and postdocs in the LSRs main location in Cyberport 4
- x) Access to summer research support via our vibrant internship program,
- xi) Social events such as the LSR research jamboree, Christmas party, Kennedy-Town lunches and more

3. Summary of Current LSR Membership

There are currently 72 LSR members from 5 departments and 2 faculties including various affiliates from outside HKU (www.lsr.hku.hk/members/). This compares with 64 members for the last report in 2021 and 15 when first established in 2017. Our pattern of growth (12% this year) continues. During this period we had 11 departures to new positions and as contracts end and 19 new members in a healthy process of change and renewal.

We remain an open, inclusive and free association of HKU faculty (16), RAPs (2), postdocs (7), RPG students (19), RAs (6), Undergraduates (7) and external associates (15). There is no pressure to join. The LSR has a flat structure under the executive where collegiality and respect are paramount. Most members are based at HKU's main campus and are formal HKU staff or students though we retain a few ex-HKU staff as members as affiliates when they move to another institution if they express a strong wish to maintain ties. We have selectively allowed some particularly important outside associates as members where this is seen as beneficial to the LSR, but we limit these. The current membership list does not include interns (21 this summer – another record). We have a total of 26 ex-members who have left the LSR since its inception. The full membership list is given in Appendix V.

4. Budget and Funding

Currently there is still no ongoing annual HKU budget allocated that supports the LSR. The FoS pays the rent of our offices in Cyberport which is a key contribution. The LSR was funded first by a \$10 million UDF 2016-2018 that was used to hire 3 faculty members (Meng Su, Joe Michalski and Binzheng Zhang) and then by a HK\$10 million BRC in October 2018 that included 5 million RMB for our first satellite (the Lobster Eye X-ray satellite launched July 25th 2020). The BRC grant remains active until December 2022 with ~HK\$0.15 million still available as of August 2022. The new BRC 6-year round provided funding for four LSR related posts with 2 in Physics and a further 2 with DES. However, none were chosen to be implemented by either department. Indeed, in terms of astrophysicists in Physics, posts have declined from 6 to 4 as other physics faculty numbers have grown from 16 to 27 over the last 2 years. It is clear a secure, adequate, and more autonomous HKU based funding and support mechanism is required for astrophysics and space and planetary sciences given the interdisciplinary nature of our activities. We cannot rely on one-off schemes for funding like the RMGS.

4.1. UGC Research Matching Grant Scheme (RMGS)

Our ability to function continues to rely on the fraction of RMGS funding that still remains under LSR control (now only the two RMGS grants to PI Parker in rounds 1 and 4) that amounts to ~\$15million originally awarded. Further LSR affiliated applications from Michalski and Webb (round 5) provided a further HK\$1.9 and HK\$10.6 million respectively. The entire set of RMGS funding expires in Dec 2023 so we hope a new HKU LSR funding model will be in place before then if the LSR is, in fact, to continue either at HKU main campus or indeed at the new Shenzhen campus.

4.2. The RGC General Research Fund (GRF) and Collaborative Research Fund (CRF)

Individual LSR members remain very active in winning RGC GRF and ECR grants with 33 such grants over the last 5 years, including 6 LSR faculty who won grants in the 2022 GRF/CRF round relevant to this report (cf 8 LSR faculty last year). GRF success in Physics was much improved this year too. One GRF grant went to an LSR member in the Faculty of Engineering and one to our sole SBS LSR member. These GRF grants brought in HK\$9.09 million at an average of HK 894K/grant for the 5 GRFs (c.f. HK\$700K/GRF grant for last year) plus \$4.62million for the excellent CRF awarded to Dr. Joe Michalski, our LSR deputy director. This is the first CRF grant led by a member of the Department of Earth Sciences and the first in the LSR. Winning peer reviewed competitive facility access on ground and space based observing facilities (such as FAST, Arecibo, NICER, SALT, ESO VLT) is also a regular feature of LSR, usually worth several million HKD annually.

A final worthy point is the award in HKU's 46th round of the PDR/RAP scheme of an RAP for Dr. Jiacheng Liu to work with Dr. Michalski's group in DES/LSR.

5. Selected Research Activities and Initiatives

Members have a vibrant, active and diverse interdisciplinary research program (see: <https://www.lsr.hku.hk/research/>). Members engage in multi-disciplinary research including high-energy astrophysics from ground-based and satellite-based detectors; space-based Earth remote sensing; atmospheric science, near Earth environment, planetary and associated geological sciences with an emphasis on terrestrial planets, and late stage stellar evolution, including planetary nebulae (see Aug 26th 2022 press release) and supernova remnants and astrochemistry (subject of a recent press release on July 28th 2022) as recent HKU research, awards and press releases show. We continue to perform as a strong and vibrant interdisciplinary entity at HKU.

LSR Distinguished Visitors Program: In previous years the LSR has promoted a vigorous distinguished visitor program. Unfortunately, due to ongoing Covid restrictions, we have been unable to host any international visitors again this year, including our Hung Hing Ying distinguished professor Albert Zijlstra. As soon as the global pandemic eases we will seek to robustly address this.

Specific Highlights: A few specific highlights from the reporting year are given below but a more comprehensive listing from individual members is given in Appendix I.

On 25th February 2022 the LSR formally announced the availability of the LSR's "Quantum Cube TM" computing cluster now accessible from the HKU network with its own IP address. It has one master node and 3 slave nodes. It has a total 128 cpu cores, 24 TB of hard drive capacity and 396 GB DDR3 memory. The Machine has been designed to run any mathematical simulations codes that cannot be done on PCs or small servers.

The Quantum Cube is an LSR and Faculty of Science facility that is not on the Physics department inventory. In the interests of inclusivity the LSR has granted access to anyone from the broader astrophysics and planetary sciences community at HKU who might need it. LSR membership is encouraged but not required for access. If you are interested in using this resource please send an e-mail to Dr. Andreas Ritter (LSR-IT support: aritter@hku.hk) who is responsible for managing this facility and who will tell you how to gain access and provide basic support.

Quantum Cube Hardware: (Advanced Configuration)

The master node has:

- Two 2.3 GHz 16-core AMD Opteron processors (32 Cores on each Motherboard)
- 96 GB of DDR3-1600 ECC/REG (fully buffered) memory
- Two 3 TB Serial ATA2 hard drives (7200 rpm, 64MB cache) (6 TB in total) with RAID mirroring & striping for additional security and faster I/O)

Each slave node has:

- Two 2.3 GHz 16-core AMD Opteron Abu Dhabi processors (32 Cores on each Motherboard)
- 96 GB of DDR3-1600 ECC/REG (fully buffered) memory
- Two 3 TB Serial ATA2 hard drives (7200 rpm, 64MB cache) (6 TB in Total)
- (with RAID mirroring & striping for additional security and faster I/O)

Installed Software

- System: Linux O/S (currently CentOS 6.4+ extras)
- XFree86 X-Windows X11R6
- TCP/IP networking
- Fortran and C/C++ compilers, (gcc/g77 and Intel)
- Java compilers for prolog, pearl, ruby, python & other languages
- Parallel Virtual Machine (PVM) for parallel computations.
- Message Passing Interface (MPI1, MPI2, OpenMPI) for parallel computations.
- Sun Grid Engine (SGE) parallel job queue

Capability

Parallel Computations in both Shared and Multi-nodes modes. Nodes are communicating via TCP/IP.

Performance:

Handpicked hardware and operating system are delivering stability for prolonged (months of non-stop) mathematical simulations. The performance of the machine varies with the computer codes and number of users.

Number of Users

Flexible. Can accommodate 12 users with heavy load computations and many more with more modest requirements. The maximum number of users depends on available hardware resources and the code that they want to run on the cluster.



*The LSR Quantum Cube in situ in the server room in Cyberport
This system was used to perform many of the quantum chemistry calculations carried out by Dr. Sadjadi for the work highlighted in the recent July 28th 2022 Press Release on the Unidentified InfraRed Emission (UIE) Bands that may be due to highly ionized C₆₀ Buckminster fullerene referred to elsewhere in this report.*

5.2. The 6U CubeSat MeV Gamma-ray Telescope Project (special focus)

The LSR proposed to design, develop and launch a novel 6U CubeSat for MeV Gamma-ray astronomy. Building on our expertise with Fermi LAT and using similar silicon detector technology but with crucial modifications, we proposed an MeV telescope as a "pathfinder" for a next generation MeV satellite. Our preliminary designs (Lucchetta et al. 2017, Rando et al. 2019, Prochilo et al. 2020) suggest that we can achieve a sensitivity better than the last MeV space telescope (COMPTEL), in a significantly smaller volume, significantly lowering costs. Our RMGS funded project, at 1/3rd share with our partners, will enable us to demonstrate cutting-edge technology and develop the necessary partnerships to give us a leading role in a future large MeV space mission, hence opening up the least explored window of the electromagnetic spectrum. The LSR, via signed MoU's with our international partners Padova-CISAS in Italy and Zhejiang University micro-satellites research group in the Mainland, brought these two key partners on board in this shared mission.



Formal launch of the LSR led 6U CubeSat MeV Gamma-ray telescope project in Jan 2022. The photo shows 11 of 12 current LSR 6U CubeSat project members.

(a) Long-term impact of this LSR led project

Enabling the development of the next generation MeV gamma-ray satellite and cementing the strategic partnership between HKU and our key partners, led by Zhejiang University & Padova-CISAS.

(b) Project objectives

- Demonstrate the new technology that will be used in future MeV gamma-ray telescopes.
- Strengthen the existing partnerships for building such low-cost science space missions at HKU and proposing for larger space missions such as PANGU (e.g. between China and Europe).
- Integrate the latest research in satellite and space science into HKU's Research goals.

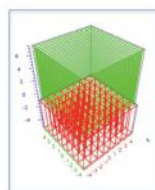
(c) Deliverables

- We will design, build, test, launch, and operate a 6U CubeSat for detecting MeV gamma rays.
- A Mission Operations Centre at HKU/HKU-Shenzhen, to receive, process, and store CubeSat data.
- We will present results at relevant conferences and publish our investigations (including CubeSat design and analysis of CubeSat data) in refereed journal articles and technical reports.
- We will engage in KE via public talks in primary and secondary schools, and in the community as a whole (e.g. as part of the FoS Science Talks and Public Lecture Series), and through our social media presence, disseminating and publicizing the results of our efforts.

- Prof. Quentin Parker (Prof.) - Project Manager
- Dr. Pablo Saz Parkinson (RAP) - Science/simulations
- Dr. Andreas Ritter (Post-doc) - IT/computing (Quantum Cube)
- Dr. Partha Sarathi Pal (Post-doc) - Science (MeV/TeV pulsars), Support
- Ms. Rosaria Prochilo (RA) - Project Engineer
- Mr. Andy Kong (PhD Student) - Electrical engineering PhD
- Ms. Haoyang Yuan (MPhil Student) - X-ray/Gamma-ray background
- Mr. Kees De Kuijper (RA) - Simulations/Science (MeV background)
- Ms. Laura Panebianco (RA) - Science (soft gamma-ray pulsars)
- Ms. Hannah Ma (RA) - Engineering/Solar panels. (HKUST MPhil)
- Mr. Rishank Diwan (RA) - TBD
- Mr. Aditya Mangla (RA, HKUST UG) - TBD. Starting July 13th

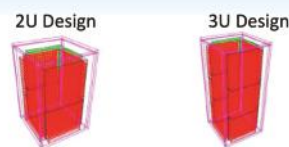
List of LSR 6U CubeSat project members and their current roles – Dr. Saz Parkinson was Project Scientist until August 15th 2022 – Dr. Partha Pal has now taken over this role with Dr. Saz Parkinson's (hopefully temporary) departure to UC Santa-Cruz, California.

Summary of some of the LSR based simulation work on the performance characteristics of the CubeSat detector payload undertaken by 3 TPG Space Science MSc students supervised by LSR members as their Capstone project.



- Design of a tracker on a 6U MeV CubeSat (Luo Hongyang)
- Sensitivity of a 6U MeV CubeSat to Astrophysical Sources (Kees de Kuijper)
- Background rejection for a 6U MeV Cubesat (Wang Tiantong (Seren))

6U MeV CubeSat Overview of Simulation work



Materials and mass of the 2U and 3U CubeSat

| Material | Mass in 2U (g) | Mass in 3U(g) |
|-----------|----------------|---------------|
| CsI | 1822.500 | 2632.500 |
| Silicon | 382.772 | 574.159 |
| Millipore | 288.693 | 417.001 |
| NE110 | 455.595 | 616.481 |
| Vacuum | 0.003 | 0.003 |
| Total | 2949.563 | 4240.143 |

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HKU Laboratory for Space Research (Hong Kong SAR, PRC) Lead Organization
Main responsibilities: Project Management, Simulations, science, funding

Padova-CISAS (Padova, Italy)
Main responsibilities: The detector, testing and development, science, funding, and in-kind staff support

Zhejiang University (China)
Main responsibilities: COTS and bespoke systems provision, systems testing and satellite and payload integration, launch and in-kind staff support

Universidad Complutense (Madrid, Spain)
Possible contributions: Trigger system, science, in-kind staff support, funding

The 6U CubeSat international collaboration and areas of responsibility. We hope the Complutense university in Madrid will join the consortium following on from the LSR delegation visit to them in July to showcase the mission.



LSR delegation of Prof. Q. Parker, Ms. Rosaria Prochilo and Ms. Hao Yang Zhang visiting Padova-CISAS to discuss CubeSat project July 19th 2022 also with Padova-CISAS representatives Prof. Denis Bastieri and Dr. Da Zhang.



Prof. Q. Parker giving a talk on CubeSat project at the Universidad Complutense, Madrid, 22nd July 2022, as part of invitation for them to join the LSR led CubeSat project.

5.3. Our first CRF and Strategic Seed Grant to explore lakes on Mars

In a first for the LSR and Department of Earth Sciences, Dr. Joe Michalski, LSR Deputy Director, has been awarded a \$4.62million Collaborative Research Fund RGC grant to lead a joint team from CUHK and PolyU to characterize ancient lake basins on Mars. The project will use advanced topographic modeling and innovative spectroscopic techniques based on HKU expertise and facilities within Dr. Michalski's PSML Laboratory: <https://www.clays.space/lab>.

Some germane plots extracted from the science case that won this important and prestigious award are shown below.

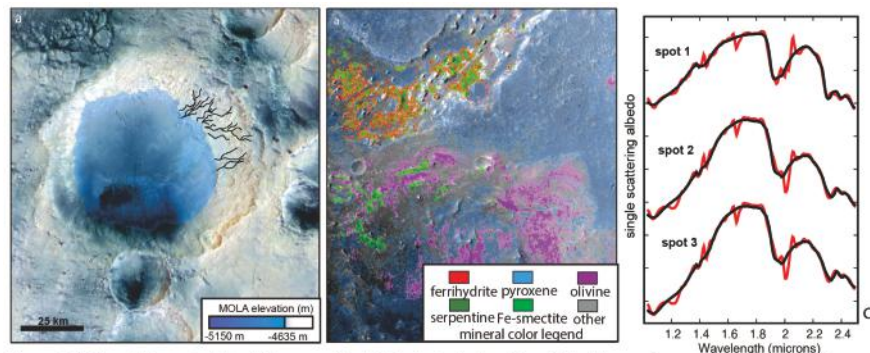


Figure 3: McLaughlin crater lake (a) shown with HRSC-derived elevation of the lake surface as defined by termination of channels and identification of delta features. Modeled mineral abundances from CRISM data are shown in "b" and examples of modeled spectra are shown in "c."

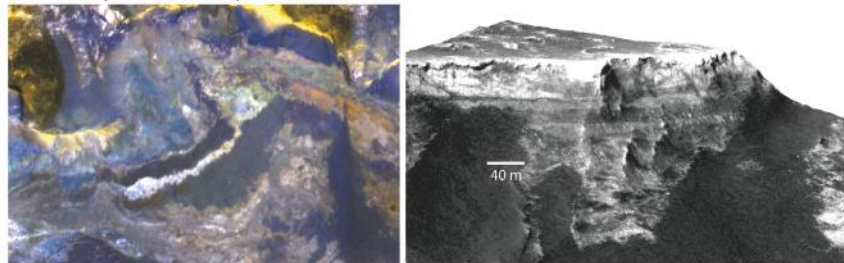


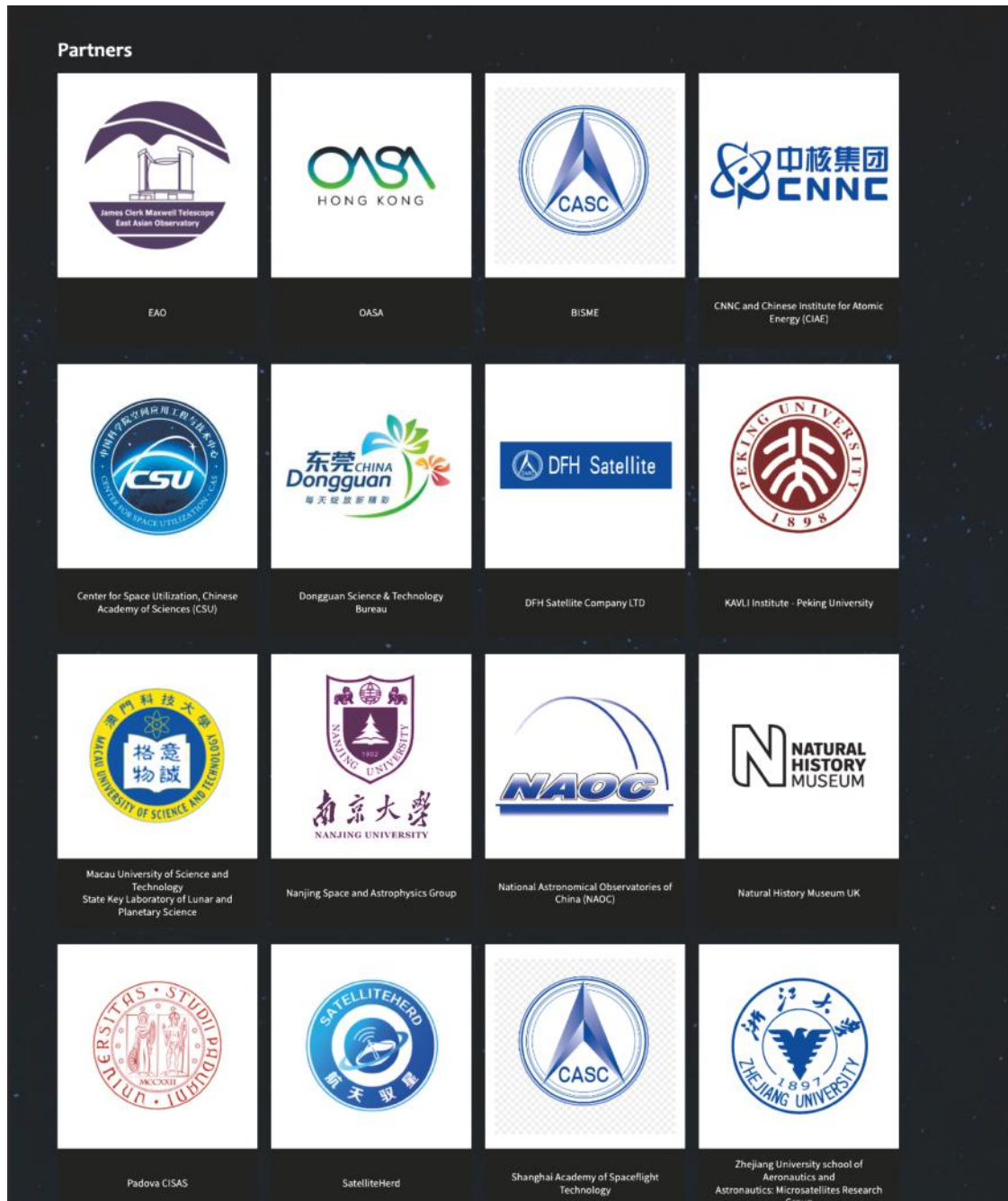
Figure 4: HiRISE color data show deposits in the floor of McLaughlin crater in false color (a) illustrating striking color / mineralogy boundaries representative of ancient chemical gradients that could have been desirable for microbial life. A HiRISE 3D image (b) shows exposures of layered stratigraphy in the floor of McLaughlin crater.



