

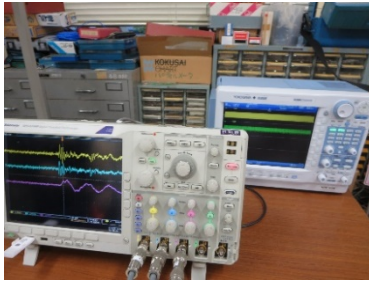
**JSPS Summer Program 2021
SP20111 - Research Report**

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| 1. Name: Hasti Jahangiri Haghighi | (ID No. SP20111) |
| 2. Current affiliation: University of Manchester/ aerospaceHV | |
| 3. Research fields and specialties: Engineering Sciences | |
| 4. Host institution: Tokushima University | |
| 5. Host researcher: Professor Masatake Kawada | |
| 6. Description of your current research Prior to my arrival in Tokushima, I had completed my PhD in EEE/ Materials science and I was working as a Material Scientist at an aerospace consultancy. My technical expertise lies in the ageing and degradation of electrical materials that are used as dielectrics or more commonly known as electric insulators. The application of my work lies mainly in the Aerospace sector; however, it is applicable to any environment where high voltages are used e.g., Automotive, Marine, Materials. During my PhD I analysed and showed that the testing environment of electrical equipment is absolutely key in ensuring correct lifetime estimations and ageing tests can be taken place, and I showed that the operating environment of commercial aircrafts are more challenging than those given in commonly used Aerospace standards. | |

7. Research implementation and results under the program

Title of your research plan: Partial discharge detection using UHF (ultra high frequency) antennas in high voltage cabling to be used in an Aerospace Application

Description of the research activities: My host university and I set out to use a new detection technique to measure early stages of electrical failure of aerospace equipment. The novelty of this work lies in the test pressures that were investigated as part of this work, where previously this detection technique has not been used within an aerospace environment. The equipment used to detect this early discharge has been shown in the photos below. The left oscilloscope shows the antenna detection and the current of the discharges, whilst the right oscilloscope shows the



waveform of applied AC voltage and the charge magnitude recorded from a separate PD detection system. We found that it is possible to detect discharges of this type using the antenna based system, even under low pressure test environments. This technique would allow for detection of insulation damage on board airplanes without having to remove or alter anything in the aircraft, allowing for a non-intrusive and non-destructive quality assessment.



Additionally, prior to starting my placement, I set out to share my knowledge from my PhD through seminars and smaller classes for undergraduate students. During my placement I gave a talk on my academic career, introduced the importance of UNs sustainability goals in research, and presented the importance of representation of all genders in academia. This was met with praise at Tokushima

University and the Vice President, Yasuhiko Kawamura, who will become the President of the university next year attended my talk. Finally, I attended weekly seminars with undergraduates and discussed technical observations in FFT (Fast Fourier Transform) analysis and also had the chance to teach individuals about life abroad, and hopefully inspired them for future collaboration through JSPS.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):



I thoroughly enjoyed my research placement and gained insight into the work culture during my time in Tokushima. I met various individuals in the electrical and mechanical departments work together harmoniously, yet each individual with their own specific role. The method of working I observed was meticulously well planned and thought through, and driven by improving the quality of work as well as

being goal orientated. Compared to other work environments I had experienced, it was still driven by productivity however less emphasis was put on immediate output and more towards ensuring it is done in the correct manner. I found this new way of working suitable for my working style and rewarding day by day. Unfortunately, due to the COVID-19 pandemic I was unable to visit much of Japan to meet individuals and experience the culture outside of the University, however my host professor went above and beyond to teach me about Japanese customs, culture inside and outside of the workplace, and for that I am very thankful.

JSPS Summer Program 2020 Research Report

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| 1. Name: Audrey COCHARD | (ID No. SP20206) |
| 2. Current affiliation: Ecole Normale Supérieure of Paris, Department of Chemistry / Biology Institute of Paris Seine, Laboratory of developmental Biology | |
| 3. Research fields and specialties: Biological Sciences Interdisciplinary and Frontier Sciences | |
| 4. Host institution: Center for iPS Cell Research and Application (CiRA), Kyoto University | |
| 5. Host researcher: Professor Hirohide SAITO | |
| 6. Description of your current research <p>My PhD work is shared between two laboratories: Zoher Gueroui's group, in the Department of Chemistry of the Ecole Normale Supérieure of Paris, and Dominique Weil's group in the Laboratory of developmental Biology of the Biology Institute of Paris Seine.</p> <p>Membrane less organelles are supramolecular assemblies of RNA molecules and proteins found in eukaryotic cells, thought to play an important role in the regulation of RNA. The general model of formation is liquid liquid phase separation, driven by multivalent low affinity interactions. The study of such naturally occurring granules remains very difficult because of the huge number of biomolecules they contain and the lack of tools to work in a cellular context. In addition to their diverse compositions and functions, condensates are also diverse in size. Whereas PBs or PML bodies are often diffraction-limited puncta, other condensates such as germ granules, centrosomes, and nucleoli can reach few micrometers in size. What sets condensate size and number in cells remains to be understood.</p> <p>We developed a method to build artificial granules in living cells, called ArtiGranules, that spontaneously form in human cells and are able to specifically recruit a heterologous RNA molecule. Using this method, we studied how the recruitment of RNA molecules at the surface of condensates impact the biophysical properties of condensates (size, number, material properties...). We showed that the RNA density at the surface of condensates was correlated to their size and number, with large condensates displaying only a few RNAs on their surface whereas high RNA density always implied smaller and more numerous condensates. We propose that the RNA present at the surface of ArtiG condensates cause a steric hindrance that may prevent the growth of condensates by both subunit addition and coalescence. Additionally, the gel-like properties of the condensates in presence of surface RNA could favor arrested coalescence of the bodies and thus contribute to limit their growth during coarsening.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Visualization and control of RNA-based formation of artificial condensates in living cells

Description of the research activities:

My PhD work has enabled the development of a method to build artificial granules in living cells, whose formation is driven by protein-protein interactions. We then recruit RNA molecules by using RNA binding proteins (RBP). However, the formation of the artificial granules is RNA independent.

A previous collaborative work between Zoher Gueroui's laboratory and the host laboratory enabled the development of a method to reconstitute artificial condensates in living cells based on interactions between a small non-coding RNA (sncRNA) and an RNA-binding protein (RBP). The formation and biophysical properties of these RNA-dependent condensates could thus be controlled by the RNA structure.

During my stay in the host laboratory, we developed a method to visualize the RNA in the RNA-dependent condensates. The visualization of the RNA in live experiments is a challenge. Single molecule Fluorescence in Situ Hybridization (smFISH) can only give information on fixed samples and is moreover impossible here due to the size of the sncRNA used. To circumvent that issue, we added in the RNA a sequence recognized by an RNA-binding protein (RBP) linked to a fluorescent protein. That fluorescent reporter can be used in live experiments and will be convenient for future studies.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Despite the sanitary situation, I was very lucky to experience some aspects of Japanese culture. I had the opportunity to attend a kabuki event with Ichikawa Ebizō XI and his daughter. I was also able to cycle around the lakes on the northern part of Mount Fuji and discover magnificent landscapes. I met a lot of people during my week-ends excursions and despite my still weak Japanese level I could exchange with them and learn a lot (a man with whom I walked and talked for two hours in the mountains surrounding Kyoto who taught me how to pray in a shrine, a couple in a ryokan who introduced me to their daily life...). These experiences have strengthened my desire to keep on learning Japanese and I hope to come back to Japan after my PhD for a post-doc.

JSPS Summer Program 2022 Research Report

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| 1. Name: Arzoumanov Jean | (ID No. SP20209) |
| 2. Current affiliation: Université Sorbonne Nouvelle – Paris 3 (France) | |
| 3. Research fields and specialties: Humanities | |
| 4. Host institution: Tokyo University of Foreign Studies | |
| 5. Host researcher: Satoshi Ogura | |
| 6. Description of your current research | |
| <p>I obtained my PhD. in in South Asian Studies from the Université Sorbonne Nouvelle – Paris 3 (France) in 2021 with a dissertation on the representation of Indian sects and ascetics in Indo-Persian literature between the Mughal and colonial periods (16th-19th centuries). I am in the process of writing several articles and a book taken from my PhD. I study more particularly textual encounters between Islamicate and Indic cultures and in the participation of non-Muslim literati in Persian literary production. My dissertation examines the history of texts written in Persian on Indian sects and ascetics produced between the 16th and 19th centuries. Relocating this object in the longer Indo-Persian cultural tradition between the Mughal and colonial periods, it focuses on a corpus, essentially manuscript, written in North India. From the late 16th century to the 17th century, Persian descriptions of Indian sects and religions were renewed thanks to detailed studies, which moved away from the Arabic and Persian doxographical traditions. From the late 17th century, a new generation of Persianized Hindu <i>munšīs</i> (secretaries) accelerated the indianisation process of Indo-Persian culture and transformed the way in which ascetics and sects were depicted, more particularly through the development of a devotional literature in Persian that was devoted to the saints of the bhakti devotional movement. The precolonial Indo-Persian literary tradition and its actors, the <i>munšīs</i>, did not disappear after the establishment of the British power in North India. Indo-Persian texts composed during the first half of the 19th century transformed forms of writing in India and contributed to Orientalist scholarship on the religions of India. They bear witness to the convergence between precolonial and colonial forms of knowledge. The ethnographic descriptions commissioned by British colonial officials give an exhaustive account of the doctrines, practices, and appearance of numerous Indian sectarian groups and allow an easier identification of ascetics' sectarian affiliation.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Translating Sanskrit law into Persian in seventeenth-century Mughal India: a study of the Persian version of the *Mitākṣarā*.

Description of the research activities:

I reviewed the manuscript 195A kept at the Zakir Husain Library (Jamia Millia Islamiya, New Delhi, India) dating from 1846 and copied for the civil judge Qāzī Muḥyī al-Dīn Ḥān. A comparison with the 1879 lithograph edition (Lucknow: Naval Kishore) shows that the latter is partly summarized. I haven't had access to the oldest copies which are kept at the Asiatic Society of Bengal (Calcutta, India) and at the Maulana Azad Library (Aligarh, India). The text is a translation of the Sanskrit canonical law treatise *Yājñavalkyadharmasāstra* alongside the *Mitākṣarā*, a Sanskrit commentary by Vijñāneśvara (12th century). The translation was composed in 1657 by La'ī Bihārī, a Hindu scribe from Bhojpur, helped by a Sanskrit scholar (pandit). The Persian translation closely follows the Sanskrit original, but the division of its chapters is different from the available edited Sanskrit texts. The main features of La'ī Bihārī's translation method are the following. He mainly translate literally the original text, but often adds short glosses to explain Sanskrit terms and also Sanskrit compounds. Interestingly, La'ī Bihārī doesn't attempt to adapt the text into its target language and culture, that is, he often keeps the Sanskrit words in the text in Persian characters, often with a translation or a gloss. This proximity with the Sanskrit original can be explained by the public which he says in the introduction to be targeting, that is "Hindus who do not know Sanskrit". Nevertheless, the translation is strikingly easy to read and pedagogical despite its difficult technical content. Overall, the translation doesn't translate the *Yājñavalkyadharmasāstra* but only the *Mitākṣarā* and is generally shorter than the original.