As part of his sabbatical and in support of his CRF and related research projects Dr. Michalski travelled to Iceland in June-July 2022 to carry out volcanology field-work.

6. Ongoing Collaborations and Partnerships

The LSR currently has 21 active MoUs and agreements starting with the first in October 2017 and the most recent in March 2022 with an agreement for the LSR to join the Sun Yat-sen University based Chinese Survey Space Telescope (CSST) science centre. We have been proactive and highly strategic in establishing key international collaborations and partnerships that often lead to MoUs. We have committed to only signing “meaningful”, highly targeted MoUs and agreements where our partners can commit real intent and resources to create joint, impactful endeavours. We only teamup with the highest quality partners – the most influential, leading, and significant.



Official logos of all current, formal individual organisation LSR partners. All our partnerships have been established via signed MoUs and agreements.

6.1. MoUs and agreements still in train over the reporting period

No MoUs were signed over the 2021-2022 reporting period as our strategic targets here have now largely been met but there are two still in train with Phoenix space as a result of our LSR lecture series for the Kiron refugee university and one with the Hong Kong-based Genius Development group who teach independently intensive STEM education to young HK SAR children: <https://www.geniusdevelop.com/about-us>. These have been held-up due to the LSR review. We did, however, join the Chinese Survey Space Telescope (CSST) Science Centre for the GBA based at Sun Yat-sen University (see section 6.3).

6.2. Member access to the JCMT through our EAO initiative

The MoU with the EAO (<https://www.eaobservatory.org/>) was a strategic move on the part of the LSR in 2020. As a result HKU-LSR is entitled to 25 hours of access time on the JCMT telescope per year. As a show of openness and solidarity the LSR decided to make this time available to all astronomers and researchers at HKU whether they were LSR members or not. A call for observing proposals was sent to all LSR members and all members of the HKU astro group in May 2022. The proposals were assessed for technical feasibility and scientific excellence by the appropriate JCMT committee and the results are given below where band 1 is considered the highest classification.

HKU proposals observatory feedback

Four programs submitted for time under HKU funding - are summarized in the table below.

| Requested | Instrument | Band 1 | Band 2 | Band 3 | Band 4 | Band 5 | Total |
|-----------|------------|--------|--------|--------|--------|--------|-------|
| M22AF002 | SCUBA-2 | | 5 | | | | 5 |
| M22AF003 | SCUBA-2 | 12 | | | | | 12 |
| M22AF004 | SCUBA-2 | | 18 | | | | 18 |
| M22AF005 | HARP | | 40 | | | | 40 |
| Total | | 12 | 63 | | | | 75 |

After Technical assessment from the observatory (taking into account clashes, and instrument capabilities we find the request to the JCMT is:

| Adjustment request after observatory review | Instrument | Band 1 | Band 2 | Band 3 | Band 4 | Band 5 | Total |
|---|------------|--------|--------|--------|--------|--------|-------|
| M22AF002 (22B) | SCUBA-2 | | 5 | | | | 5 |
| M22AF003 (23A) | SCUBA-2 | 12 | | | | | 12 |
| M22AF004 (23A) | SCUBA-2 | | 8 | | | | 8 |
| M22AF005 (22B) | HARP | | 40 | | | | 40 |
| Total | | 12 | 53 | | | | 65 |

Summary of JCMT panel assessments of the HKU-LSR submitted observing proposals for JCMT time. Our allocation was capped at 50 hours.

6.3. Membership of the GBA CSST Science Centre

In March 2022 the LSR was invited to become a formal member of the GBA CSST Research Centre based at SYSU in Zhuhai. Six LSR members formally joined at this time in the first membership call and one non LSR member from the Physics Department. We believe this CSST science centre will rival those in Beijing and Shanghai in terms of our research proposals. We hope the LSR will play a full role in formulating exciting proposals to use the CSST emanating from the SYSU centre. Covid has prevented travel to the centre to work with colleagues there but we hope 2023 will be different. The plaque celebrating the university collaboration in this new initiative is given below.



Plaque showing the 12 universities that are official members of the GBA SYSU CSST science centre with HKU taking pride of place next to SYSU itself as host. 5 member universities are from HK SAR.

7. Selected Contributions and Achievements from LSR members

2022 EXTERNAL AWARD

Dr Joseph Michalski elected as a Fellow of the Geological Society of America 2022

Dr Joseph MICHALSKI, Associate Professor of the Department of Earth Sciences and Deputy Director of the Laboratory for Space Research at The University of Hong Kong (HKU), has been elected as a Fellow of the Geological Society of America (GSA) 2022, in recognition of his efforts in forging novel and paradigm-shifting theories about Mars in the areas of volcanism, climate history, and a potential deep biosphere, as well as mentoring and training young planetary scientists, and his thoughtful leadership of geoscience programs.

GSA Fellowship is an honour bestowed once per year at the spring GSA Council meeting. GSA members are nominated by other GSA members in recognition of a sustained record of distinguished contributions to the geosciences and the Geological Society of America through such avenues as publications, applied research, teaching, administration of geological programs, contributing to the public awareness of geology, leadership of professional organizations, and taking on editorial, bibliographic, and library responsibilities.

About Dr Joseph Michalski

Dr Michalski is a geologist and planetary scientist interested in mineral exploration (on any planet) and the relationship between geology, mineralogy and life, whose expertise is in clay mineralogy, clay minerals in the solar system, the geology and astrobiology of Mars, and remote sensing and spectroscopy.

He is also a Fellow of the Canadian Institute for Advanced Research (CIFAR - Earth4D) and a senior editor for Oxford University Press.

About GSA

GSA is a global professional society with a membership of more than 20,000 individuals in more than 100 countries. GSA provides access to elements that are essential to the professional growth of earth scientists at all levels of expertise and from all sectors: academic, government, business, and industry. The Society unites thousands of earth scientists from every corner of the globe with a common purpose to study the mysteries of our planet (and beyond) and share scientific findings.



THE
GEOLOGICAL
SOCIETY
OF AMERICA®

**DR JOSEPH MICHALSKI
ELECTED AS A FELLOW
OF THE GEOLOGICAL
SOCIETY OF AMERICA
2022**



Dr. Joe Michalski was elected a fellow of the prestigious Geological Society of America (GSA) by their Council in July 2022. Society Fellowship is an honor bestowed on the best of their profession by election at the spring GSA Council meetings. GSA members are nominated by other GSA members in recognition of a sustained record of distinguished contributions to the geosciences and the Geological Society of America



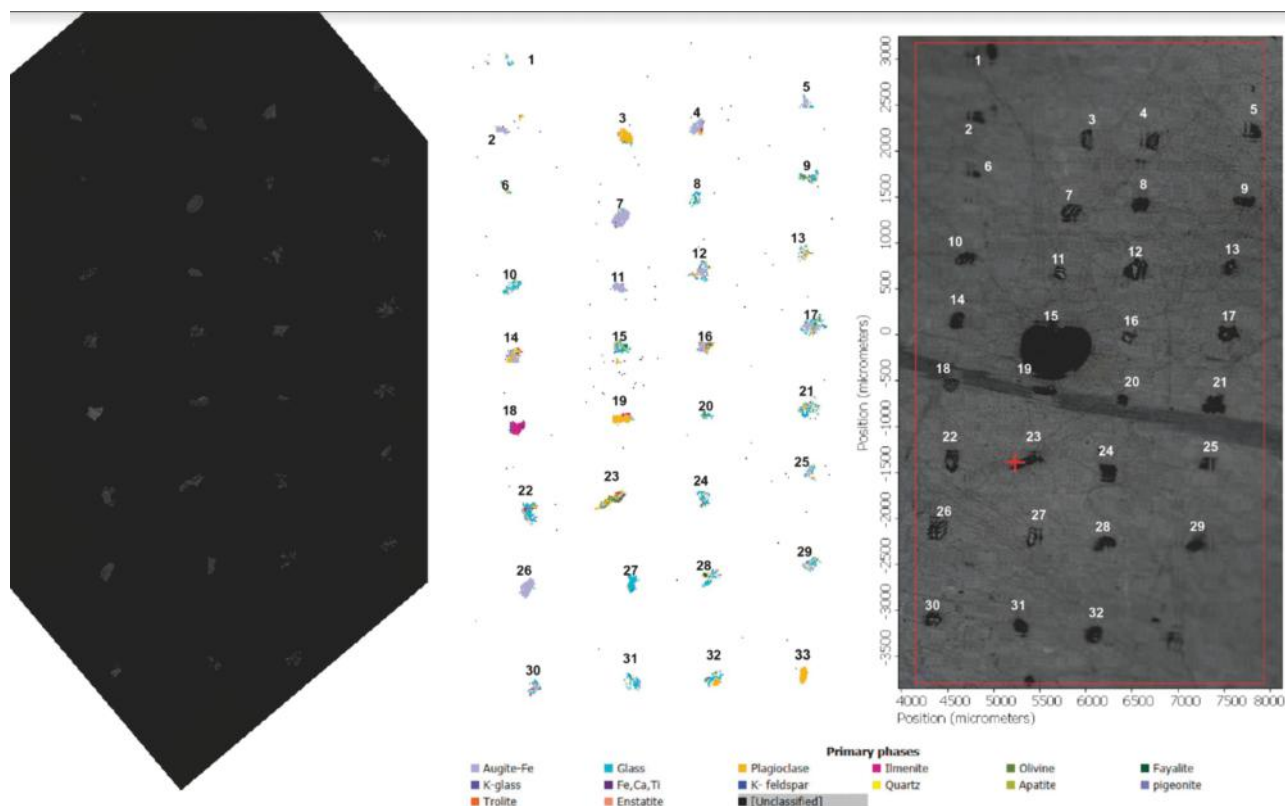
Prof. Quentin Parker being presented with the medal for the Gemini prize for 2022 co-organised by La Société astronomique de France (SAF) and Société Française d'Astronomie et d'Astrophysique (SF2A), for a project in collaboration with a French amateur team led by Pascal Le Dû 'Search for and Confirmation of Planetary Nebulae Candidates' by the Director of the Strasbourg Observatory Dr. Pierre Allan Duc in Strasbourg in July 2022
<https://www.hku.hk/press/press-releases/detail/24617.html>

China's Moon Dust Paves the Way for Future Mining Missions

APRIL 21, 2022



Dr. Joe Michalski, LSR deputy director, was interviewed by Wall Street Journal to share his insight on moon mining. Please view the video in this link: <https://www.wsj.com/video/chinas-moon-dust-paves-the-way-for-future-mining-missions/A6A9112C-94BC-46C2-A23E-65FF40676756.html>



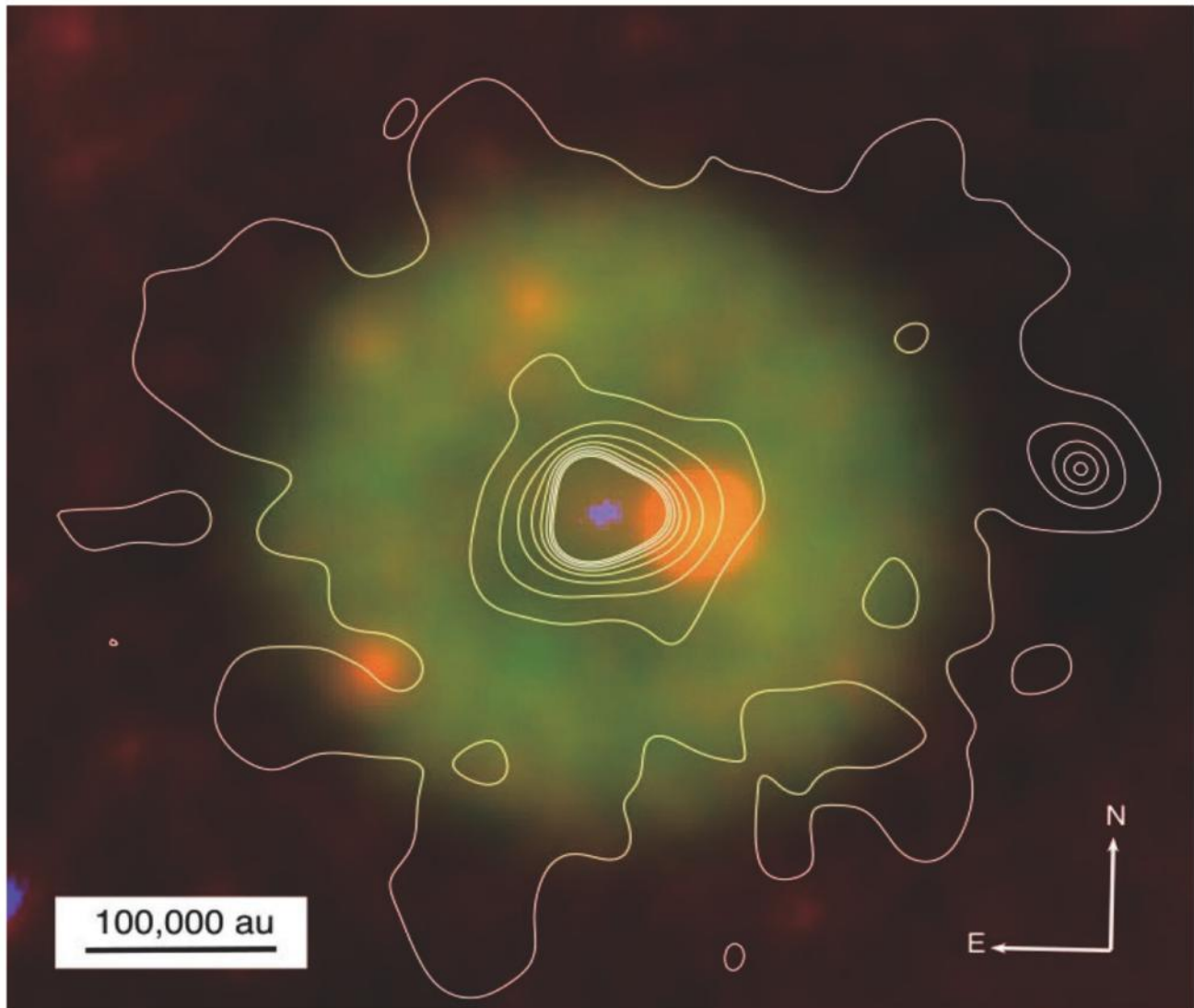
The Planetary Spectroscopy and Mineralogy Laboratory analyses samples of Moon dust returned by Chang'e 5 – HKU-LSR and PSML lab is honoured to be able to work on a sample of moon dust from China's remarkable sample return mission.



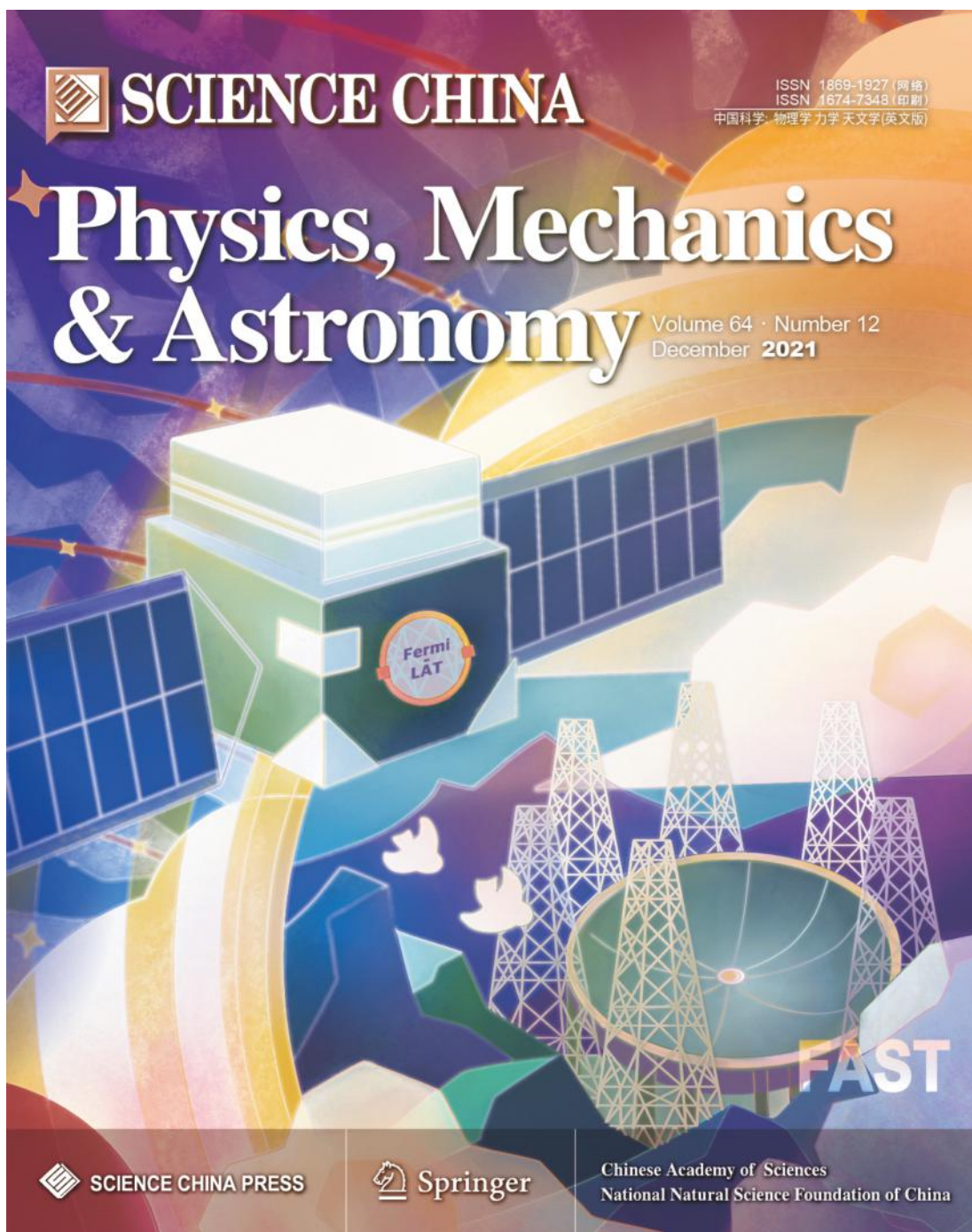
Dr. Andreas Ritter

Webinar by Dr. Andreas Ritter

 DECEMBER 07, 2021



Dr. Andreas Ritter will give a speech on 8th December about Parker's Star – Pa 30 and implications for supernovae of type Ia at SuperNova Explosions group SNE_x, which is hosted by the Hagai Perets group, Department of Physics, Technion, Israel.

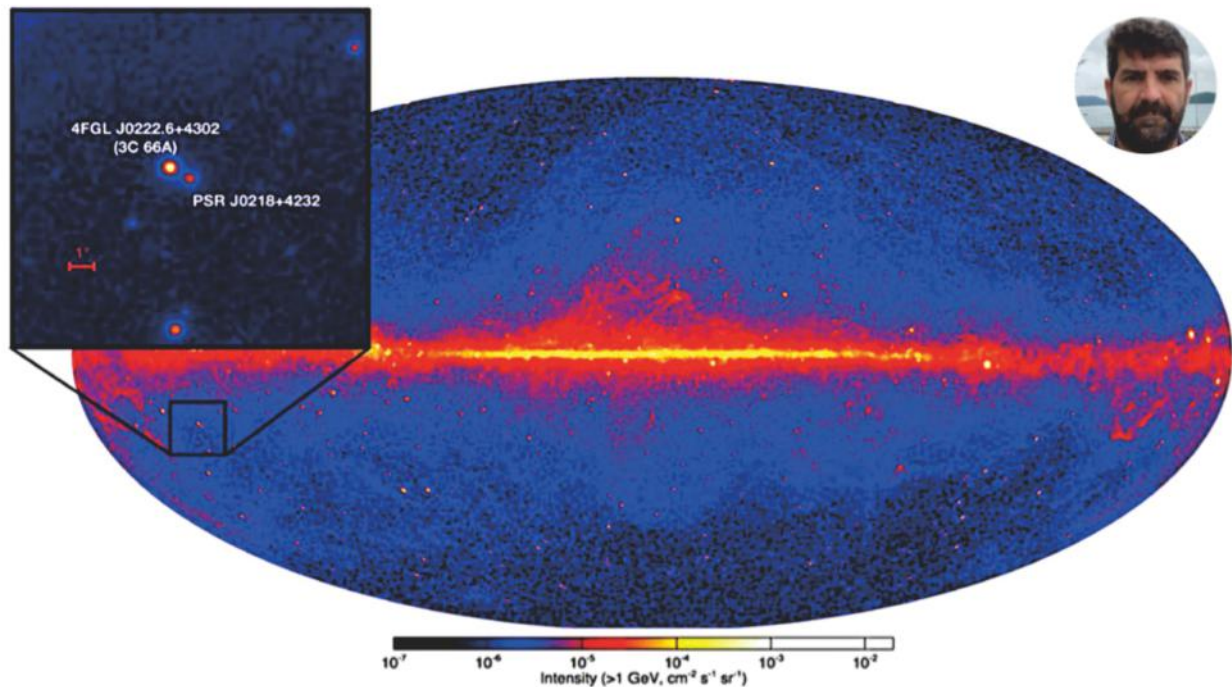


The titled article by LSR senior member Dr. Pablo Saz Parkinson, was published on Science China Physics, Mechanics & Astronomy. Interested please click to download.

Here's the link to the article itself:

<https://ui.adsabs.harvard.edu/abs/2021SCPMA..6429562W/abstract>

FAST, the world's largest single dish radio telescope discovered an extremely radio-faint millisecond pulsar from the Fermi-LAT unassociated source 3FGL J0318.1+0252 as a result of a close collaboration between Fermi and FAST. Dr. Pablo Saz Parkinson played a fundamental role in this discovery and is co-author on the prestigious "Science" journal. This widely read Chinese popular science magazine put the story on the front cover in December 2021 with editorial comment.



Dr. Pablo Saz Parkinson (image top right) et al. 2022 published results of his GRF project on the highest energy emission from millisecond pulsar PSR J0218+4232. They showed that this pulsar emits gamma rays up to 25 GeV, making it the most highly energetic millisecond pulsar known. It is thus one of the youngest and most energetic millisecond pulsars with results published in The Astrophysical Journal (ApJ, 922, 251. doi:10.3847/1538-4357/ac20d7) during the reporting period.



result, from many years of study was partially funded by HKU's Big Data Project Fund. Their main results showed how Neural Networks and Boosted Decision Trees can both be used to improve the signal-to-noise of HAWC.

8. LSR Press Releases (September 1st 2021 to 31st August 2022)

We remain very proactive in seeking publicity for our most significant activities, research outputs and initiatives. Over the reporting period we have again had several key HKU LSR press releases that have generated news stories and significant press. Our coverage has been especially prominent in the Mainland, including TV, video, radio and in print. Links to all 6 of the HKU press releases (same number as last year) are given below while the list of the key media coverage arising from these and all other media coverage involving the LSR (including relevant web links) are provided in Appendix VI.

1. September 2nd 2021

HKU environmental scientists solve key observational issues in new generation of satellites, transforming the way to track fine-scale changes of our planet from space:

<https://hku.hk/press/press-releases/detail/23190.html>

2. September 15th 2021

An explosive Cosmic Chinese Conundrum - a hot detective story from a very cold case: HKU Astrophysicists solve a 900-year-old mystery, giving an ancient Chinese guest star of AD1181 a place to stay and rest:

<https://hku.hk/press/press-releases/detail/23256.html>

3. May 9th 2022

Secondary School Students team up to simulate production of "CubeSat" prototypes to unfold business opportunities in the "NewSpace" era:

<https://hku.hk/press/press-releases/detail/24487.html>

4. June 1st 2022

HKU Astrophysicist Professor Quentin Parker and His Collaborators
Awarded the 2022 Gemini Prize:

<https://hku.hk/press/press-releases/detail/24617.html>

5. July 28th 2022

HKU Laboratory for Space Research put a positive spin on the Buckyball 'C60': Its potential for high level ionisation and as the origin for some of the Mysterious Unidentified Infrared Emission Bands seen in the Universe:

<https://hku.hk/press/press-releases/detail/24859.html>

6. August 26th 2022

Discovery of the oldest visible planetary nebula hosted by a 500 million year old Galactic cluster – a rare beauty with a hot blue heart:

<https://hku.hk/press/press-releases/detail/24977.html>

9. Selected Knowledge Exchange, community service and outreach activities

The LSR prides itself on its outreach, Knowledge Exchange and community service activities. We believe these are an important part of our mission to educate and influence students and the public more broadly in Astrophysics, Space and Planetary Sciences and related activities.

9.1. The “BEST” Business Economy in Space Technology STEM initiative (special focus)



In collaboration with OASA and the HKU Academy for the Talented the LSR ran the “Business Economy for Space Technology (BEST)” programme for Hong Kong secondary school students from Sept 2021 to April 2022 – see <https://cubesat.hku.hk/> for full details. The basic idea was that school teams will design and build a CubeSat prototype with the use of computer-aided design tools and attendance at extensive workshops and 20 minute instructional segments spread over 2 semesters. Full details of the comprehensive program designed by the LSR and OASA can be found here: <https://cubesat.hku.hk/programme>. Project PI Prof Parker won a \$150,000 KE grant in September 29th 2021 (KE-IP-2021/22-68) to help support the BEST program that was mostly used to provide stipends for STEM mentors.

We were planning for about 10 schools to sign up for this program but 22 teams from 21 schools joined and completed the program. This very strong interest created a few logistic issues but these were solved with the dedication and support of our wonderful partners and an excellent team of STEM and business mentors. These were sourced from mainly postgraduate and graduate students from HKU for STEM mentors and OASA business contacts and members for business mentors. BEST would not have been the tremendous success it was without their support. We are also very grateful that this programme was supported by the teachers and principals of our different school teams and of course by the judges who made the very difficult choices to select the winning teams <https://cubesat.hku.hk/judges>.

An excellent SCMP article on the BEST program is here from 3rd March 2022: <https://www.scmp.com/yp/discover/news/hong-kong/article/3169038/best-programme-lets-students-explore-space-science-build>



The final presentation and award ceremony were successfully held on April 30, 2022. This is a screen shot of most of the school teams and participants that connected via Zoom for the awards ceremony. One key factor in judging the awards was how each project met some of the United Nations' 17 Sustainable Development Goals.



Laboratory for Space Research and several LSR STEM Mentors hosting a visit to the LSR from the team from St. Stephen's Girls' College team on their project "spASH" that went on to win "The BEST Astropreneurship Award"

School Teams



"The BEST Overall Award"

Internship opportunities at the HKU Laboratory for Space Research

"The BEST OASA Award"

Five-year membership at The Orion Astropreneur Space Academy

Victoria Shanghai Academy

Project Name: QBE Agricultural Monitoring



"The BEST Astropreneurship Award"

Student Ambassadors at one of the Cyberport's signature event "Digital Entertainment Leadership Forum"

"The BEST OASA Award"

Five-year membership at The Orion Astropreneur Space Academy

St. Stephen's Girls' College

Project Name: spASH



"The BEST STEM Award"

Internship opportunities at the Genius Development

"The BEST OASA Award"

Five-year membership at The Orion Astropreneur Space Academy

Li Po Chun United World College of Hong Kong

Project Name: Seatellite



"The Most Liked Project Award" – received total 2037 likes on Instagram

HKU Scholarships to attend HKU summer programmes organized by HKU Academy for the Talented.



"The BEST OASA Award"

One-year membership at The Orion Astropreneur Space Academy

Carmel Pak U Secondary School

Project Name: Material Testing



"The BEST OASA Award"

One-year membership at The Orion Astropreneur Space Academy

Chinese International School (Team 2)

Project Name: OZONESAT

The final project videos from all the 22 school teams that participated in BEST can be viewed here: <https://cubesat.hku.hk/school-teams>. The quality of some of these team presentations and their ideas for viable CubeSat missions were outstanding.

BEST team participants were given authentic exposure to project management and team building skills together with workshops and professional mentorship guidance on topics of space science, engineering and astropreneurship. BEST covered the concept and mission of a CubeSat, as well as how to build and deploy a prototype. Through solid training in leadership, teamwork, critical and analytical thinking and communication and presentation skills, students were able to accomplish a common goal along with their interdisciplinary team members. Fantastic press coverage in Chinese of the BEST program for this year is given in this link from 4th april 2022:

<https://www.wenweipo.com/a/202208/04/AP62eadd6ee4b033218a5b4942.html>

9.2. The LSR summer Internship program (special focus)

LSR interns in their own words:

"It is a pleasure for me to be working here at the LSR for the past two weeks, which not only broadened my horizons on science and programming related fields, but also gave me precious insight and experience on research jobs. I am deeply thankful to Dr. Quentin for offering this wonderful opportunity, my mentor Rishank for guiding me along my internship journey, and every staff member and my co-workers for my superb internship experience at the LSR"

by Lisa Tso, LSR intern Summer 2022.

"I was delighted to be a full-time Intern Research Assistant over 2022 summer under Dr. Pablo Saz Parkinson. Working with the dedicated team at the LSR, I worked primarily on the technical and computing aspects of simulations and scripting for the MeV CubeSat project. Using the LSR's quantum cube computer for processing opened new possibilities with the incredible degree of speed and automation possible, and using my python and linux knowledge I am proud to have been able to contribute to this incredible project. I am incredibly grateful to the LSR for the opportunity afforded to a young undergraduate student such as myself, and the invaluable support and advice given by those around me."

By Aditya Mangla, LSR summer intern/RA 2022

"At LSR I worked with Mr Pal and a team of motivated interns to develop a Zooniverse citizen science project to help classify and identify significant orbital periodicities in Lomb-scargle periodograms of data from the TESS Satellite. Thanks to Dr Partha Pal, in the 6 weeks I was there I learned about the TESS Satellite, the Fourier Transformation, periodograms, Bayes Theorem, and how to code in Python (Astropy, Matplotlib, Scipy etc). Additionally, I learned invaluable soft skills such as how to collaborate with other members of a research team, how to make and present slideshows, and how to write about scientific topics in an accessible way, and I got a glimpse into what life as an astrophysical researcher looks like, which only strengthened my resolve to be one when I am older. I am grateful for the opportunity to have worked with Mr Pal this summer, and I hope to do so again in the future."

By Zaara Bhatia, LSR intern Summer 2022

We again remain very proactive in this important Knowledge exchange and outreach area and believe we have the most active student internship program in the Faculty of Science. Our internship program serves as a valuable KE and community service while also helping to build our brand. Our LSR internships offer our research staff useful, short-term research support. We have hosted 73 interns since 2016 for periods of between 2-3 weeks and 3 months. Interns come from local international schools, HKU and local universities but also (Covid notwithstanding) from overseas (e.g. India, USA, Singapore, Spain). This year's interns are a mix of mainly high school students from various top HK schools, summer Research Fellows, undergraduate students from HKU and elsewhere; and student team members from winners of our BEST program.



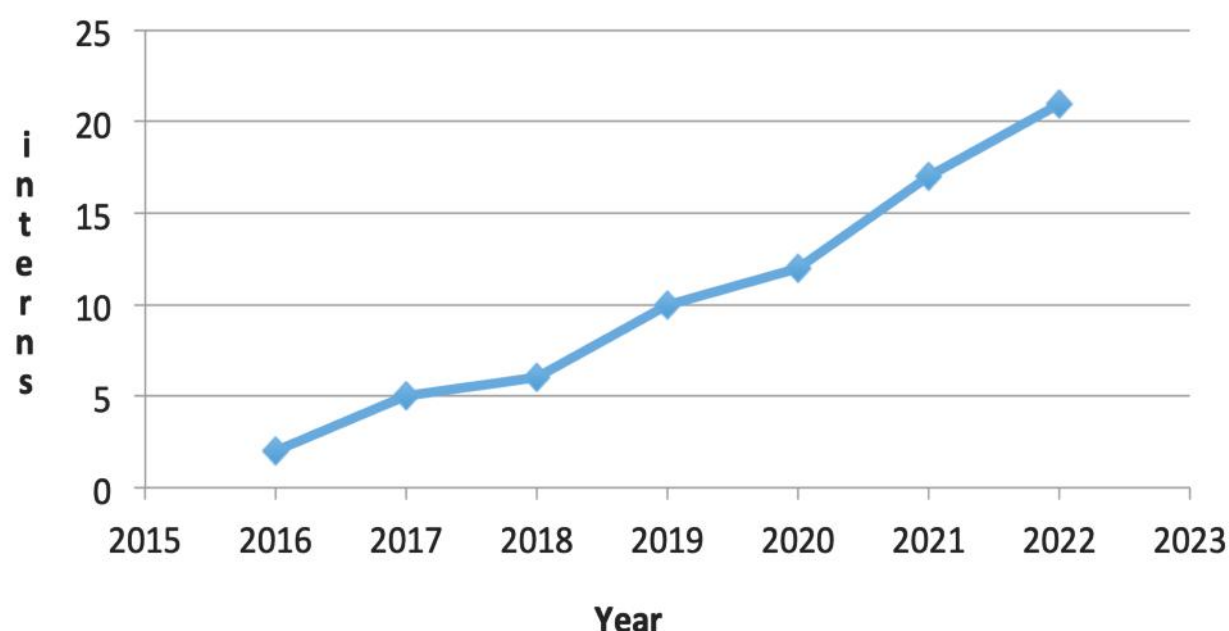
Photo showing 4 LSR interns from summer 2022 working with LSR CubeSat engineer Mr Andy Kong.

The LSR internship program has grown organically and rapidly since inception in 2016 with our first two interns to reach a new maximum this summer of 21. We do not advertise this program with applications all generated via word of mouth and reputation. We do not cater just to physics majors but also accept students from computing and engineering as befits the interdisciplinary nature of the LSR. Student projects cover work on computer simulations and aerospace design (for CubeSats and Mars rover drills), late stage stellar evolution and high-energy astrophysics.



Special LSR Intern and supervisor Lunch – there is a very positive social aspect to our internship program.