Further work on the text would necessitate to study the other manuscripts. A comparison with the translation and codification of Indian law under the colonial rule might be interesting, since the only other example of a Persian translation of a Sanskrit law treatise was made during the colonial era.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Matthieu GARNUNG | (ID No. SP20214) |
| 2. Current affiliation: LPC2E, University of Orleans, CNRS | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: The University of Electro-Communications | |
| 5. Host researcher: Prof. Yasuhide HOBARA | |
| 6. Description of your current research <p>Sprites are brief luminous discharges observed above thunderstorms. Sprites are one specific type of transient luminous events (TLEs). Spanning over an altitude range from ~40 to 90 km, they are the optical manifestation of a complex electrodynamic coupling between the troposphere and the ionosphere.</p> <p>On 2020/07/06, an interesting picture of these events was taken by a Japanese photographer. This picture is fascinating because of the presence of two TLEs. Furthermore, one of these TLEs could be a gigantic jet (GJ), a rare TLEs starting from the top of the thundercloud to the ionosphere, which is currently not well-known. In addition, the position and the time of the picture are given with a GPS clock allowing us to seek the radio waveform in the Extremely Low Frequency (ELF) range.</p> <p>Using the waveform recorded in the DC~ HF range by 6 stations of the Japan Total lightning Network (JTLN) operated by UEC and Earth Networks. Locations of the causative lightning discharges of TLEs were successfully obtained by the Time Of Arrival (TOA) technique. These lightning discharges have complicated waveforms with a moderate amplitude in LF band. On the other hand, the analysis of the ELF magnetic data reveals that these two TLEs are associated with a very powerful transient signature with very large Qds of few thousand Ckm. Moreover, these transients have a very long relaxation time (> a few 100 ms). These signatures are often indicative of the lightning associated with GJ. It has also revealed the presence of a third TLE.</p> <p>The presence of a radio signature for a TLE led us to employ both advanced image processing (filtering, enhancing, denoising) and local statistical analysis. Then, we successfully identified a weak TLE in the picture. The classification of the type of TLEs was made by the use of two methods. Firstly, we compute the intensity pixel ratio between each channel in the RGB space. Comparing this value with respect to identifying events in the literature, we conclude the presence of sprites rather than GJ from the obtained image despite the contradictory signature from ELF transients implying GJ. However, the upper part of a GJ (i.e., above 40 km altitude) is made of plasma filaments (streamers) sharing similar properties with sprites. A morphological analysis of the TLE shapes revealed that these three events are probably sprites. Unfortunately, the base of the potential GJ candidate is not visible in the picture due to the thundercloud ahead of the TLE. In</p> | |

addition, the image comes from a long-time exposure. Therefore, we cannot have access to temporal information. The lack of spectrophotometric calibration of the camera does not allow us to make a more refined analysis.

Nevertheless, the study of the analyzed TLE events has revealed exciting information and gives us an important lesson for future video observations of TLEs near Tokyo in the summertime. The number of events identified in a waveform can differ from the recorded picture at the same time due to the nature of the event and its dynamics. which will be helpful to study the electrodynamics of the ionosphere during a thunderstorm.

Now, the current research moves to a larger scale. Using two distant ELF stations, one in Japan and the other in Malaysia, we are moving to statistical analysis of the ELF radio signature associated with highly energetic lightning events (i.e., sprites/JG producing lightning) for years over the Pacific area. It is the first attempt to detect the lightning with Qds with high sensitivity antennae in this area. This study will allow us to locate lightning events by ELF only and evaluate the accuracy of the triangulation results using ENTLN (JTLN+global network) and identify some lightning parameters (like polarity, height, intensity...) in space and time. For this task, we expect a significant volume of data to be processed. Therefore, the machine learning technique will be used to identify some variables (current peak, height, latitude, longitude...) as well as source current waveforms as a proxy for different classes of TLEs. It is essential to mention that this study will be done in space and time.

In addition to the data analysis, I participated in the installation and test observations of a new antenna installed in Kumamoto for the JTLN.

7. Research implementation and results under the program

Title of your research plan:

ELF transients associated with energetic lightning events for the statistical characterize of the transient luminous events over Japan and Pacific areas.

Description of the research activities:

- Image processing for the identification of hidden patterns of TLEs.
- Analyze of ELF magnetic waveform associated with typical radio signatures of transient luminous objects like gigantic jets and/or sprites.
- TOA in ELF range using the JTLN for the localization of lightning discharge.
- Beginning of a spatial and temporal statistical analysis of the strongest lightning events over East Asia.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay, I participated in many opportunities thanks to Prof. Hobara. I got the chance to go to Kumamoto for the installation of a new antenna in the JTLN. I visited the Mt. Fuji radar museum, and saw the majestic Mt. Fuji. I also went to the Sugadaira space wave observatory, belongs to the center for Space Science and Radio Engineering (SSRE) of UEC.

I also visited the Shinjuku, Akihabara and many other Japanese districts. These travels in Tokyo and its surroundings were good opportunities to discover the Japanese foods and its culture.

Finally, I participated in giving a short presentation on the University of Orleans and the LPC2E in the context of international exchange between the University of Orleans and the University of Electro-Communications.

It is also important to mention that the Japanese lectures provide a comfortable help for day-to-day life.

9. Adviser's remarks (if any):

I am very happy to have Dr. Garnung in my lab to complete his summer school fellowship after many trials with a significant delay. He works very hard despite hard condition in COVID rampant in Japan and had a significant achievement during such a short stay.

He is also interested in Japanese culture and tried to have a full experience here such as learning Japanese, visiting different places in Japan. If any chance, I am very happy to further collaborate with him and his team in the University Orleans, France regarding lightning and related electromagnetic phenomena etc.

【SP20420】

JSPS Summer Program 2022 Research Report

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| 1. Name: Pritpal Matharu | (ID No. SP20420) |
| 2. Current affiliation: McMaster University | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: Hitotsubashi University | |
| 5. Host researcher: Prof. Tsuyoshi Yoneda | |
| 6. Description of your current research My research consists of investigating problems that arise in theoretical and computational fluid dynamics. Using an optimization-based approach, I am investigating and assessing the fundamental performance limitations of certain classes of turbulence closure models. This research also introduces a level of mathematical rigour to determine optimal closure models for hydrodynamic models. In addition, I am also studying problems concerning the physical phenomenon of anomalous dissipation, also known as the “zeroth law of turbulence”. | |
| 7. Research implementation and results under the program | |

【SP20420】

Title of your research plan:

Optimal Initial Conditions for the Zeroth Law of Turbulence

Description of the research activities:

During my time in Japan, I was able to further my research project with Professor Yoneda, concerning optimal initial conditions for the zeroth law of turbulence. Currently we are in the process of writing these results and preparing a manuscript for submission for publication.

In addition, Professor Yoneda and I have started two new projects investigating fundamental questions in turbulence theory. One of these projects is investigating energy transfer in turbulent flows, while the other regards the connection between observing fluids from the kinetic theory point of view and the macroscopic viewpoint.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan, it was wonderful to experience a completely new culture and meet so many wonderful local people. It was great experiencing many temples and shrines, as well as to participate in many social experiences with individuals from all around the world.