LSR Summer Interns 2016 to 2022



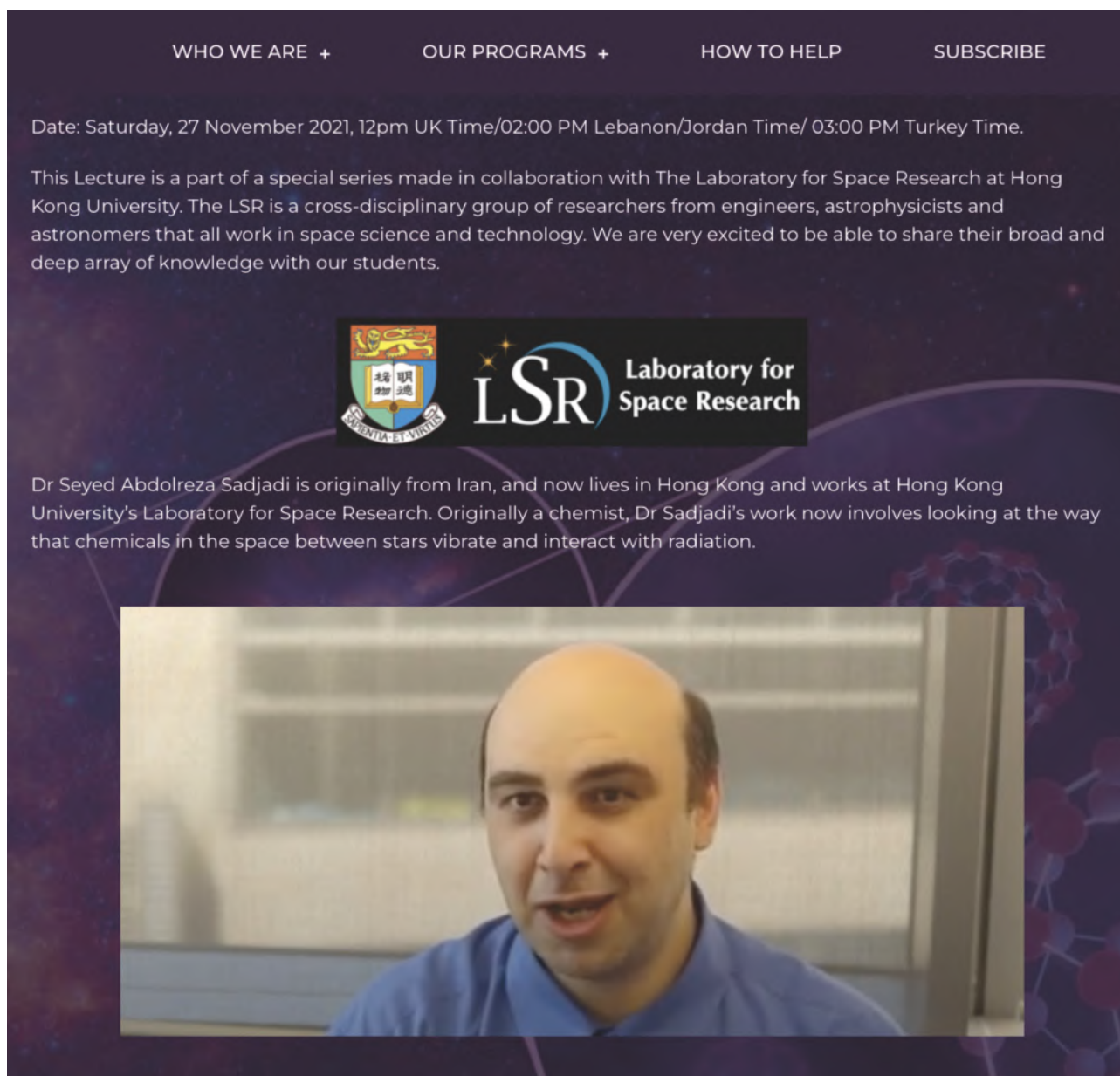
Plot showing the growth of the LSR internship program from its inception in 2016 up to the current reporting period in 2022. With current resources it is likely that no further growth is possible.

| | | | | | | | |
|--------------------|---------------|-----------------|-------------------------------------|------|--------|-----------------|----|
| Anirudh Rajesh | High School | year 12 | West Island School | 2022 | ST | TBC | 53 |
| Anvesha Bajpai | High School | year 12 | ESF Island School | 2022 | | July-August | 54 |
| Adrian Lee | High School | year 12 | Chinese International School | 2022 | | TBC | 55 |
| Julian Chung | High School | year 11 | German Swiss International School | 2022 | | 20July-16August | 56 |
| Yang Jiawei | High School | Dp1 | Singapore International School (HK) | 2022 | | 28June-12 July | 57 |
| Tang Hongrui | High School | S4 | Singapore International School (HK) | 2022 | | 11July-18 July | 58 |
| Gavin Wong | High School | S4 | Singapore International School (HK) | 2022 | | 25July-5Aug | 59 |
| Lisa Tsio | High School | S4 | Singapore International School (HK) | 2022 | | 28June-12 July | 60 |
| Zhou JingYun (Leo) | High School | S4 | Singapore International School (HK) | 2022 | | 11July-18 July | 61 |
| Zhara Bhatia | High School | year 11 | Hong Kong International School | 2022 | | TBC | 62 |
| Jason | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK/RP | July | 63 |
| Kyan | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK/RP | July | 64 |
| Rae | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK/RP | July | 65 |
| Michael | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK | August | 66 |
| Nicole | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK | August | 67 |
| Ethan | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK | August | 68 |
| Anson | High School | BEST winners | Victoria Shanghai Academy | 2022 | AK | August | 69 |
| Chow Yin Hei | Undergraduate | HKU Scholarship | HKU - SRF awardee | 2022 | QAP | June-August | 70 |
| Aditya Mangla | Undergraduate | RA | HKUST | 2022 | PSP | June-August | 71 |
| Shuyu Yue | Undergraduate | RA | SYSU | 2022 | QAP/AR | July-August | 72 |
| Benjamin Lau | Undergraduate | RA | Boulder Colorado, USA | 2022 | QAP/AR | June-August | 73 |

For the reporting period Sept 2021 til August 2022 we have hosted 21 LSR interns listed above, a new record intake and up from 17 last year.

9.3. The Kiron refugee campus “LSR lecture Series”


The LSR is very proud to continue to participate in the Kiron refugee campus (see: <https://kiron.ngo/en/>) under their Phoenix Space student program such as <https://phoenixspace.org/lecture-series-202111-the-cosmic-chemistry-set/> which presents the first LSR lecture to be broadcast on November 27th 2021. The target student group are teenage refugees, generally from and living in the Middle East. Their knowledge of science and maths is highly variable, A key aim is to bring STEM education to such disadvantaged students who are refugees from war, famine, natural disasters and other calamities. We have put together a series of 9 LSR lectures by different volunteer members of the LSR and these have mostly already been filmed at the LSR in Cyberport and on HKU campus.




WHO WE ARE + OUR PROGRAMS + HOW TO HELP SUBSCRIBE

Date: Saturday, 27 November 2021, 12pm UK Time/02:00 PM Lebanon/Jordan Time/ 03:00 PM Turkey Time.

This Lecture is a part of a special series made in collaboration with The Laboratory for Space Research at Hong Kong University. The LSR is a cross-disciplinary group of researchers from engineers, astrophysicists and astronomers that all work in space science and technology. We are very excited to be able to share their broad and deep array of knowledge with our students.

 **LSR** Laboratory for Space Research

Dr Seyed Abdolreza Sadjadi is originally from Iran, and now lives in Hong Kong and works at Hong Kong University's Laboratory for Space Research. Originally a chemist, Dr Sadjadi's work now involves looking at the way that chemicals in the space between stars vibrate and interact with radiation.



Extract from <https://phoenixspace.org/lecture-series-202111-the-cosmic-chemistry-set/> for our first broadcast lecture in November 2021.

After each lecture (webinar), the full video of our LSR lectures together with the accompanying live Question & Answer session gets uploaded to YouTube. It is then added to what will be a specially branded LSR course by "phoenixspace" via an online platform that offers free education for refugees. Each LSR lecture is supported by a text summary, suggested reading/viewing and a short quiz - all to assist students with their learning. This will be in both Arabic and English. We hope that the special LSR lecture series will grow and will form part of dozens of videos that will eventually become a high-quality STEM educational resource for Arabic language science teaching worldwide, not just for refugees.

LSR members involved in these lectures are Prof. Q. Parker, , Prof. Gregg Li (OASA-LSR), Dr. Joe Michalksi, Dr. Alex Webb, Dr. SeyedAbdolreza Sadjadi (left LSR in March 2022), Dr. Pablo Saz Parkinson (left LSR in August 2022), Dr. Andreas Ritter, Dr. Shawn Wright and Ms. Rosaria Prochilo.

10. Future Plans and Opportunities

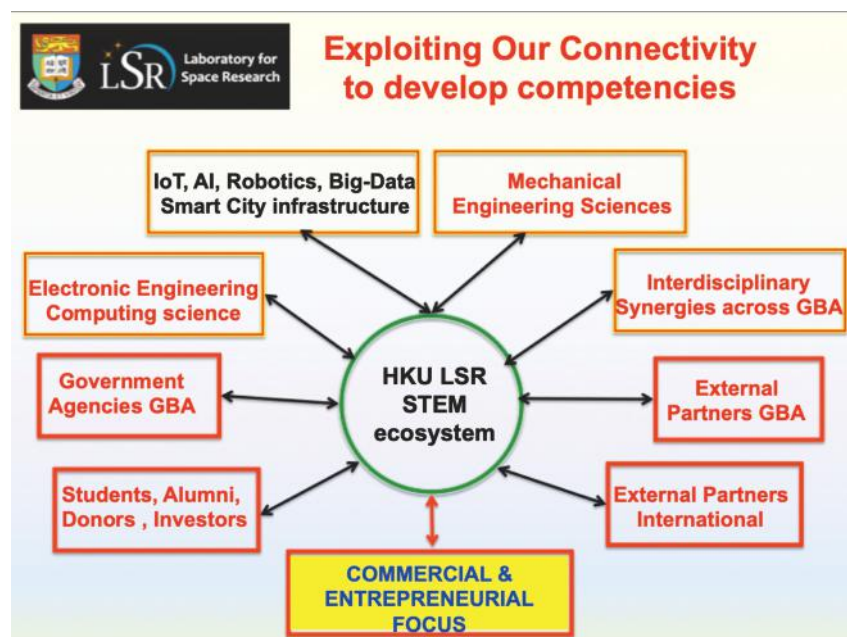


It is important that the future plans for the LSR are aligned with and in the same direction as the plans for HKU as a whole. Our future depends on the level of support from HKU senior management and the Faculty of Science as we transition to our new Dean Professor Qiang Zhou and also if the INSPIRE initiative for the planned new HKU campus in Shenzhen can be realised. Positive indications have been made and the LSR remains hopeful but no firm action has yet been taken by HKU at the time of writing. Nevertheless, during this period of uncertainty, we have remained adept at securing funding, undertaking impactful projects, maintaining good relations with our partners and continuing to raise our profile via regular news items, initiatives and press releases. A few key future LSR plans, evolved from last year's report, are listed below:

- Secure meaningful long-term funding whether in Hong Kong or Shenzhen
 - this is essential if our future is to be secured

- Achieve more autonomy
 - Given the current severe operational constraints that have badly impacted our operations this is a vital need
- Set up the “INSPIRE” laboratory in Shenzhen
 - this will depend on HKU agreement with the Shenzhen government
- Establish CAS-HKU joint INSPIRE laboratory in HKU and Shenzhen
 - this would be only the 2nd HKU-CAS joint lab in 10 years if realised. If a joint CAS lab is established re-brand the LSR to INSPIRE at HKU perhaps via conversion to a proper HKU centre or institute
- Consolidate projects and develop our space & planetary science program:
 - The UV satellite planned with NJU, BISME and DFH for which 13.5million RMGS funding is available is in abeyance as the funding was appropriate by the department of physics
 - The funded 6U CubeSat MeV Gamma-ray mission (as a pathfinder to the hoped for RMB 1 billion PANGU mission) is proceeding
 - Continue to develop a World class spectroscopy lab for Planetary science under deputy LSR director Dr. Joe Michalski
 - Investigate CubeSat Commercial missions including via “BEST”

Although we hope to continue to grow our capacity in terms of RAPs, PDFs, RPG students, RAs and distinguished international visitors a key issue is the question of the availability of sufficient academic staff in the right areas to direct and manage the LSR. As an example, despite up to 4 joint posts with the LSR and DES/Physics being funded in the first BRC round of the new 6 year cycle, none of these posts were advertised to be filled. In fact astrophysicists in the Physics department have dropped from 6 in number in 2020 to 4 (soon to be 3) today at the same time as general Physics staff have increased from 16 to 27.



Schematic diagram of how we believe the LSR fits into the bigger STEM picture and how we can exploit such synergies and connectivity to build valuable competencies.

Opportunities



- There are various formal channels for opportunities to promote cooperation in science and technology between HK SAR and the Mainland but especially in the GBA and these apply well to an entity like the LSR
- Opportunities include joint conferences, laboratories, research and technology projects, establishment of State Key labs in HK SAR and the GBA including a 'smart city' ethos
- These beneficial, strategic activities are a harbinger of eventual of HK SARs research infrastructure and program integration. This includes our new HKU Shenzhen campus being built and hopefully our LSR-INSPIRE initiative also to be based there
- Strengthening of scientific and technological co-operation under one country two systems is also one specific advantage our LSR science and technology community can enjoy while not preventing/affecting the majority of our global scientific collaborations
- It is one that we can leverage via our special status and unique placement in this part of SE Asia to enhanced, global effect

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 - These beneficial, strategic activities are a harbinger of eventual of HK SARs research infrastructure and program integration. This includes our new HKU Shenzhen campus being built and hopefully our LSR-INSPIRE initiative also to be based there
 - Strengthening of scientific and technological co-operation under one country two systems is also one specific advantage our LSR science and technology community can enjoy while not preventing/affecting the majority of our global scientific collaborations
 - It is one that we can leverage via our special status and unique placement in this part of SE Asia to enhanced, global effect
- 36

- BEST – Business Economy for Space Technology LSR led STEM initiative
- BISME – Beijing Institute of Space Mechanics and Electricity
- CAS – Chinese Academy of Sciences
- CCST – Chinese Survey Space Telescope
- CNNC – Chinese National Nuclear Corporation
- CSU – Center for Space Utilisation, Chinese Academy of Sciences
- DES – Department of Earth Sciences
- DFH – DFH Satellite Company Ltd.
- EAO – East Asian Observatory
- ECR – Early Career Researcher
- ESO – European Southern Observatory
- FAST – Five Hundred Meter Aperture Telescope, Guizhou, SW China
- GBA – Greater Bay Area
- GRF – General Research Fund of RGC
- HERD – High Energy Radiation Detector
- HKU – The University of Hong Kong
- INSPIRE – International Space & Planetary Institute for Research Excellence
- JV – Joint Venture Company
- KE – Knowledge Exchange
- LSR – Laboratory for Space Research
- MoU – Memorandum of Understanding
- NAOC – National Astronomical Observatories of China
- OASA – Orion Astropreneur Space Academy
- PANGU – Pair production Gamma-ray Unit (a gamma-ray space telescope)
- PDF – Postdoctoral Research Fellow
- PSHK – Physical Society of Hong Kong
- RAP – Research Assistant Professor
- RGC – Research Grants Council
- RMGS – Research Matching Grant Scheme
- RPG – Research Postgraduate
- SALT – South African Large Telescope
- SCMP – South China Morning Post
- SMT – Senior Management Team, HKU
- STB – Science & Technology Bureau, Dongguan
- SYSU – Sun Yat Sen University, Zuhai
- TPG – Taught PostGraduate Masters
- UDF – University Development Fund, HKU
- VLT – Very Large Telescope (ESO 8m telescopes)



12. Acknowledgments

It is a pleasure to acknowledge and thank Ms. Bingrong Zhu our LSR laboratory manager for her steadfast support right up until she left for a longer term appointment still within the HKU family in July 2022.

We acknowledge the wonderful support and funding from the Research Grants Council for our RMGS, GRF and CRF funds and HKU for UDF and BRC support that has enabled the LSR to flourish so far.


We thank the interim Dean of Science, Prof. Vivian Yam for her support of the LSR throughout her tenure and the FoS Secretary Ms. Venus Chu for her integrity, support and kindness. Finally, we also express our thanks to Mr. Man-Fai Lee in the finance section of the FoS for all his excellent support in facilitating a smooth and painless use of our BRC funding that is not under departmental oversight.

APPENDIX I

Selected research highlights in top journals from LSR members

I.1. LSR co-authored paper:

<https://www.science.org/doi/epdf/10.1126/science.abm3231>



Current IssueFirst release papersArchiveAbout▼Subr

HOME > SCIENCE > VOL. 376, NO. 6592 > A GAMMA-RAY PULSAR TIMING ARRAY CONSTRAINS THE NANOHERTZ GRAVITATIONAL WAVE BACKGROUND > A...

REPORT | GRAVITATIONAL WAVES





[f](#) [t](#) [in](#) [d](#) [e](#) [m](#)

A gamma-ray pulsar timing array constrains the nanohertz gravitational wave background

THE FERMI-LAT COLLABORATION**†

SCIENCE • 7 Apr 2022 • Vol 376, Issue 6592 • pp. 521-523 • DOI: 10.1126/science.abm3231

6,647

 CHECK ACCESS

A gamma-ray pulsar timing array

Abstract

Supplementary Materials

References and Notes

A gamma-ray pulsar timing array

After galaxies merge, the supermassive black holes (SMBHs) at their centers are expected to form binaries that emit gravitational waves at nanohertz frequencies. Numerous SMBH binaries throughout the Universe should combine to produce a gravitational wave background. Existing searches for this signal use radio observations of pulsars as sensitive clocks and look for small shifts in the pulse timings. The Fermi-LAT Collaboration implemented a pulsar timing array using gamma rays and achieved a sensitivity close to that of the radio approaches. The results set an independent upper limit on the gravitational wave background, which is subject to different noise sources. —KTS

Abstract

After large galaxies merge, their central supermassive black holes are expected to form binary systems. Their orbital motion should generate a gravitational wave background (GWB) at nanohertz frequencies. Searches for this background use pulsar timing arrays, which perform long-term monitoring of millisecond pulsars at radio wavelengths. We used 12.5 years of Fermi Large Area Telescope data to form a gamma-ray pulsar timing array. Results from 35 bright gamma-ray pulsars place a 95% credible limit on the GWB characteristic strain of 1.0×10^{-14} at a frequency of 1 year^{-1} . The sensitivity is expected to scale with t_{obs} , the observing time span, as $t_{\text{obs}}^{-13/6}$. This direct measurement provides an independent probe of the GWB while offering a check on radio noise models.