9. Adviser's remarks (if any):

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| 1. Name: Anna Nielsen | (ID No. SP20002) |
| 2. Current affiliation: University of California, Berkeley | |
| 3. Research fields and specialties: Social Sciences | |
| 4. Host institution: University of California, Berkeley | |
| 5. Host researcher: Prof. Jun MITSUMOTO | |
| 6. Description of your current research | |
| <p>The objective of the current research project is to examine the distribution of rice agriculture and other subsistence strategies in Japan's Kofun period (ca. 250-600 CE) from a perspective of sustainability and disaster resilience, emphasizing how the results of this research may differ from generally held assumptions about food production at the time. My project examines the roles of various subsistence strategies, particularly wet-rice agriculture, dryland cropping, slash-and-burn farming, and complex landscape and water management systems, with relation to varying environmental conditions, terrain, and vulnerability to natural disaster in archaeological sites of Japan's Chugoku region. Japan is particularly prone to a wide variety of natural disasters, including floods, typhoons, earthquakes, landslides, tsunamis, and volcanic eruptions, while the Chugoku region can also be prone to droughts (Okamoto <i>et al.</i> 2004), meaning that Okayama is an ideal place in which to study ecosystem vulnerability in the past, along with the strategies that people used to anticipate or mitigate disaster.</p> | |
| 7. Research implementation and results under the program | |
| Title of your research plan: <i>Analyzing Subsistence Strategies in Japan's Kofun Period from the Perspectives of Sustainability and Disaster</i> | |
| Description of the research activities: | |
| <p>This project draws on sites in the Chugoku region, particularly mountainous and low-lying areas of Okayama Prefecture. The focus is on Kofun-period agricultural sites, although I intend to also include some Yayoi- and Final Jomon-period sites to track changes during transitional periods. The first step of this project has been library research to examine regional excavation reports on agricultural and settlement sites. I have used the libraries and archives at Okayama University to obtain more detailed data on the Chugoku region specifically and compile a list of suitable sites about which sufficient data are available. I have also visited some sites in person to gain landscape and feature data that are not available in the site reports. From here, I plan to use GIS analysis to plot agricultural sites in order to track changes in the locations of agricultural sites over time and in some cases map with remotely sensed data of the site layouts, then analyze the distribution of sites from the perspectives resilient landscape management in periods of growing population, versus periods of disaster, crisis, or climate change. Finally, I will examine why, in the context of the natural environment, transitional phase Kofun peoples adopted the types of subsistence strategies inferred from my analysis. How did rice paddy fields change location, or did they not? In what ways were changing site locations connected to the development of large-scale irrigation and subsequently of monumental</p> | |

tombs?

While at Okayama University, I had the opportunity to travel to Kyoto in order to present my research at the Nara National Research Center for Cultural Properties, as well as the chance to travel to Tokushima for several days with professors from Berkeley and Ehime University to analyze agricultural landscape and interview the last surviving slash-and-burn farmer in all of Japan. I was able to visit many archaeological sites and museums in the prefecture of Okayama, as well as in the nearby prefectures of Hiroshima, Hyogo, Kagawa, Ehime, and Tokushima. In addition, I also visited several prefectural archaeological research centers, where I was able to obtain detailed information on local landscapes and archaeological materials. I also attended several weekly university classes, including lectures on Kofun-period history and methods classes teaching the basics of archaeological sketching, GIS, and digital scanning of artifacts. Many of these techniques are used frequently by archaeologists in Europe and Asia but not in the United States, so I was able to learn them for the first time. Since I worked every week in the university student laboratory, I also had the opportunity to talk frequently with my fellow graduate students about our research and after every conversation, came away with new ideas and recommendations about how I could proceed with my work. After one particularly fruitful conversation, one of my colleagues exclaimed “*This* is cultural exchange!”, which echoes my sentiments perfectly.

8. Please add your comments, including any cultural experiences during your stay in Japan (if any):

Since I own horses and work as a farrier (horseshoer) in my home country, I volunteered frequently at both the Okayama University horse stables and local riding clubs, where I was able to exercise horses, observe Japanese farriers at work, attend university equestrian competitions, and learn the basics of Japanese mounted archery. I made a close friend who works for the Okayama Prefectural Tourism Board and most weekends, I went with her to various archaeological sites, festivals, artistic events, and even her family’s grape farm. A friend from my church community took me to a family friend’s workshop to try my hand at making Bizen-yaki, the local historic pottery. I became very interested in Bizen-yaki and returned many times to the city of Bizen, where I befriended several other local artisans and was given tours of modern pottery kilns, ancient kiln sites, and other archaeological areas of Bizen. The region is also famous for katana production, and since a member of my church congregation is a professional sword sharpener, I also visited the sword-making workshops several times to see him and other artisans at work.

9. Advisor’s remarks (if any):

From Jun Mitsumoto: コメント

I believe that her stay in Okayama has greatly advanced both her archaeological research and her experience with Japanese culture.

JSPS Summer Program 2020 Research Report

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| 1. Name: Andrew Aikawa | (ID No. SP20004) |
| 2. Current affiliation: University of California, Berkeley | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: University of Tsukuba | |
| 5. Host researcher: Professor Susumu Okada | |
| 6. Description of your current research My research focuses on the experimental study of nanoparticle diffusion and how it can be controlled on nanomaterials, using atomic scale microscopy. The goal of the study is to determine how to engineer new types of motion for creating new kinds of chemical reactions on electronics. We engineer new surface interactions by stacking and twisting exotic 2D materials. The study uses computer vision to track particles and deep learning to do data analysis over sparse experimental data. | |

7. Research implementation and results under the program

Title of your research plan:

Investigating Diffusion Using Video Scanning Tunneling Microscopy and Deep Learning

Description of the research activities:

The research I conducted with Professor Okada during my stay at the University of Tsukuba was a computational analysis of the physical system I had experimentally characterized while I was at UC Berkeley. The goal of the study was to provide a theoretical explanation for the experimental motion I had measured during my Ph.D. research by using computer simulations to predict the properties of nanoscale motion on graphene by calculating the interaction between particles and the surface they were adsorbed onto. The Okada research group taught me how to perform DFT calculations on my own and advised me throughout the exchange how to model my system. Although during my stay, I did not finish my research project, our work was continued with the help of other co-authors after my departure from Japan. I am still preparing the final results and manuscript for this work to be submitted to an academic journal. The work from my time in Japan is also included in my Ph.D thesis.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Before my entry into Japan, I had participated in a virtual homestay program where I got to practice speaking Japanese with another Japanese family. I also was able to visit many other research labs and universities, namely the Oiwa group (Osaka University), Koretsune group (Tohoku University), the Takamura and Mizuta groups (JAIST). During my stay, I also had the chance to talk about campus life and programming culture at UC Berkeley to a group of undergraduate students at the University of Tokyo.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Barbara KINSELLA-KAMMERER | (ID No. SP20006) |
| 2. Current affiliation: Queens College, CUNY | |
| 3. Research fields and specialties: Social Sciences | |
| 4. Host institution: Hamamatsu University School of Medicine | |
| 5. Host researcher: Prof Kenji TSUCHIYA | |
| 6. Description of your current research | |
| <p>Maintaining a balanced diet is essential for improving and keeping up with the overall health of an individual, especially during pregnancy. The intake of omega-3 fatty acids are essential for maintaining a healthy pregnancy for both mothers and their offspring. Omega-3 fatty acids include, but are not limited to, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Fatty fish intake, as well as dietary supplements such as fish oil are primary sources for both DHA and EPA. Umbilical cord blood levels of omega-3 fatty acids have been found to be associated with maternal diet (Donahue et al., 2009).</p> <p>EPA and DHA may exhibit protective physical effects for the fetus. Prior research has shown that fatty acid supplementation during pregnancy has been found to be associated with several positive birth outcomes, such as a longer gestational age and higher birth weight in children (Larque et al., 2012; Makrides et al., 2010). Both higher levels of EPA and DHA in umbilical cord blood have been found to be associated with reduced allergy development in children as well (Barman et al., 2020; Decsci et al., 2022).</p> <p>Regarding child behavioral outcomes, prior research has been mixed and few studies have set out to examine the relationship between EPA and DHA on child behavior using umbilical cord blood, as several studies have utilized EPA/DHA in maternal serum as biomarkers. Our current research set out to examine both the independent and interaction effects that umbilical cord levels of EPA and DHA may have on child behavioral outcomes at 8 years old. Since the primary diet in Japan consists largely of high fish intake, it was hypothesized that higher levels of both EPA and DHA would be significantly associated with decreased risk of externalizing problems. Lower levels of EPA and DHA were hypothesized to be significantly associated with increased risk of externalizing problems.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Lower Levels of DHA in Umbilical Cord Blood May Moderate the Relationship between Lower EPA Levels and Increased Risk of Externalizing Problems in Children at 8 Years of Age

Description of the research activities:

Materials

Exposures

EPA and DHA in umbilical cord blood was analyzed using data from the Hamamatsu Birth Cohort for Mothers and Children (HBC Study).

Outcomes

Child behavioral difficulties at 8 years of age were examined using the Strengths and Difficulties Questionnaire (SDQ). The domains for conduct problems and hyperactivity were used in this study to assess externalizing behaviors. The conduct problems subscale (range: 0 to 10) assesses the frequency of temper tantrums and disruptive behavior. The hyperactivity subscale (range: 0 to 10) assesses restlessness and difficulties in concentration.

Results

Statistical analysis

EPA and DHA umbilical cord blood levels were categorized into tertiles (high, medium, & low). They were also analyzed as continuous variables. A negative binomial regression analysis was used for all analyses.

Covariates

Child sex, parity, mother's educational history, mother's pre-pregnancy BMI, feeding patterns of the children, maternal smoking, maternal alcohol use, maternal age at child's birth, gestational age, birth weight, paternal educational history, net income at child's birth, and time variations between surveys were considered as covariates based on prior studies. They were all included in the final model in which all the results below are adjusted for.

Independent effects of EPA cord blood on externalizing behaviors

When EPA cord blood levels were considered as categorical, the lowest tertile of EPA was associated with a one-unit increase in the conduct problems subscale at 8 years old ($p = .042$, $RR = 1.29$, 95% CI 1.00-1.67). None of the EPA tertiles were significantly associated with increased risk of hyperactivity.

When EPA cord blood levels were considered as continuous, significantly associated with a one-unit increase in the conduct problems subscale at 8 years of age ($p = .035$, $RR = 0.77$, 95% CI 0.61-0.98) and the hyperactivity subscale ($p = .029$, $RR = 0.77$, 95% CI .61-.97).

Independent effects of DHA cord blood on externalizing behaviors

Using a negative binomial regression analysis, when DHA levels were considered as categorical or continuous, DHA was not significantly associated with the conduct problems or hyperactivity subscales at 8 years of age in the final model.

Interaction effects between EPA and DHA on externalizing behaviors

A significant interaction effect was found between EPA and DHA on externalizing behaviors. The lowest tertile of EPA and lowest tertile of DHA were significantly associated with a one-unit increase in the conduct problems subscale ($p = .010$, RR = 1.49, 95% CI 1.10-2.04) and the hyperactivity subscale at 8 years old ($p = .035$, RR = 1.38, 95% CI 1.02-1.86). No other combinations of any tertile of EPA and DHA were associated with the conduct problems and hyperactivity subscales.

Discussion

Research regarding fatty acids and child outcomes have been mixed. For example, one study had found that higher levels of EPA in cord blood increased the risk for child difficulties, such as conduct problems (Kohlboeck et al., 2011). Our results were consistent with prior literature that had found lower levels of EPA tended to increase child behavioral problems, but those results were nonsignificant (Loomans, et al., 2014). Our results regarding DHA on its own are not consistent with prior literature. After adjusting for potential confounders, our results did not find any association between DHA and child outcomes.

However, it appears that DHA appeared to moderate the relationship between EPA levels and child conduct problems, as well as hyperactivity. To our knowledge, previous literature has not examined interaction effects between levels of both EPA and DHA found in umbilical cord blood. Our results suggest that both EPA and DHA may be working together to influence behavioral problems, particularly when levels are low. More research is needed to investigate effective nutritional intervention measures during pregnancy, particularly regarding fatty acids.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Conducting research in Japan has been an incredible experience and I have learned so much more about my field, as well as about the history, science, and culture of Japan. It has been a very fruitful experience. Thank you to Professor Tsuchiya and the rest of the HBC study for being so supportive!