I.2. LSR co-authored paper:

<https://www.nature.com/articles/s41561-022-00989-0>

nature geoscience

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Article | [Published: 28 July 2022](#)

Rewetting global wetlands effectively reduces major greenhouse gas emissions

[Junyu Zou](#), [Alan D. Ziegler](#), [Deliang Chen](#), [Gavin McNicol](#), [Philippe Ciais](#), [Xin Jiang](#), [Chunmiao Zheng](#), [Jie Wu](#), [Jin Wu](#), [Ziyu Lin](#), [Xinyue He](#), [Lee E. Brown](#), [Joseph Holden](#), [Zuotai Zhang](#), [Sorain J. Ramchunder](#), [Anping Chen](#) & [Zhenzhong Zeng](#) 

[Nature Geoscience](#) **15**, 627–632 (2022) | [Cite this article](#)

3073 Accesses | **137** Altmetric | [Metrics](#)

Abstract

Carbon and nitrogen losses from degraded wetlands and methane emissions from flooded wetlands are both important sources of greenhouse gas emissions. However, the net-exchange dependence on hydrothermal conditions and wetland integrity remains unclear. Using a global-scale in situ database on net greenhouse gas exchanges, we show diverse hydrology-influenced emission patterns in CO₂, CH₄ and N₂O. We find that total CO₂-equivalent emissions from wetlands are kept to a minimum when the water table is near the surface. By contrast, greenhouse gas exchange rates peak in flooded and drained conditions. By extrapolating the current trajectory of degradation, we estimate that between 2021 and 2100, wetlands could result in greenhouse gas emissions equivalent to around 408 gigatons of CO₂. However, rewetting wetlands could reduce these emissions such that the radiative forcing caused by CH₄ and N₂O is fully compensated by CO₂ uptake. As wetland greenhouse gas budgets are highly sensitive to changes in wetland area, the resulting impact on climate from wetlands will depend on the balance between future degradation and restoration.

I.3. LSR co-authored paper:

<https://iopscience.iop.org/article/10.3847/2041-8213/ac26b5/meta>

THE ASTROPHYSICAL JOURNAL LETTERS

A Rotating Azimuthally Distributed Auroral Current System on Saturn Revealed by the Cassini Spacecraft

R. L. Guo^{1,2,3} , Z. H. Yao¹, W. R. Dunn^{4,5} , B. Palmaerts² , N. Sergis^{6,7} , D. Grodent² ,
S. V. Badman⁸, S. Y. Ye⁹ , Z. Y. Pu¹⁰, D. G. Mitchell¹¹ , B. Z. Zhang¹², N. Achilleos^{5,13},
A. J. Coates^{4,5} , Y. Wei¹ , J. H. Waite¹⁴, N. Krupp¹⁵, and M. K. Dougherty¹⁶ 

[— Hide full author list](#)

Published 2021 October 1 • © 2021. The American Astronomical Society. All rights reserved.

[The Astrophysical Journal Letters](#), Volume 919, Number 2

Citation R. L. Guo et al 2021 *ApJL* **919** L25



Article PDF



Article ePub

[Figures](#) ▾ [Tables](#) ▾ [References](#) ▾

[+ Article information](#)

Abstract

Stunning aurorae are mainly produced when accelerated electrons travel along magnetic field lines to collide with the atmosphere. The motion of electrons often corresponds to the evolution of a magnetic field-aligned current system. In the terrestrial magnetosphere, the current system is formed at the night-side sector, and thus produces an auroral bulge at night. Due to the different energy sources between Saturn and the Earth, it is expected that their auroral current systems are fundamentally different, although the specific auroral driver at Saturn is poorly understood. Using simultaneous measurements of the aurora, particles, magnetic fields, and energetic neutral atoms, we reveal that a chain of paired currents, each of which includes a downward and an upward current branch, is formed in Saturn's magnetosphere, which generates separated auroral patches. These findings inform similar auroral current structures between the Earth and Saturn, while the difference is that Saturn's unique mass and energy sources lead to a rotational characteristic.

I.4. LSR led paper:

<https://ui.adsabs.harvard.edu/abs/2021ApJ...918L..33R/abstract>

THE ASTROPHYSICAL JOURNAL LETTERS

OPEN ACCESS

The Remnant and Origin of the Historical Supernova 1181 AD

Andreas Ritter^{1,2} , Quentin A. Parker^{1,2} , Foteini Lykou^{1,2,3} , Albert A. Zijlstra^{2,4} ,
Martín A. Guerrero⁵ , and Pascal Le Dû⁶ 

Published 2021 September 15 • © 2021. The Author(s). Published by the American Astronomical Society.

[The Astrophysical Journal Letters](#), Volume 918, Number 2

Citation Andreas Ritter *et al* 2021 *ApJL* 918 L33



[Figures](#) ▾ [Tables](#) ▾ [References](#) ▾

[+ Article information](#)

Abstract

The guest star of AD 1181 is the only historical supernova of the past millennium that is without a definite counterpart. The previously proposed association with supernova remnant G130.7+3.1 (3C 58) is in strong doubt because of the inferred age of this remnant. Here we report a new identification of SN 1181 with our codiscovery of the hottest known Wolf–Rayet star of the oxygen sequence (IRAS 00500+6713 or 2MASS J00531123+6730023, here named by us as "Parker's star") and its surrounding nebula Pa 30. Our spectroscopy of the nebula shows a fast shock with extreme velocities of $\approx 1100 \text{ km s}^{-1}$. The derived expansion age of the nebula implies an explosive event $\approx 1000 \text{ yr}$ ago that agrees with the 1181 event. The on-sky location also fits the historical Chinese and Japanese reports of SN 1181 to within $3^\circ 5'$. Pa 30 and Parker's star have previously been proposed to be the result of a double-degenerate merger, leading to a rare Type Iax supernova. The likely historical magnitude and the distance suggest the event was subluminal for normal supernova. This agrees with the proposed Type Iax association that would also be only the second of its kind in the Galaxy. Taken together, the age, location, event magnitude, and duration elevate Pa 30 to prime position as the counterpart of SN 1181. This source is the only Type Iax supernova where detailed studies of the remnant star and nebula are possible. It provides strong observational support for the double-degenerate merger scenario for Type Iax supernovae.

I.5. LSR led paper:

<https://doi.org/10.3847/2041-8213/ac88c1>.

THE ASTROPHYSICAL JOURNAL LETTERS

OPEN ACCESS

The Planetary Nebula in the 500 Myr Old Open Cluster M37

Vasiliki Fragkou¹ , Quentin A. Parker^{2,3} , Albert A. Zijlstra^{3,4} , Roberto Vázquez¹ , Laurence Sabin¹ , and Jackeline Suzett Rechy-Garcia⁵ 

Published 2022 August 23 • © 2022. The Author(s). Published by the American Astronomical Society.

[The Astrophysical Journal Letters](#), Volume 935, Number 2

Citation Vasiliki Fragkou et al 2022 *ApJL* **935** L35



[Figures](#) ▾ [Tables](#) ▾ [References](#) ▾

+ Article information

Abstract

We report confirmation of a large, evolved, bipolar planetary nebula and its blue, white dwarf central star as a member of the ~500 Myr old Galactic open star cluster M37 (NGC 2099). This is only the third known example of a planetary nebula in a Galactic open cluster and was found via our ongoing program of identifying and studying planetary nebulae—open cluster associations. High confidence in the association comes from the consistent radial velocities and proper motions for the confirmed central star and cluster stars from Gaia, reddening agreement, and location of the planetary nebula well within the tidal cluster boundary. Interestingly, all three Galactic examples have bipolar morphology and likely Type-I chemistry, both characteristics of higher mass progenitors. In this case the progenitor star mass is in the midrange of $\sim 2.8 M_{\odot}$. It provides a valuable, additional point on the key stellar initial-to-final mass relation independent of cluster white dwarf estimates and also falls in a gap in the poorly sampled mass region. This planetary nebula also appears to have the largest kinematical age ever determined and implies increased visibility lifetimes when they are located in clusters.

I.6. LSR led paper:



Contents lists available at ScienceDirect

Earth and Planetary Science Letters

www.elsevier.com/locate/epsl



Geomorphologic exploration targets at the Zhurong landing site in the southern Utopia Planitia of Mars



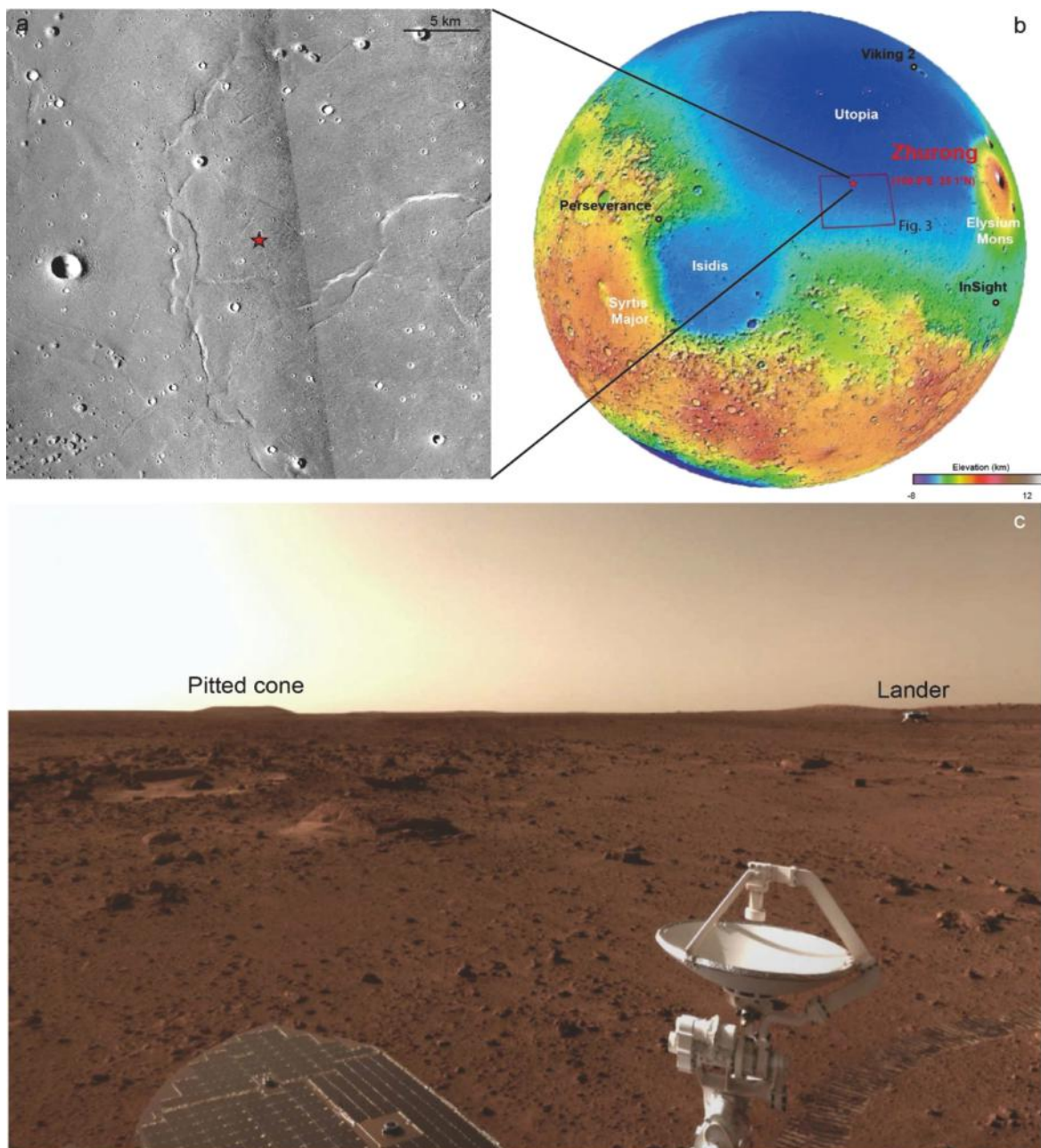
Binlong Ye^{a,1}, Yuqi Qian^{b,1}, Long Xiao^{b,*}, Joseph R. Michalski^{a,*}, Yiliang Li^a, Bo Wu^c,
Le Qiao^d

^a Department of Earth Sciences and Laboratory for Space Research, University of Hong Kong, Hong Kong, China

^b State Key Laboratory of Geological Processes and Mineral Resources, School of Earth Sciences, China University of Geosciences, Wuhan, China

^c Department of Land Surveying and Geo-Informatics, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China

^d Shandong Key Laboratory of Optical Astronomy and Solar-Terrestrial Environment, School of Space Science and Physics, Shandong University, Weihai, China



I.7. LSR led review paper:

Geological diversity and microbiological potential of lakes on Mars

Joseph R. Michalski^{1✉}, Timothy A. Goudge^{2,3}, Sean Crowe⁴, Javier Cuadros⁵, John Mustard⁶ and Sarah Stewart Johnson⁷

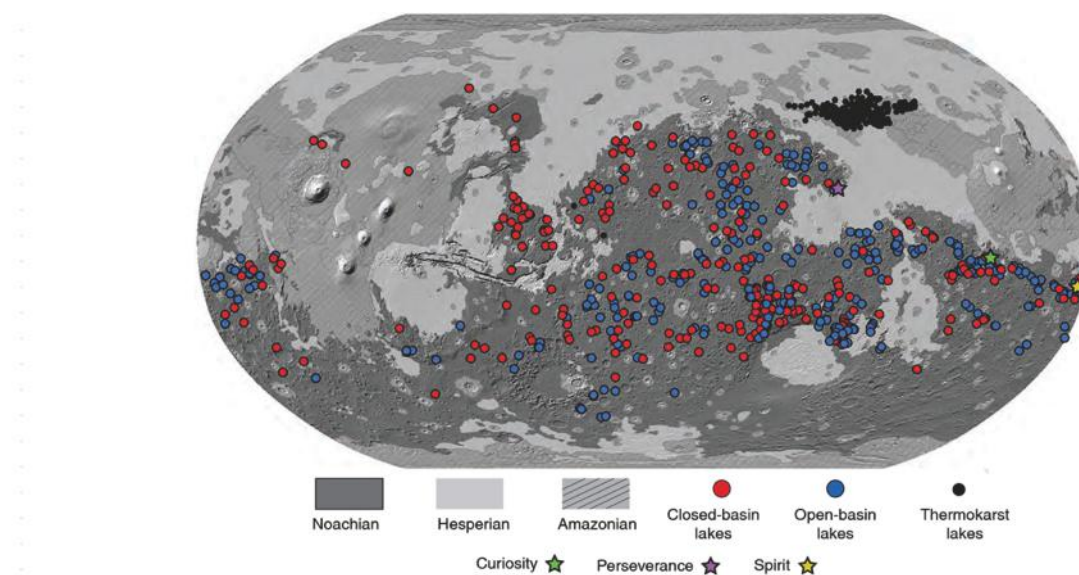


Fig. 2 | Compiled global distribution of lake basins on Mars. Most lakes occur in Noachian terrain, although some occur in Hesperian terrain. Thermokarst lakes occur in Amazonian terrain. Landing sites targeting lake deposits described in the text are also labelled.

I.8 & I.9. Two more LSR led Nature papers in press:

Ye. B. and J. R. Michalski (in press), Chemical weathering over hundreds of millions of years of greenhouse conditions on Mars, Nature Communications Earth & Environment.

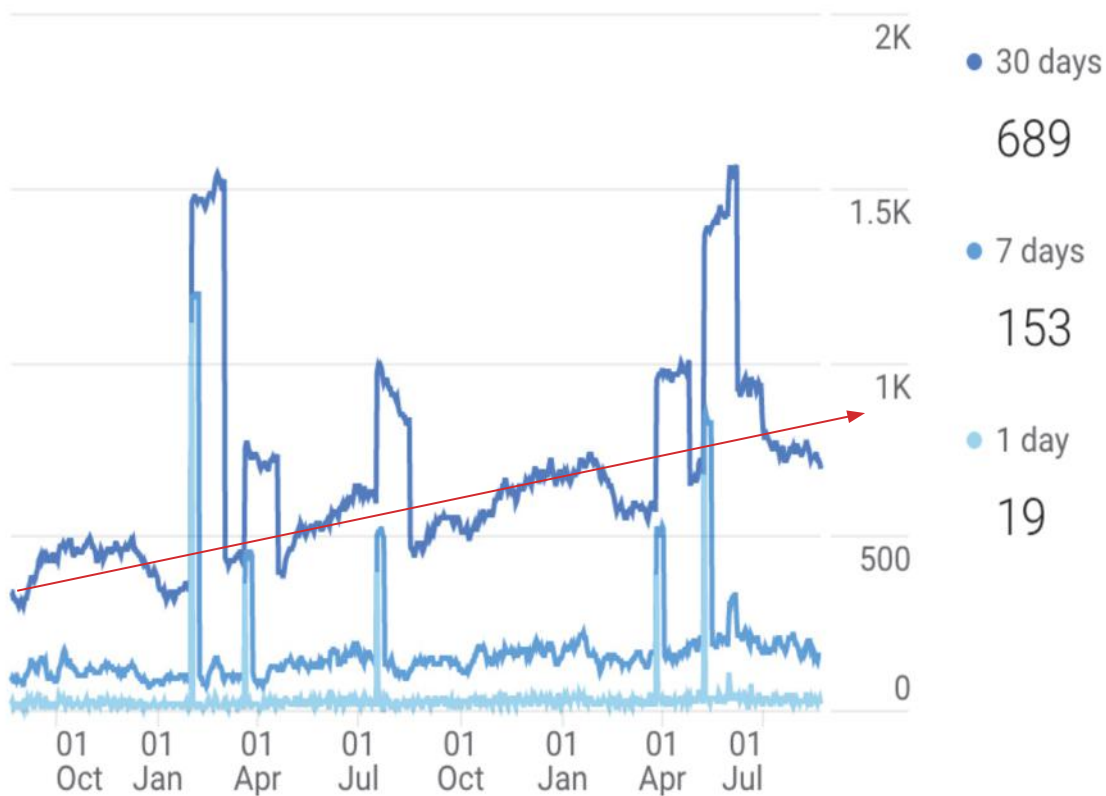
Michalski, J. R., T. A. Goudge, S. Crowe, J. Cuadros, J. Mustard and S. Stewart Johnson (in press), Geological diversity and microbiological potential of lakes on Mars, Nature Astronomy.