9. Adviser's remarks (if any):

Ms. Barbara Kinsella-Kammerer is an excellent, young and talented researcher. She was so quick to learn the statistical software she had never used, the statistical models she had never learnt, and the dataset created under the scientific and cultural contexts she had never familiar with until she came to Japan. During her stay in just two months here, she wrote up a protocol for a new project (shown above), conducted analyses and led herself, together with us, to the point where nutritional intervention for pregnant women might better be updated. It is highly likely that she will finish up writing up a paper and will

publish it in a scientific journal, which is also quite likely to strengthen the tie between the two research teams in Japan and the US. Finally, she has been surprisingly industrious for working on this project as well as keeping good relationship with us, and I believe she will be the one of the key figures in scientific collaborative projects between the two countries.
Kenji J. Tsuchiya

JSPS Summer Program 2022 Research Report

| | |
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| 1. Name: Curt J. DAVIS, Ph.D. | (ID No. SP20010) |
| 2. Current affiliation: University of Delaware | |
| 3. Research fields and specialties: Social Sciences; society-technology-environment connections | |
| 4. Host institution: Teikyo University | |
| 5. Host researcher: Professor Kohei WATANABE, Ph.D. | |
| 6. Description of your current research My research involves a cross-cultural comparison of organic waste management, specifically of food waste. Before beginning the JSPS Summer Program, I completed a study of food waste management at universities in the United States and found that anaerobic digestion (AD) of food waste is rare, but theoretically feasible. I was aware of some facilities in Japan that were successfully processing food waste through AD and wanted to learn how they overcome both societal and technical challenges in the process. | |

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| 7. Research implementation and results under the program | |
| | Title of your research plan: Exploration of organic waste management processes in Japan. |
| | Description of the research activities: During this two-month program, I did extensive desk research (web-based searches) and conducted interviews with several Japanese experts on organic waste management. These included at least seven academic researchers, over ten people working at the municipal or prefectural levels, over fifteen people employed at waste treatment facilities, and five professional consultants. I conducted site visits at waste treatment facilities in several prefectures including: four in Hokkaido, one in Tokyo, two in Kyoto, one in Aichi, one in Osaka, and one |

in Fukuoka. During this research, I was able to uncover preliminary findings regarding the varying successes of waste management programs as well as establish a wide network of connections with which to facilitate future research.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

This program allowed me to travel extensively in Japan with Japanese researchers and learn more about the country than could be learned living in the greater Tokyo area. I also participated in the home stay program, which allowed me to have a cultural exchange with a Japanese family.

9. Adviser's remarks (if any):

I hope that Dr Curt Davis's stay in Japan has provided him with important information for advancing his research, and will be useful in his future career. It has also provided the advisor with new insights and opportunities to establish or enhance ties with researchers and practitioners in related fields. I look forward to further research collaboration with Dr Davis and other researchers whom we have made contacts on this occasion. I also hope that this will be a good precedent for stimulating international collaboration in academic research at Teikyo University.

I would like to thank the interviewees and the hosts at the facilities that we visited, as well as those that helped us in coordinating the interviews and site visits. We are also grateful to JSPS and the administration at Teikyo, without whose support these activities were not possible.

JSPS Summer Program 2022
Research Report

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|--|------------------|
| 1. Name: Samuel Harrison MOODY | (ID No. SP20101) |
| 2. Current affiliation: Durham University, Department of Physics, United Kingdom | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: RIKEN Research Institution | |
| 5. Host researcher: Prof. Fumitaka KAGAWA | |
| 6. Description of your current research | |
| <p>At Durham, my research focusses on magnetic skyrmions: a nanosized whirlpools of magnetisation that have the potential to be used for ultra-low energy digital memory devices. They are found within particular types of magnets. These magnets also host a variety of different spin-textures, including helices. Previously, I have used neutron scattering, resonant x-ray scattering as well as magnetometry measurements to investigate a variety of spin-textures in these magnets.</p> <p>Researchers at RIKEN have recently discovered that when sending an electrical current through a helical magnet, the resultant signal is returned as an echo – out of phase with the input signal. This phenomenon is known as inductance, and inductors are commonly used in electrical devices. This discovery has the potential to dramatically reduce the footprint and energy-cost of these devices. Interestingly, the sign of the inductance was negative, leading to interesting physical consequences which have not been studied/observed before.</p> <p>For the JSPS summer project, we plan to further investigate this phenomenon. I am familiar with the magnetism and the materials, but I have never performed electronic measurements or investigated something using micromagnetic software. At RIKEN, we plan to develop these skills to make me a more rounded researcher capable of both computation simulations as well as a wide variety of experimental techniques.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Micromagnetic Simulations of a Magnetic Domain Wall: Towards Understanding Emergent Electromagnetic Induction

Description of the research activities:

During my stay at RIKEN, I performed micromagnetic simulations (computational simulations which investigate the detailed magnetic structure within a material) to try to understand the origin, mechanism and physics behind driving magnetic textures using an electrical current. We found that there are several different regimes of behavior, each with a unique electrical fingerprint which can be observed using a lock-in amplifier in the laboratory. These regimes have not previously been studied and may explain the origin of the negative inductance. We intend to publish these computational results within a journal in the near-future as a guide for experimentalists looking for emergent induction in a variety of materials.

Furthermore, we are in the process of performing laboratory measurements on a bespoke sample that is optimized for serving the effects suggested in the simulations. We intend to closely work together in the future to publish further papers, and mutually benefit from the collaboration made possible by the JSPS summer programme.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

- Went out for an Izakaya meal with my Homestay in Japan Host.
- Visited the Asakusa Tori-no-ichi Fair I
- Hiking in Takaosan
- Visiting Kyoto, Nara and Hiroshima

9. Adviser's remarks (if any):

He was able to catch the key points of his new research topic in a short time, and even though micromagnetic simulation was new to him, he was able to learn it in a short time and obtain important results that revealed the essence of emergent inductance. Although he did not have enough time to complete the experiments, his findings will greatly inspire future experiments.