APPENDIX II

APPENDIX IIA. Two years of LSR Website traffic Sept. 2020-August 2022

The LSR website (www.lsr.hku.hk) is our window to the world. Since the last report there has been a significant growth in traffic again assumed a result of significant press coverage of LSR activities and commentary around the burgeoning Chinese Space programme over the last two years. The number of users has increased from over the same period as last year with the number of access sessions also doubling. Mainland China again leads the USA in terms of country of origin of access. Active users have also tripled over the last two years as shown in the graphic. Significant LSR news events and “system attacks” have lead to dramatic access upticks here and but on a clearly increasing general active user trend.


Active Users



Aug 23, 2020 - Aug 23, 2022 ▼

[ACTIVE USERS REPORT >](#)

LSR website access sessions by users over the last two years showing a strong secular increase in interest in our website and our activities.

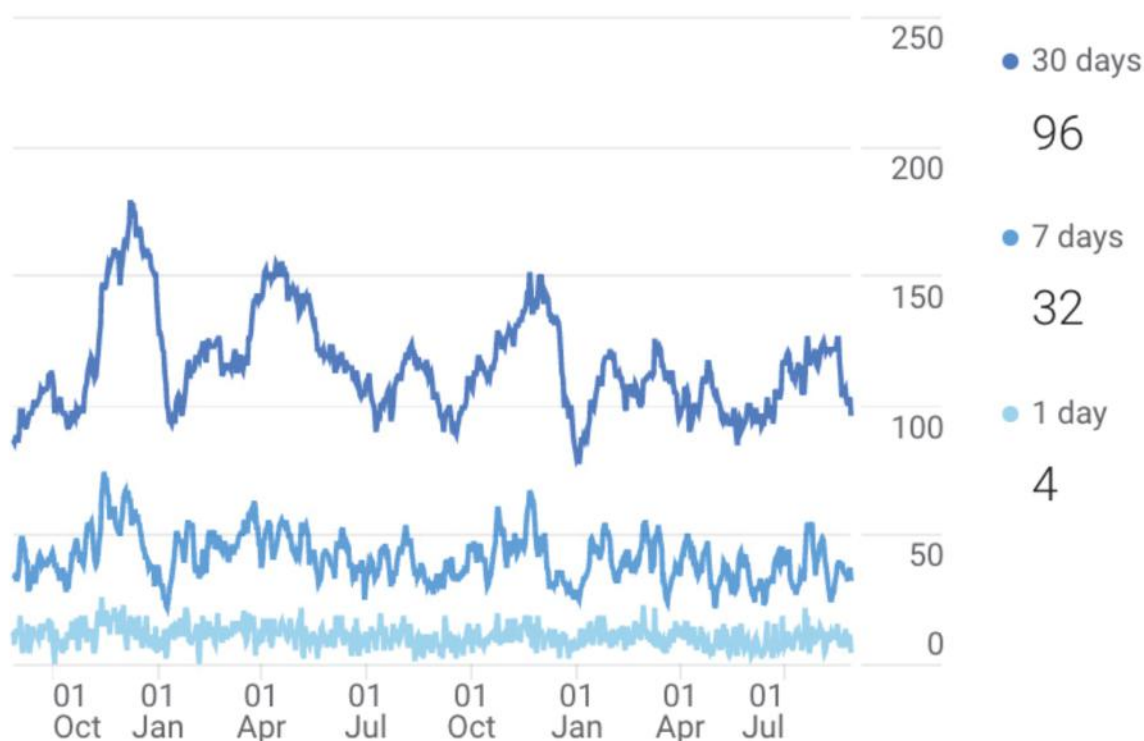
| Country ? | Acquisition | | |
|---|---|---|---|
| | Users ? ↓ | New Users ? | Sessions ? |
| | 8,494 % of Total: 100.00% (8,494) | 8,431 % of Total: 100.12% (8,421) | 12,071 % of Total: 100.00% (12,071) |
| 1.  Hong Kong | 3,824 (44.64%) | 3,749 (44.47%) | 6,255 (51.82%) |
| 2.  China | 1,008 (11.77%) | 992 (11.77%) | 1,280 (10.60%) |
| 3.  United States | 812 (9.48%) | 801 (9.50%) | 932 (7.72%) |
| 4.  United Kingdom | 241 (2.81%) | 235 (2.79%) | 288 (2.39%) |
| 5.  Japan | 236 (2.76%) | 236 (2.80%) | 275 (2.28%) |
| 6.  India | 181 (2.11%) | 179 (2.12%) | 223 (1.85%) |
| 7.  Taiwan | 157 (1.83%) | 156 (1.85%) | 176 (1.46%) |
| 8.  Germany | 114 (1.33%) | 111 (1.32%) | 126 (1.04%) |
| 9.  Italy | 113 (1.32%) | 113 (1.34%) | 146 (1.21%) |
| 10.  France | 95 (1.11%) | 94 (1.11%) | 119 (0.99%) |
| 11.  Australia | 92 (1.07%) | 89 (1.06%) | 115 (0.95%) |
| 12.  Canada | 90 (1.05%) | 89 (1.06%) | 109 (0.90%) |
| 13.  Netherlands | 89 (1.04%) | 89 (1.06%) | 141 (1.17%) |
| 14.  Singapore | 85 (0.99%) | 84 (1.00%) | 99 (0.82%) |
| 15.  Macao | 76 (0.89%) | 76 (0.90%) | 90 (0.75%) |
| 16.  Brazil | 69 (0.81%) | 69 (0.82%) | 87 (0.72%) |
| 17.  Pakistan | 59 (0.69%) | 59 (0.70%) | 81 (0.67%) |
| 18.  Spain | 54 (0.63%) | 54 (0.64%) | 68 (0.56%) |
| 19.  South Korea | 54 (0.63%) | 52 (0.62%) | 60 (0.50%) |
| 20.  Indonesia | 52 (0.61%) | 52 (0.62%) | 59 (0.49%) |

List of top 20 countries accessing the LSR website over the report period.

APPENDIX IIB: HASH Website traffic Sept. 2020-August 2022

The HASH database is a key service for our global research community in late stage stellar evolution. The LSR hosts the “Hong Kong/AAO/Strasbourg H-alpha Planetary Nebulae database” (HASH: www.hashpn.space), a world-class repository for this community. An LSR PDF, Dr. Andreas Ritter curates and manages HASH. We currently have ~950 users from 55 countries with ~250 different universities, institutes and affiliations. See below for graphical details of useage statistics of this important LSR community resource.

Active Users



Aug 29, 2020 - Aug 29, 2022 ▼

[ACTIVE USERS REPORT >](#)

HASH website access sessions by users over the last two years showing a stable average user access rate of ~120/day.

| Country ? | Acquisition | | |
|---|---|---|---|
| | Users ? ↓ | New Users ? | Sessions ? |
| | 939 % of Total: 100.00% (939) | 911 % of Total: 100.44% (907) | 5,689 % of Total: 100.00% (5,689) |
| 1.  United States | 206 (21.00%) | 205 (22.50%) | 925 (16.26%) |
| 2.  Hong Kong | 120 (12.23%) | 118 (12.95%) | 1,274 (22.39%) |
| 3.  China | 113 (11.52%) | 112 (12.29%) | 128 (2.25%) |
| 4.  France | 75 (7.65%) | 64 (7.03%) | 697 (12.25%) |
| 5.  Germany | 59 (6.01%) | 54 (5.93%) | 287 (5.04%) |
| 6.  United Kingdom | 44 (4.49%) | 35 (3.84%) | 331 (5.82%) |
| 7.  Spain | 40 (4.08%) | 35 (3.84%) | 263 (4.62%) |
| 8.  Mexico | 35 (3.57%) | 30 (3.29%) | 124 (2.18%) |
| 9.  Italy | 27 (2.75%) | 27 (2.96%) | 65 (1.14%) |
| 10.  Australia | 21 (2.14%) | 21 (2.31%) | 43 (0.76%) |
| 11.  Turkey | 21 (2.14%) | 21 (2.31%) | 228 (4.01%) |
| 12.  India | 20 (2.04%) | 17 (1.87%) | 89 (1.56%) |
| 13.  Taiwan | 17 (1.73%) | 17 (1.87%) | 43 (0.76%) |
| 14.  Austria | 14 (1.43%) | 11 (1.21%) | 23 (0.40%) |
| 15.  Belgium | 14 (1.43%) | 14 (1.54%) | 81 (1.42%) |
| 16.  Japan | 14 (1.43%) | 11 (1.21%) | 19 (0.33%) |
| 17.  Brazil | 11 (1.12%) | 9 (0.99%) | 17 (0.30%) |
| 18.  Netherlands | 10 (1.02%) | 10 (1.10%) | 14 (0.25%) |
| 19.  Russia | 10 (1.02%) | 8 (0.88%) | 27 (0.47%) |
| 20.  Poland | 9 (0.92%) | 9 (0.99%) | 12 (0.21%) |

List of top 20 countries accessing the HASH website over the report period showing the great diversity in our global user community.

APPENDIX III

Current complete list of all LSR Mainland and International MoUs and agreements

The LSR has engaged in a vigorous, strategically targeted program of Mainland and International partnerships consolidated by the signing of various MoUs and agreements from 2017 onwards. This was to establish a firm foundation and basis for growth with the strongest and most relevant groups possible.

LSR MoUs signed

1. Natural History Museum UK – October 2017
2. Nanjing University - November 2017
3. Padova-CISAS ITALY – March 2018
4. Zhejiang University – December 2018
5. National Astronomical Observatories of China (NAOC) – March 2019
6. Shanghai Academy of Space Flight Technology (SAST) – March 2019
7. CNNC and Chinese Institute for Atomic Energy (CIAE) – September 2019
8. Beijing Institute for Science and Mechanical Electricity (BISME) – December 2019
9. Dongguan Science & Technology Bureau - December 2019
10. DFH Company limited – December 2019
11. CSU – China Space Utilisation – May 2020
12. East Asian Observatory – October 2020
13. 3 way MoU with LSR, OASA & HKU Academy for the talented – May 2021

LSR MoUs in train since March 2022

1. Phoenix Space – ready, on hold pending outcome of LSR review
2. Genius Academy – ready but on hold pending outcome of LSR review

LSR Agreements signed

1. KAVLI institute, PKU, Beijing – May 2018
2. Beijing Institute for Science and Mechanical Electricity (BISME) – December 2018
3. Shenzhen 5 party agreement for Space Payloads - December 2018
4. Greater Bay Space Alliance - March 2019
5. Membership of the Joint Innovation Centre for Space Science (JICSS) – March 2019
6. China Space Utilization (CSU) – December 2019
7. Orion Astropreneur Space Academy (OASA) – March 2021
8. GBA SYSU Chinese Space Station Telescope Research Centre – March 2022

APPENDIX IV

Miscellany of additional materials

IV A: Updated and Recap of proposed CAS-HKU joint lab in Space and Planetary Sciences and the prospects for establishing the 'INSPIRE' laboratory in the GBA at the new HKU Shenzhen campus.

The rationale and relevant background for a CAS-HKU joint lab remains the same as for 2021 and is simply restated below:

- Form deep scientific/technical collaboration between FoS/LSR and CSU as a highly desirable aim for mutual research/development benefit via a joint laboratory in the Greater Bay Area and HK SAR
- Build close and long-term cooperation to advance frontier research in space science, planetary science and technical development in space manufacturing, space resources exploration and utilization
- Develop in-depth cooperation across a series of scientific research and technology development projects including, but not restricted to, the LSR
- Jointly work on scientific research projects, and promote the transformation and application of Science and Technology in the Greater Bay Area including HK SAR.

Background:

- Proposal, suggested by CAS and emerged from the new LSR-CSU agreement signed at CSU* HQ in Beijing on December 10th 2019.
- Follows original suggestion from CAS president in November 2017 (during his visit to HKU) that Space Science is one of only two areas CAS could foresee as the basis for a new CAS-HKU laboratory in the immediate future
- Follows from all our accomplishments in the interim including in 2022
- If we can establish this lab it would be only the second CAS-HKU joint laboratory since 2011

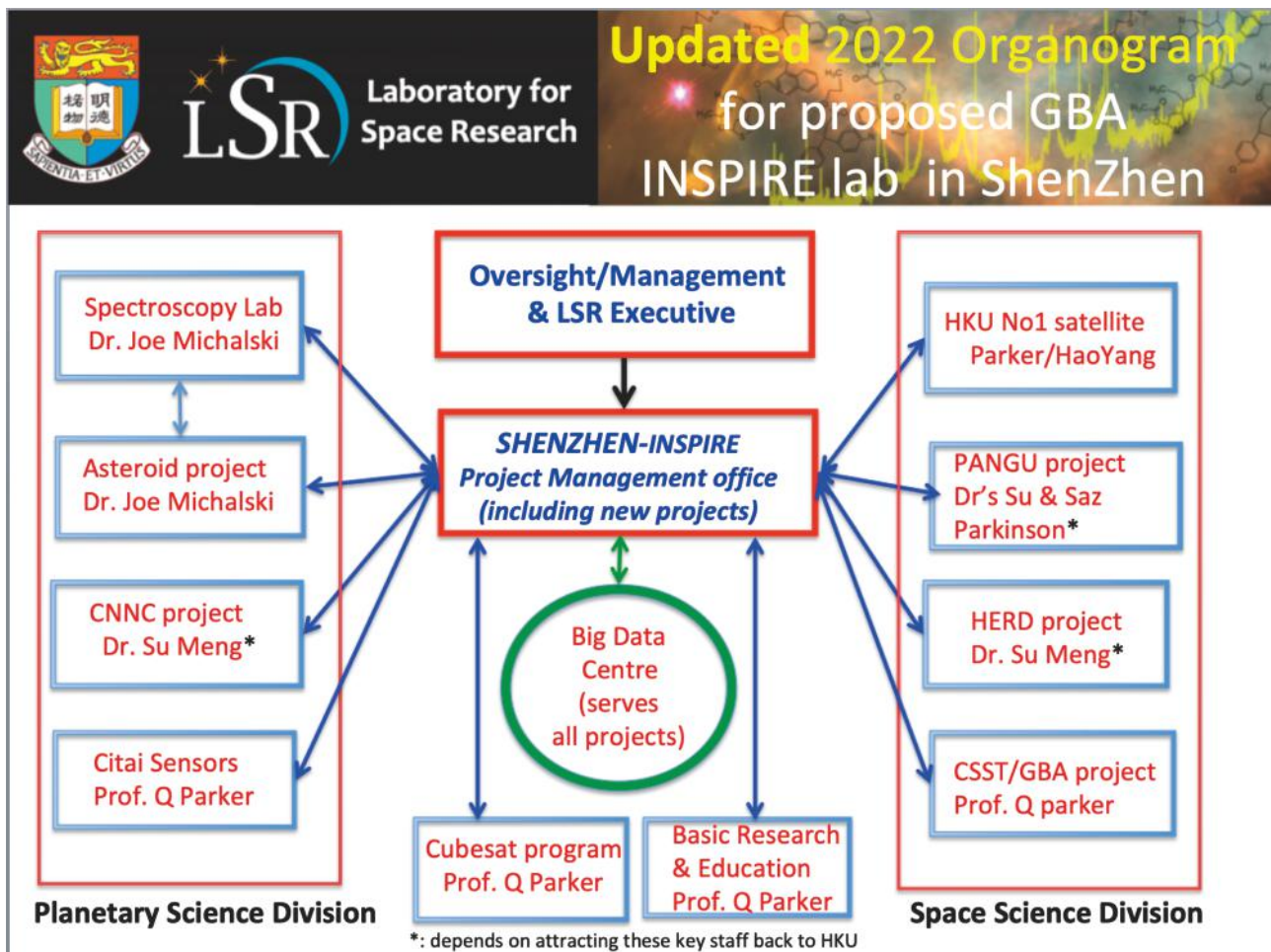
*CSU is the "Centre for Space Utilization" that runs China's interests in Space development including the Chinese Space Station.
(see http://english.csu.cas.cn/About_CSU/General_Information/)

New: The HKU Shenzhen campus, proposed LSR developments and context

In the four years since the CAS president's visit, the LSR has continued to consolidate our presence. This is via a range of initiatives, projects and strategic partnerships that establish our brand, vision, capacity and international links, accompanied, when appropriate, by press-releases and excellent publicity (especially in the Mainland) – refer to Section 8, 9 and Appendix VI.

We now have 13 MoUs and 8 agreements with elite Mainland and global partners with two more in train. Our associated portfolio of key active and potential projects is also healthy. What is required however, is some firm direction and support from HKU so that we can be provided with the resources and investments needed to make the most of the opportunities on offer and bring them to fruition and success.

There currently remains a mature LSR proposal (updated as needed) to set up the International Space and Planetary Institute for Research Excellence (INSPIRE) in Shenzhen as a next level evolution of the LSR. In this model appropriate resources and investments would be agreed between the local Shenzhen government and HKU. We have high hopes that HKU-LSR can establish INSPIRE on the HKU Shenzhen campus in 2023/2024 and also as part of a possible HKU-CAS joint lab.



Updated graphic from August 2022 showing the proposed project's based organizational structure for the "INSPIRE" lab intended for the new HKU Shenzhen campus. INSPIRE is an acronym for "International Space and Planetary Institute for Research Excellence" as an evolution to the next level for the LSR. Note all these projects with asterisked PI's depend on key staff being retained and attracted back to HKU for the Shenzhen campus.

IV B: Some recent LSR activities and initiatives

The LSR was invited to have a special booth at the prestigious Hong Kong Laureate forum in October 2021 in the Xiqu centre in the new cultural quarter in Kowloon – a special video was also recorded and released later:

https://www.youtube.com/watch?v=MMH_ifcqQ2Y



Photo of the LSR booth from October 15th 2021 taken in the atrium of the Xiqu centre, West Kowloon Cultural District.



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Future of Economy

The "Right Stuff" for the Future "Science" Economy

- the emerging opportunities in high tech in the GBA and the burgeoning Space Ecosystem from an OASA and tertiary education STEM focused perspective"

Talent and Opportunity in a Science and Tech, commercial and state based ecosystem.