JSPS Summer Program 2022 Research Report

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|---|-------------------|
| 1. Name: Noam Sebastian Vogt-Vincent | (ID No. SP20102) |
| 2. Current affiliation: University of Oxford | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: Okinawa Institute of Science and Technology Graduate University | |
| 5. Host researcher: Professor Satoshi Mitarai | |
| 6. Description of your current research <p>The subject of my DPhil (PhD) is modelling the marine dispersal of substances such as plastic debris and coral larvae in the western Indian Ocean (WIO). These applications have enormous importance for marine conservation. For instance, understanding how coral reefs are connected through coral larval dispersal allows us to identify which reefs might be more vulnerable to environmental change, and which reefs might be playing a particularly important role in maintaining regional reef resilience. Unfortunately, due to the very large dispersal distances involved in these applications, direct tracking of debris or larvae is generally unfeasible. As a result, numerical models (validated against observations) provide us with valuable insights into these problems.</p> <p>My research has involved setting up and running a high-resolution, multidecadal simulation of surface currents in the WIO called <i>WINDS</i> (Western INDIan ocean Simulation) and running large-scale dispersal simulations based on currents from <i>WINDS</i> and global ocean simulations. I have carried out a marine debris attribution study to identify the main sources of marine plastic debris accumulating at remote islands in the western Indian Ocean, and am currently working on predicting the connections between thousands of reef sites in the WIO.</p> | |

7. Research implementation and results under the program

Title of your research plan: *Larval dispersal and reef connectivity from a high-resolution multidecadal ocean model*

Description of the research activities:

- Completed simulations of larval dispersal between ~8000 coral reef sites in the western Indian Ocean, with a postprocessing system that can adapt these dispersal simulations to arbitrary biological parameters (i.e. not limited to any one particular coral species).
- Computed time-mean connection probability, larval fluxes, and connection variability across the 27-year simulation time period (Figure 1) for an example coral species.
- Quantitatively compared these estimates to dispersal predictions from coral population genetics, which has helped us refine biological parameters used in our postprocessing.
- Developed techniques to evaluate physical drivers of seasonal/interannual connectivity variability, tying in closely with my previous work on simulating marine debris.
- Started to use graph theory to identify ‘keystone reefs’ in the western Indian Ocean.

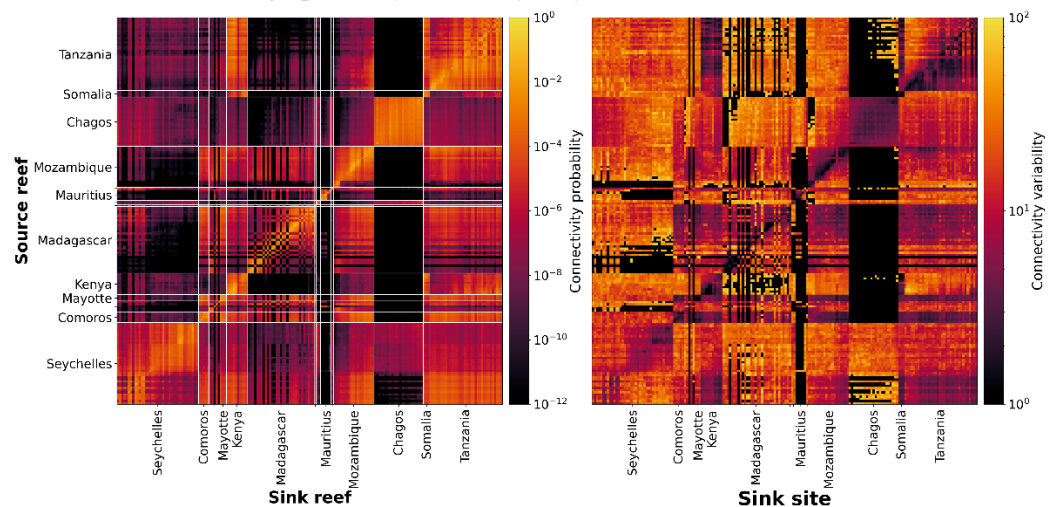


Figure 1: *Left:* Matrix giving predictions of the likelihood of an *Acropora millepora* larva (a common type of branching stony coral) travelling between 180 reef groups in the WIO. *Right:* Variability of these connections (standard deviation of daily connection probability, normalised by the time-mean connection probability).

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I had a great time working in the Marine Biophysics Unit at OIST – the MBU is a very special research unit, with lovely people and a broad range of exciting research being carried out. Aside from my own work, I was able to collaborate with researchers working on deep-sea hydrothermal vent connectivity, attended the naming ceremony of the unit’s new waveglider 「せいうちさん」, had a great time diving around Okinawa (lots of reef sharks and turtles!), and was able to visit other islands in the Ryukyus such as Iheyajima, Tokunoshima, and Amami-Ōshima (including outreach activities on marine pollution).

9. Adviser’s remarks (if any):

Noam worked very hard during his stay in my lab at OIST. He was always prepared very well for our meetings. I really enjoyed our discussion on a wide range of topics, including dispersal modeling, future research directions, etc. I have mentored and trained more than 20 graduate students. Noam is the very best one I have had.

JSPS Summer Program 2022 Research Report

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|---|-------------------|
| 1. Name: Alina Velias | (ID No. SP20103) |
| 2. Current affiliation: Athens University of Economics and Business/London School of Economics | |
| 3. Research fields and specialties: Social Sciences | |
| 4. Host institution: Kyoto University | |
| 5. Host researcher: Dr Yu Zhou | |
| 6. Description of your current research | |
| <p>My thesis comprises three essays on behavioural and experimental economics. My job market paper “On the measurement of disease prevalence” (joint with Sotiris Georganas and Sotiris Vadoros, pre-print at CEPR Economics) is a methodological investigation into the effect of self-selection bias on measurement of disease prevalence.</p> <p>“The best is yet to come: Retirement and prosocial behaviour” (joint with Ioannis Laliotis and Sotiris Georganas; JEBO, 2022) shows that retirement leads to more altruistic behaviour, and this change is not just attributable to external factors, such as a lower need for virtue-signalling, but seems to be caused by a change in preferences. To measure the impact of retirement we use a novel combination of representative cross-sectional and longitudinal individual-level survey data from 22 European countries, and a complementary incentivised field experiment on a representative sample of individuals.</p> <p>“Who is miserable now? Identifying clusters of people with the lowest subjective wellbeing in the UK” (joint with Paul Dolan and Kate Laffan; Social Choice and Welfare, 2021) addresses the problem of identifying the worst-off members of society. We take various measures of subjective wellbeing (SWB) as indicators of the how well people are doing in life and employ Latent Class Analysis to identify those with greatest propensity to be among the worst-off in a nationally representative sample of over 215,000 people in the UK. Our results have important implications for how best to analyse data on SWB and who to target when looking to improve the lives of those with the lowest SWB.</p> | |

7. Research implementation and results under the program

Title of your research plan:

The Ignorance Trap: Who falls for expertise-defying populists and why

Description of the research activities:

The milestones of the research activities include the following.