In an emerging post Covid World different work realities confront a new future. This will be more connected in some ways disconnected in others and paradoxically we may be both remote and close to each other at the same time. However, success will still depend on Talent. Finding the "right stuff" to make a positive difference in a complex, technology dominated, interdependent world becomes key. Using this talent wisely is also key to unlocking the opportunity door when it comes knocking. Creating, recognising and seizing coming opportunities will largely be the domain of the STEM focused, tech-savvy, agile operators who are connected to the pervasive data grid of the "Internet of things". This is increasingly dependent on what we are doing in space. We will be operating both in sophisticated "smart-city" ecosystems ever more reliant on data in all its forms for commercial and social decision making and also across globally distributed networks of cyber connected teams who rely on that data to make decisions that affect millions of people.

Our education systems and newly developing initiatives like OASA will be conduit of the talent production line for the "right stuff" in this rapidly emerging environment but:

- Can we recognize it properly?
- Can we support it correctly?
- Can we use it wisely?

And can we help ensure talent creates opportunity and opportunity captures talent? These issues are briefly explored here.

By **Professor Quentin Parker**, Director, Laboratory for Space Research, HKU

Prof. Quentin Parker gave a keynote presentation at the live-streamed "Future in You" science –economy forum held on April 15th and 16th 2022.

IV.C Miscellaneous LSR Knowledge Exchange Events

Prof Quentin Parker shared his insights on KPMG podcast series

 OCTOBER 29, 2021



In KPMG's Future Hong Kong podcast series, Prof. Quentin Parker, LSR Director, together with Dr. Gregg Li of OASA discussed the major imperatives for investment in space exploration and the expected societal and economic benefits of space research for Hong Kong, the region and globally.

<https://home.kpmg/cn/en/home/insights/2021/10/future-hong-kong-podcast.html>

“The NewSpace Economy: Hitting the Sweet Spot in 2022”



NOVEMBER 04, 2021



LSR Director Prof Quentin Parker shared his views in a panel discussion “The NewSpace Economy: Hitting the Sweet Spot in 2022” at Cyberport on Nov 2.

Click the link below to watch full video.

<https://ne-np.facebook.com/cyberport.hk/videos/573661260528827>

Parker's star research



NOVEMBER 23, 2021



Parker's star research on the Supernova that had a big PR impact in Sept has just appeared in two major French Science Magazines:

National Geographic

<https://www.nationalgeographic.fr/espace/une-supernova-observee-pour-la-premiere-fois-au-12e-siecle-livre-enfin-ses-secrets>

Sciences et Avenir

https://www.sciencesetavenir.fr/espace/astrophysique/900-ans-apres-sa-premiere-description-cette-supernova-vient-d-etre-retrouvee_158592?xtor=RSS-9

The birth and death of the stars

DECEMBER 02, 2021



WHAT ARE THE STARS? WHAT ARE THE TYPES OF STARS THERE ARE? WHAT IS THE LIFE AND DEATH OF THE STARS? WILL BE THE QUESTIONS THAT WILL BE ADDRESSED AT THE CIAUS.

The University Center for Exact Sciences and Engineering (CUCEI), through the Institute of Astronomy and Meteorology (IAM) and the Guadalajara International Book Fair (FIL) invite the seventh International Colloquium on Astronomy, Universe and Society (CIAUS), which will address the birth and death of the stars, on December 4, at Expo Guadalajara.

At the round table “What are the stars?” The properties of objects, their structure and, specifically, the Sun as the star that gives life will be discussed. The specialists in charge include [Prof Quentin Parker, from the University of Hong Kong](#).

The colloquium will close with the participation of [Prof Sun Kwok, from the University of Hong Kong](#), who will speak about the cosmic seeds of the stars.

<http://www.gaceta.udg.mx/invitan-al-septimo-coloquio-internacional-de-astronomia-en-el-marco-de-fil/>

<http://iam.cucei.udg.mx/noticia/invitan-al-septimo-coloquio-internacional-de-astronomia-en-el-marco-de-fil>



The University of Hong Kong Laboratory for Space Research, participated in a HASSE (Houston Association for Space and Science Education) space school event to explore the strong development of the Chinese Space program on 4th June 2022

Europlanet Early Career (EPEC) Network and EPEC Podcast:

Dr. Safoura Tanbakouei, LSR member and a postdoctoral researcher in Department of Earth Science is participating to organize podcasts for EPEC, the Europlanet Early Career network. EPEC aims to amplify their voice around the planet to reach other early career researchers, with the same goals, the same interests, and the same needs for scientific development. You can listen to the podcast via following links:

<https://music.amazon.com/podcasts/1c32c48b-9caa-458d-8350-c32d6ea40565/stairway-to-space>

<https://podcasts.apple.com/us/podcast/stairway-to-space/id1632913280>

<https://open.spotify.com/show/0xgaYFX7wsML6wcAHUVuHo>

<https://www.youtube.com/channel/UCx3IJSUB2SFH-iV1iQZTBfg>

Episode presentation: I. Belgacem, I. Di Pietro, F. Karakostas, E. Luzzi, M. Mirino, J.E. Silva
Production team: I. Di Pietro, F. Karakostas, E. Luzzi, M. Mirino, J.E. Silva, S. Tanbakouei (pictured) and G. Tognon



The Europlanet Early Career (EPEC) network is organized by early-career researchers, for early-career researchers and include volunteers from across the international community. The EPEC network is open to all early-career planetary scientists and space professionals (e.g. MSc., PhD, PostDocs). One of the main objectives of EPEC is to form a strong network between young professionals by organizing early-career-relevant events and by engaging in different projects amongst the different working groups (see website for more details on working groups). Join us now:

EPEC website: <https://www.europlanet-society.org/ea...>

Facebook: <https://www.facebook.com/epec.epn>

Twitter: https://twitter.com/epec_epn

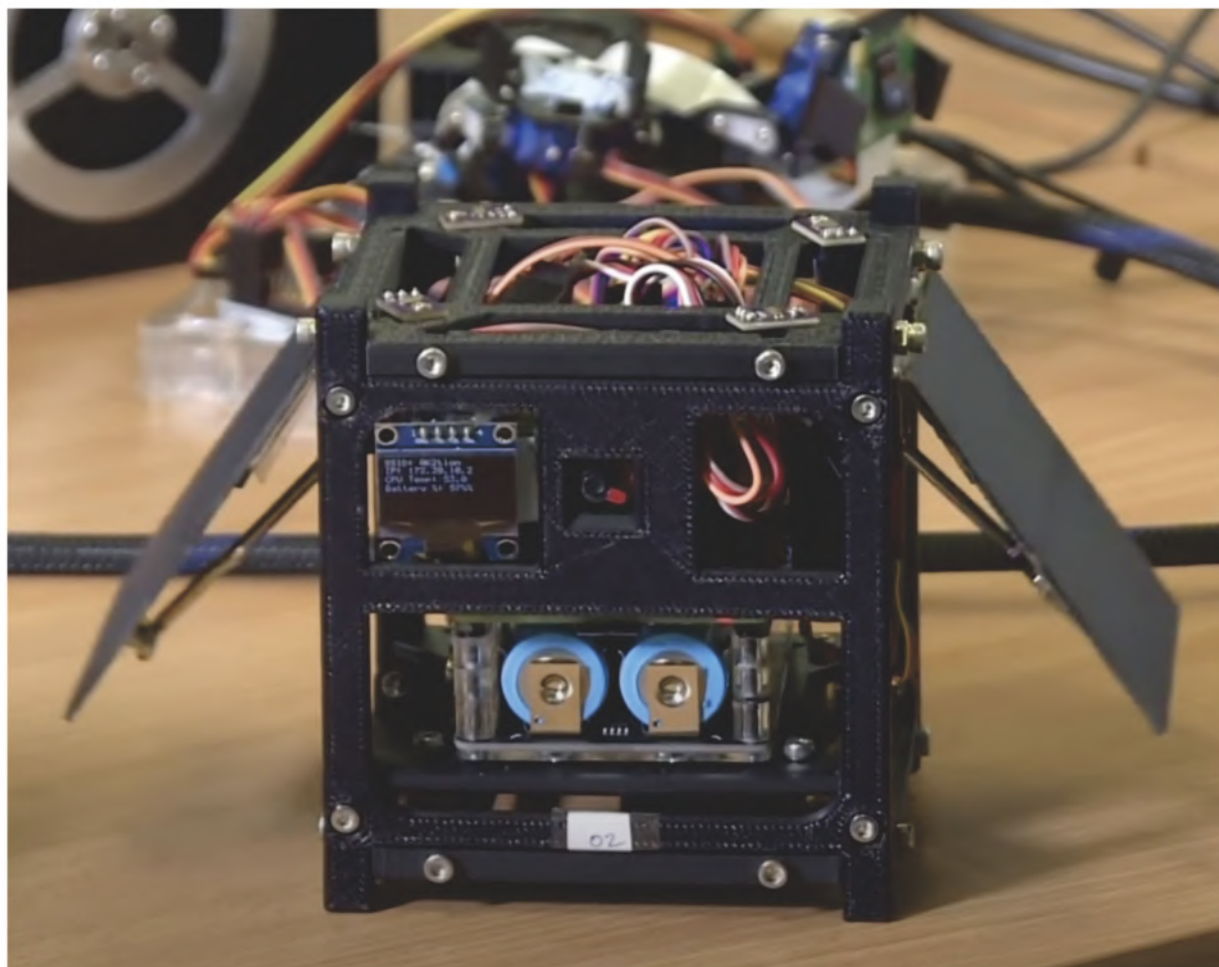
The LSR on TVB television



TVB television came to the LSR on 18th November 2021 to film and create a story on the LSR. The program was broadcast on January 5th 2022.

LSR on TVB

 JANUARY 06, 2022



On January 5th 2022, TVB broadcasted a TV program talking about Cubesate and space. It was interviewed and filmed at LSR. You can watch the video in this link (start from 11minutes and 45seconds): <https://news.tvb.com/programmes/innovationgps/61d58179c652e9031fa3c45e/0/NFT%E6%BD%9B%E5%8A%9B%E8%82%A1%E5%A4%AA%E7%A9%BA%E7%B6%93%E6%BF%9F>

The poster is set against a dark blue space background with stars. At the top center is the OASA logo in green and blue. To the left is a yellow comet with a blue and white nucleus. To the right is a red and white UFO. A large yellow and orange sun is partially obscured by a red UFO saucer. A green beam of light shines down from the saucer. The text 'Monthly Forum' is in white on the red saucer. Below it, 'ASK ME ANYTHING ABOUT ASTROPRENEURSHIP' is in bold yellow. 'UFOS SHOULD YOU CARE?' is in large, glowing green letters. The date and venue are listed below. The bottom section has a pink background with circular portraits of the speakers.

OASA

Monthly Forum

**ASK ME ANYTHING ABOUT
ASTROPRENEURSHIP**

**UFOS
SHOULD YOU CARE?**

Date: 28 Jul 2022 18:30 (HKT)
Venue: Zoom

Moderator:


Prof. Gregg Li
Executive Chairman
of OASA

Guest Speakers:


Chris Altman
NASA-trained
Commercial Astronaut


Foo Xiang Feng
Young Marco Polo


Prof. Quentin Parker
Director of the Lab for Space
Research, HKU

On July 28th 2022 Prof. Quentin Parker formed part of a 3 member panel to discuss this interesting if controversial topic with a large live audience streamed via zoom and organized by our key OASA partner as part of their "Ask me anything about astropreneurship" series.


APPENDIX V

LSR Current Membership List (72 members as of 26th August 2022)

| Name | Title | University/ Institute | Faculty | Department |
|------------------|--|---|-------------------------|----------------------------|
| Quentin Parker | Director, Professor | HKU | Science | Physics |
| Joseph Michalski | Deputy Director, Associate Professor | HKU | Science | Earth Science |
| Meng Su | Ex officio Deputy Director, Hon. Associate Professor from March 2021 | HKU | Science | Physics |
| Alfred Amruth | PhD Student | HKU | Science | Physics |
| Denis Bastieri | Chair Professor | University of Padova (Italy); & Guangzhou | Science | Physics and Astronomy |
| Kayi Chan | Research Assistant | HKU | Science | Earth Sciences |
| Vanessa Chan | Undergraduate Student | HKU | Science | Physics |
| Ruilin Cheng | PhD student | HKU | Science | Earth Sciences |
| Yoyo Chu | PhD student | HKU | Science | Earth Sciences |
| Charles Cosgrove | Affiliate ex HKU SRA | HKU | Forensic Science | Faculty of Science |
| Max Collins | MPhil Research Postgraduate Student | HKU | Science | Earth Sciences |
| Rishank Diwan | Research Assistant | HKU | Science | Physics |
| Kees de Kuijper | Research Assistant | HKU | Science | Physics |
| KennyFan | Undergraduate Student | HKU | Science | Physics |
| Xuan Fang | Research Professor | HKU | Science | Physics |
| Enhao Feng | PhD Student | HKU | Science | Physics |
| Foo Xiang Feng | MSc student | HKU | Science | Physics |
| Chih-Hao Hsia | Assistant Professor | MUST, Macau (ex HKU) | Science | Lunar & Planetary Sciences |
| Ethan Kao | High School Graduate | WIS | Science | Physics |
| Jed Kaplan | Associate Professor | HKU | Science | Earth Sciences |
| Thomas G. Kaye | Director, Foundation for Scientific Advancement | Arizona, USA | Science | Astrophysics |
| Andy Kong | Research Assistant | HKU | Science/ Engineering | Physics |
| Fiona Kwok | Assistant Professor | HKU | Engineering | Civil Engineering |
| Sun Kwok | LSR Founding Director, HKU Professor Emeritus | UBC, Canada / HKU | Science | Earth, Ocean Atmospheric |
| Charles Lee | MPhil Research Postgraduate Student | HKU | Science | Earth Sciences |
| Helen Lee | Undergraduate Student | HKU | Science | Physics |
| Leo Man Yin Lee | Undergraduate Student | HKU | Science | Physics |

| | | | | |
|------------------------|---|---|-------------------------|-------------------------------------|
| Gregg Li | Adjunct Professor | HKU | Science | Physics |
| Yushan Li | PhD Student | HKU | Science | Physics |
| Jiacheng Liu | PhD Student | HKU | Science | Earth Sciences |
| Kehan Long | Undergraduate Student | HKU | Engineering | Engineering |
| Hongyang Luo | MSc student | HKU | Science | Physics |
| Aditya Mangla | Undergraduate student | HKUST | Science | Physics |
| Ryan McKenzie | Assistant Professor | HKU | Science | Earth Sciences |
| Diganta Misra | MSc Student | Montreal Institute of Learning Algorithms | Engineering | Computer Science |
| Stephen Ng | Associate Professor | HKU | Science | Physics |
| Tze Chuen Ng | Consultant Professor Beijing Spacecrafts | Chinese Space Agency/ HKU | Design | N/A |
| Partha Pal | Postdoctoral Fellow | HKU | Science | Physics |
| Laura Panebianco | Research Assisant | HKU | Science | Physics |
| Michael Pittman | Research Assistant Professor | HKU | Science | Earth Sciences |
| Rosaria Prochilo | MSc Student | University of Padova/HKU | Engineering | Physics |
| Andreas Ritter | Postdoctoral Fellow | HKU | Science | Physics |
| SeyedAbdolreza Sadjadi | Affiliate | Genius Academy | Cyberport | N/A |
| Pablo Saz Parkinson | Research Assistant Professor (til Aug 15) | HKU | Science | Physics |
| Yang-woo Seong | Undergraduate Student | HKU | Science | Physics |
| Victor Schubert | Space Entrepreneur | CUHK | Business Administration | Global Econ & Finance |
| Katie Strattmann | PhD Student | HKU | Science | Earth Sciences |
| Zhihong Shi | PhD Student | HKU | Science | Physics |
| Shuyu Tan | MPhil Research Postgraduate Student | HKU | Science | Physics |
| Keith Ki Tse Tsz | Undergraduate Student | HKU | Science | Physics |
| Safoura Tanbakouei | Postdoctoral Fellow | HKU | Science | Earth Sciences |
| Jing Wang | Postdoctoral Fellow | HKU | Science | SBS |
| Seren Wang | MSc student | HKU | Science | Physics |
| Alex Webb | Associate Professor | HKU | Science | Earth Sciences |
| Kenneth K. Y. Wong | Professor | HKU | Engineering | Electrical & Electronic Engineering |
| Shawn Wright | Postdoctoral Fellow | HKU | Science | Earth Sciences |
| Jin Wu | Assistant Professor | HKU | Science | Biological Sciences |

| | | | | |
|--------------------|--|-------------------------------|--------------------------------------|------------------------------------|
| Zexi Xing | PhD Research Postgraduate Student | HKU | Science | Physics |
| Yijung Yang | Postdoctoral Fellow | HKU | Science | Physics |
| Binlong Ye | PhD Student | HKU | Science | Earth Sciences |
| Boris Yim | Instructional Assistant | HKUST | Science | Physics |
| David Hoi-Fung Yu | Assistant Lecturer | HKU | Science | Faculty of Science |
| Hao Yang Yuan | Mphil Student | HKU | Science | Physics |
| Yiming Zhao | MSc student | HKU | Science | Physics |
| Binzheng Zhang | Assistant Professor | HKU | Science | Earth Sciences |
| Yong Zhang | Professor | Sun Yat Sen University | Science | Physics and Astronomy |
| Siyang Zhong | Research Assistant Professor | HKUST | Engineering | Mechanical & Aerospace Engineering |
| Wenhan Zhou | PhD Research Postgraduate Student | HKU | Science | Physics |
| Birry Bingrong Zhu | LSR Laboratory Assistan (til July 2022) | HKU | Science | Faculty of Science |
| Albert Zijlstra | Hung Hing Ying HKU Distinguished Visiting Professor (til Dec 2022) | University of Manchester/ HKU | Jodrell Bank Centre for Astrophysics | Physics and Astronomy |




MEMBERS


[Home](#) [About](#) [Activities](#) [Members](#) [Publications](#) [Research](#) [News & Events](#) [Contact](#) [How We Operate](#)

Members

Below is a list of all LSR faculty and staff members. Use the filter on the left to refine the results. Click on the individual for their further details.



- LSR currently has 72 members
- Come from 5 departments & 2 faculties
- A free association of scientists, engineers and technologists
- **No costs to members**
- No pressure to join
- Everyone has a voice
- Supportive, egalitarian, collegiate, respectful
- Well connected with growing brand
- UDF, BRC and RMGS funding
- LSR at Cyberport currently hosts 12 regular members rest on campus/overseas



Putting a face to our LSR membership.

APPENDIX VI

List of all press, TV, video and radio stories and interviews with LSR members during the reporting period.

This reporting period has seen a spectacular explosion of more than 52 press, television, radio and opinion pieces interviewing or quoting LSR members (up from 44 last year). This is largely thanks to the burgeoning Chinese Space program and emerging new space race and exciting Astronomy and planetary science discoveries over the reporting year.

Coverage for our BEST program

The BEST program deserves a special mention. There have been 9 separate press stories on this LSR-OASA-HKU Academy initiative between March and May 2022. Full detail of all these stories and their associated web links are given here:

<https://cubesat.hku.hk/press-coverage>

Series of SCMP and China Daily articles

Between October 2021 and July 2022 Prof. Quentin Parker has been active this reporting period with a series of 4 SCMP and 20 China daily articles largely but not exclusively associated with the Chinese Space program and STEM education issues. See:

<https://www.lsr.hku.hk/series-of-south-china-morning-post-interview-related-prof-quentin-parker/> for details of a few of the most relevant.

1. September 2021

Dr. Joe Michalski, Deputy LSR Director, was interviewed by “Hong Kong Today” about Chinese Space Program. It was broadcasted on 3 Sep 2021 on RTHK. You can listen the playback by clicking this link (starts from 1:05:20):

https://news.rthk.hk/rthk/en/news-programmes/this-episode.htm?cmsid=77&episode_id=767178&livetime=20210903000000

Prof .Quentin Parker, LSR Director, participated in CRI panel discussion – will the “billionaire space race” benefit humanity? (27 September 2021)

Hosted by “China Plus”, you can watch the video by clicking this link:

<https://www.youtube.com/watch?v=BDFOV-qTBlw&t=108s>

2. October 2021

Prof Quentin Parker, LSR Director, shared his insights in CGTN Live : How are media covering China’s missions to space? Something to fear or praise? What role is China playing in the future of international cooperation in space? And what impact is the commercial space sector making? (5 October)

You can watch the video by clicking this link:

<https://www.youtube.com/watch?v=gWYRQWtoIZo>

CHINA PLUS Radio Talk: How should we assess China's progress in building its own space station in the past few years? (October 18, 2021). Prof Quentin Parker, LSR Director, was invited by CHINA PLUS World Today to talk about the subject. Please click here to listen the full story:

<http://chinaplus.cri.cn/podcast/detail/1/2697295>

RTHK radio – China's latest space mission. It was broadcasted on 18 Oct 2021 9:15am on RTHK Radio 3. You can listen to the playback by clicking this link (start from 46:18):

<https://www.rthk.hk/radio/radio3/programme/backchat/episode/761575/contentindex/1/>

In KPMG's Future Hong Kong podcast series, Prof. Quentin Parker, LSR Director, together with Dr. Gregg Li of OASA discussed the major imperatives for investment in space exploration and the expected societal and economic benefits of space research for Hong Kong, the region and globally (29 Oct 2021):

<https://home.kpmg/cn/en/home/insights/2021/10/future-hong-kong-podcast.html>

3. November 2021

RTHK Backchat interview. Prof Parker gave his views on the latest spacewalk by astronauts aboard the Tiangong space station, the first Chinese woman to walk in space, and space security amid US calls to establish international rules governing activities in space (8 November).

You can listen the playback by clicking this link:

<https://www.rthk.hk/radio/radio3/programme/backchat/episode/782302/contentindex/2/>

4. February 2022

Chinese rocket's moon crash won't be dangerous but raises questions, experts say, 15/02/2022. See:

https://www.scmp.com/news/china/science/article/3167151/chinese-rockets-moon-crash-wont-be-dangerous-raises-questions?module=perpetual_scroll_0&pgtype=article&campaign=3167151

5. March 2022

To promote understanding and interests of the young generation in Hong Kong in various disciplines in science and technology, the HKLF (Hong Kong Laureate Forum) interviewed Prof. Quentin Parker, director of Laboratory for Space Research. Please click this link to view the inspiring video:

https://www.youtube.com/watch?v=MMH_ifcqQ2Y

Professor Quentin Parker is invited by Wall Street Journal to share his insight on comparison between Blue Origin and CAS Space vehicles and how perfecting the reusable rocket could unlock access to the broader space economy. Please click the following link to view the video:

<https://www.wsj.com/video/series/in-depth-features/us-vs-china-the-tech-and-design-behind-space-tourism-rockets/B2348FDC-208B-4201-99AC-5864827C2DFF>

6. April 2022

Dr. Joe Michalski, LSR deputy director, was interviewed by Wall Street Journal to share his insight on moon mining. Please view the video in this link: <https://www.wsj.com/video/chinas-moon-dust-paves-the-way-for-future-mining-missions/A6A9112C-94BC-46C2-A23E-65FF40676756.html> (21 April)

The titled article from «WIRED» quoted Dr. Joe Michalski, LSR deputy director. Please view the full article in this link: <https://wired.me/science/the-uae-wants-to-put-humans-on-mars-by-2117-its-plans-start-now/> (21 April)

Busy May looms for China space launches as Tiangong trio prepare for home. See: https://www.scmp.com/news/china/science/article/3173570/busy-may-looms-china-space-launches-tiangong-trio-prepare-home?module=hard_link&pgtype=article (10 April)

Series of China Daily radio interviews and podcasts during April 2022

China's plan for a moon base at lunar south pole (start from 43:30mins): https://radio.cgtn.com/podcast/news/1/Whats-waiting-for-Twitter-after-Elon-Musks-takeover/345541?jump_from=1_05_37_01 (26 April)

Shenzhou-13: Another success in China's space exploration. What's its long-term impact? See: <https://radio.cgtn.com/podcast/news/1/Shenzhou-13-Another-success-in-Chinas-space-exploration-Whats-its-long-term-impact/344231> (16 April)

First completely commercial crew to the International Space Station (start from 44min). See: <https://radio.cgtn.com/podcast/news/1/Whats-behind-the-rise-of-far-right-in-France/342780> (11 April)

7. May 2022

See BEST program details above for 9 press articles on this STEM initiative

8. July 2022

RTHK radio interview with Prof. Quentin Parker to discuss the exciting, new James Webb Space Telescope images (14 July). See: <https://www.rthk.hk/radio/radio3/programme/backchat/episode/827142/contentindex/2/>

9. August 2022

Dr. Safoura Tanbakouei, LSR member and a postdoctoral researcher in the Department of Earth Science participated in a recent podcast by EPEC the Europlanet Early Career network (1 August). See: <https://podcasts.apple.com/us/podcast/stairway-to-space/id1632913280>

China Radio International interview with Prof. Quentin Parker to discuss the NASA Artemis moon missions. (30 August). See: <https://radio.cgtn.com/podcast/news/1/Olaf-Scholz-EU-visions/368727>

APPENDIX VII

The LSR family and the loss of a friend

The LSR subscribes to an ethos of tolerance, equal recognition and treatment regardless of race, religion, gender or LGBTQ status. Currently 24% (17) of our members are female, which, though lower than we would prefer, still bears favourable comparison with most departments in the Faculty of Science. Our international representation is also high with members from more than a dozen different countries other than the Chinese Mainland and the HK SAR of the PRC. We are strong supporters of diversity in the workforce.

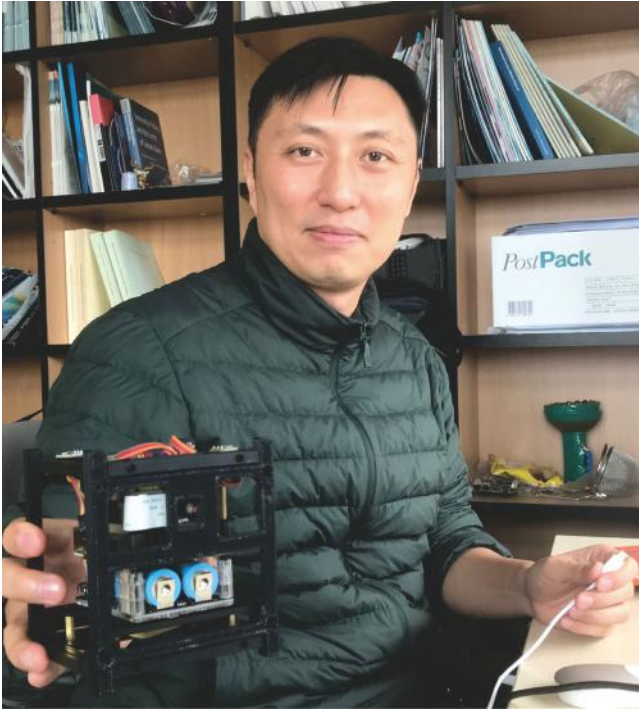
In July 2022 a great supporter and friend of the LSR sadly passed away after a long illness. Prof. Stefano Debei was director of the internationally significant Padova-CISAS group in Italy in Space satellites and technology – one of the strongest such groups in Europe. In June 28th 2018 an LSR delegation, led by the then Dean of Science Prof. Evans signed the 3rd LSR MoU that was also first of our truly international MoUs with Padova CISAS where Prof. Debei was a signatory. This followed a visit from Prof. Debei to Hong Kong and the LSR in Sept 2017. This relationship led to establishment of an MSc exchange scheme with Ms. Rosaria Prochilo arriving in HK in 2019 as the first MSc student and the birth of our 6U MeV CubeSat project. The LSR sent a wreath to his funeral out of friendship, gratitude and respect for a truly great scientist, leader, visionary and supporter of the LSR.



Left: LSR wreath; right: MoU Signing at Padova, June 28th 2018, Prof. Debei is on the far left next to Dr. Meng Su.

APPENDIX VIII

Member focus: Andy Kong, Part time PhD and LSR RA in CubeSats



Life is short, I want to use every single ounce of it to understand the surrounding, the world, the universe and most importantly, myself. Using the spark of curiosity within, I keep the energy growing. It is the fun part of being alive, and it is the only lifting force from being ordinary.

The reason I joined the LSR?

We all love space. In 2014, with many helping hands, I have launched a weather balloon to near space, it was fun. But the energy died off and everything went back to normal. After some years, I went back to school, and got my masters degree in engineering. And now I am doing my part-time PhD about cybersecurity and AI. Last year, there was a news about the LSR everywhere and I decided to join in this family. I want to utilize my engineering skill in astrophysics and Space Science, and yes, merging different fields is an easy way to spark new idea and to write papers...

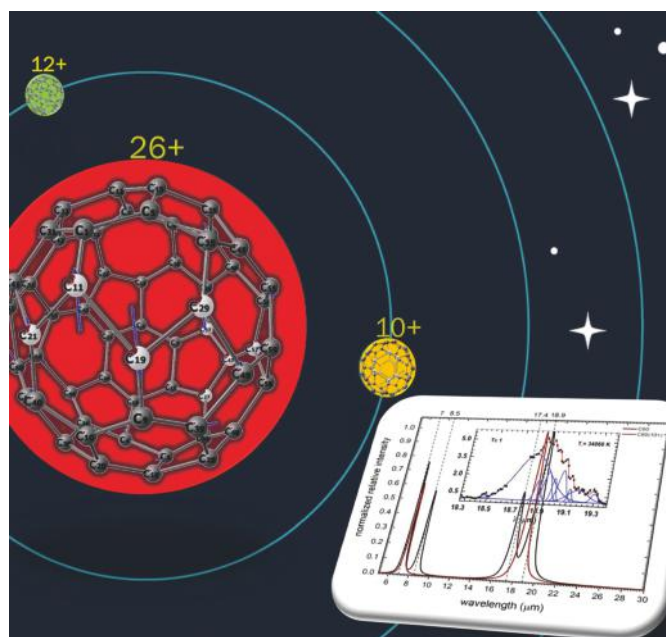
The universe is full of mysteries and myth, I am lucky to meet all the experts in the LSR. They are willing to help me clear up many misinformation I have learned from the internet. From astrophysics to string theory, they can explain clearly each subject. I have learned from them not only knowledge but an unbounded admiration and enthusiasm they all have for the universe.

Currently, I am working on cubeSats and a 6U MeV "Gamma ray" telescope CubeSat. We did several cubeSat workshops and a STEM competition (BEST) this year. Sharing is the best way to learn, I hope we can do more face-to-face workshops and there may be a chance of launching the satellite to near space too.

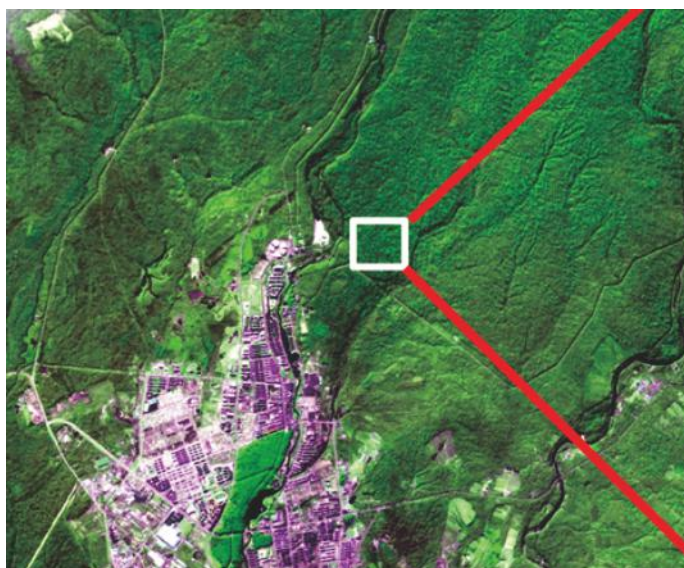
If you like space and are full of crazy ideas, please come to the LSR and find me, you are my kind of people. :)

Images used for the front cover of the LSR Annual Report

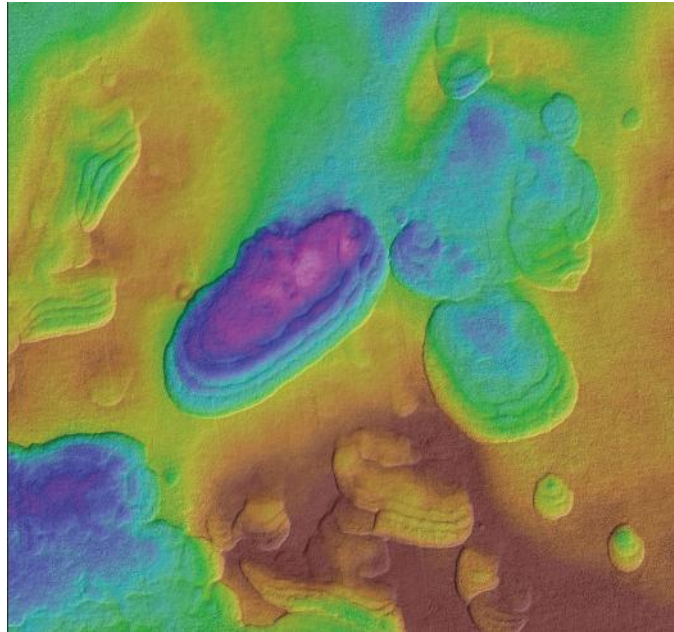
All images were taken from some of the top LSR papers and press releases over the reporting period



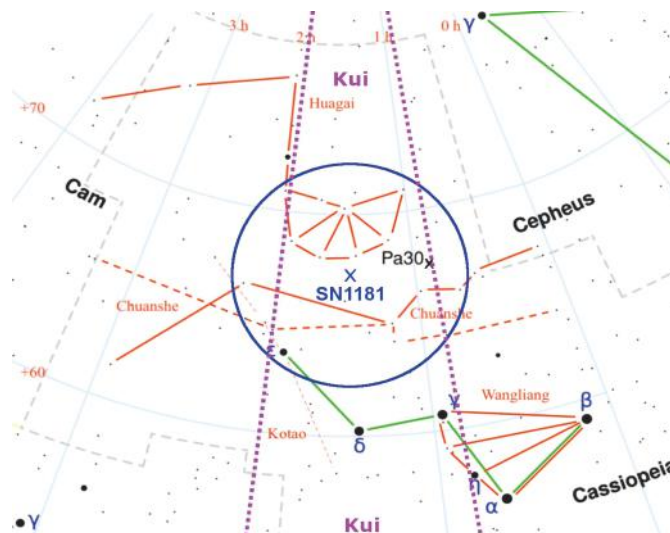
1. Top left: Schematic of the highly ionized species of the C60 molecule or “Buckyball” and their possible association with Unidentified Infrared Emission (IUE) bands as reported by Sadjadi et al 2022, ApJ) – see: <https://www.scifac.hku.hk/press/release/hku-laboratory-for-space-research-put-a-positive-spin-on-the-buckyball-c60>



2. Top Right: Selected remote sensing image. Several issues remain with CubeSat observations that hinder broader application such as cloud contamination, varying sun angles causing data issues and accurate biophysical interpretation of satellite imagery. Dr. WU (LSR member) and Dr. Jing WANG in SBS HKU, developed novel observational methods to help address these issues.
See: https://www.hku.hk/press/news_detail_23190.html



3. Bottom Left: HiRISE digital elevation map showing small, scallop shaped depression in the Utopia Planitia region of Mars. These features are thought to represent shallow lakes formed by ice-melt late in Mars's history analogous to "thermokarst" lakes on Earth. Such features could trace recent climate change on Mars as evidence for melting of permafrost. Taken from Nature Astronomy review article by Dr. Joe Michalski



4. Bottom right: Star map of the ancient Chinese asterisms and modern constellations that show the approximate location of the historical Chinese quest star of SN1181AD and our proof of its association with a SN Type Iax supernova explosion and its remnant Pa30 (Ritter et al, Sep. 2021, ApJ Letters)

See: https://www.hku.hk/press/news_detail_23256.html



Address: Laboratory for Space Research, 4th Floor,
Block A, Cyberport 4, Hong Kong SAR, China

Telephone: (852) 3662 1432

Fax: (852) 3962 1439

Email: lsrhku@hku.hk

Website: www.lsr.hku.hk

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