- Seminar presentations and subsequent discussion of the research project and related studies:

14.07.2022 – Microeconomics and Game Theory Workshop, Kyoto Institute of Economic Research (KIER), University of Kyoto (chaired by Professor Tadashi Sekiguchi)

01.07.2022 - Waseda University (chaired by Professor Yukihihi Funaki)

31.05.2022 – Institute of Social and Economic Research (ISER), Osaka University (chaired by Professor Nobuyuki Hanaki)

- Research meetings to discuss study design with relevant experts:

Professor Tadashi Sekiguchi, Professor Chiaki Hara, Professor Nobuyuki Hanaki, Professor Yukihihi Funaki.

- Seminar and workshop participation:

Institute of Social and Economic Research (ISER), Osaka University: 24.05.2022, 07.06.2022, 14.06.2022, 21.06.2022, 28.06.2022

Microeconomics and Game Theory Workshop, Kyoto Institute of Economic Research (KIER), University of Kyoto: 26.05.2022, 02.06.2022, 16.06.2022, 23.06.2022

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I also gained valuable contacts for my other research project titled “Linking Wikipedia Editing Activity with Geo-Specific Socio-Economic Data to Measure Social Capital.” I had a chance to establish links with Japanese-speaking researchers with the view to further the cross-cultural comparisons project based on Wikipedia editing activity. This study would benefit a great deal from balancing the analysis of Western languages that we have been focusing on so far – with Eastern languages and cultures – such as Japanese Wikipedia.

9. Adviser’s remarks (if any):

JSPS Summer Program 2022
Research Report

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| 1. Name: Elizabeth Rusbridge | (ID No. SP20109) |
| 2. Current affiliation: Nottingham Trent University | |
| 3. Research fields and specialties: Chemistry | |
| 4. Host institution: Osaka University | |
| 5. Host researcher: Prof. Hiroki AKUTSU | |
| 6. Description of your current research | |
| <p>Superconductivity is one of the most interesting, and yet poorly understood phenomenon of our time. Materials possessing this property exhibit the ability to conduct large electrical currents with zero resistance indefinitely. Owing to this, superconducting materials are ideal for use in power transmission cables, as well as medical applications like that of MRI as a result of their powerful magnetic fields. Superfast transport is a product of superconductivity, such as the bullet train in Japan. Since the origin of superconductivity and the ideal conditions required for a material to enter this state are not yet understood, this project aims to aid in providing theoretical information to allow explanation of this strange phenomenon. In this, materials will be synthesised which possess both superconducting properties, as well as chirality; this combination is not observed in nature, and therefore in doing so, it may be possible to understand the mechanism of superconductivity. Chiral materials hold two conformations, much like human hands hold a left and right conformation, whereby they are non-superimposable mirror images of one another. Structurally, there are identical and have the same physical and chemical properties.</p> <p>Chiral conductors, however, have shown differences in conducting properties in a magnetic field; this effect is known as electrical magnetochiral anisotropy (eMChA). The first experimental evidence for eMChA was reported in 2014, where a bulk chiral conductor based on tetrathiafulvalene (TTF) was synthesised, where TTF is an important component of molecular electronics, and will play a large part in this project. The first occurrence of chirality and superconductivity in the same material was reported in 2017 within a nanotube of tungsten disulphide. In this, the forward and backward flow of current was inequivalent in an applied magnetic field, which does not consist with traditional chirality. This origin of this antisymmetric observation is unknown, and has never been studied in terms of the interplay between chirality and superconductivity, and therefore provides the basis of this research. Combination of these two properties in the same lattice can be achieved using organic-inorganic hybrid materials, opening the door for the study of chiral molecular metals, as well as the potential to synthesise the first ever chiral molecular superconductor. Crystal engineering of materials of this type allow for a multitude of new property combinations to be studied, examples of those synthesised thus far include soluble ferromagnets, paramagnetic superconductors and metallic proton conductors.</p> <p>Materials of this type have been synthesised at NTU and require characterisation in Japan.</p> | |

7. Research implementation and results under the program

Title of your research plan: Synthesis of Chiral & Racemic 2D Superconductors - Physical Property Characterisation

Description of the research activities:

All samples brought to Japan required resistivity measurements, as well as SQUID magnetometry. These tools are important for studying both the electrical and magnetic properties of each sample.

Resistivity measurements require much preparation; each sample requires four gold wires to be attached to the surface of a single crystal in a straight-line using carbon paste, which is then mounted onto a cell via the attached wires. Once these cells are prepared, preliminary resistance measurements are performed to ensure the cell conducts correctly & that the wires are sufficiently attached to the surface of the crystal. Due to the incredibly small size of each single crystal (~1-2 mm), these samples require much precision and time to prepare, and in many cases, multiple attempts. Once the samples are mounted and primary readings are performed, resistivity measurements can be performed, whereby the sample cell is mounted onto the apparatus and voltage is applied over a set temperature range (290 K – 4.2 K). After completion, sample conductivity can be determined *via* plotting the results into a graph of resistance as a function of temperature. These allow samples to be identified as superconducting, metallic, semiconducting or insulating, and any phase changes between said states at given temperatures.

SQUID magnetometry was also performed on all samples; some are awaiting measurement due to equipment fault, but samples have been prepared & stored appropriately. Samples require much preparation for this method, though much less skill is required. Aluminium foil is prepared to a size of 1.5 cm x 2 cm and mass recorded, before addition of sample onto the foil. The foil is then folded specifically to prevent sample loss and re-weighed. The foil is then placed into a plastic straw, with one end plugged to prevent fall-out. Each sample is prepared this way within separate straws, before mounting onto the SQUID probe and measurements performed. The magnetic moment of each sample can be measured as a function of magnetic field at 77 K.

All data collected during the JSPS fellowship will be analysed alongside previous data and prepared for a number submissions to academic journals, should results be novel and of interest to the research community.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I have absolutely loved my time in Japan; it has been a dream come true & I would love to return in the future to live here for a number of years! I spent weekends exploring much of Osaka, and had a four day trip to Tokyo, where I toured the Imperial Palace, visited Shinjuku, Harajuku, Shibuya, Meji-Shrine, Senso-ji Temple, as well as a number of other areas.

Life in Japan has been very wonderful over the last two months; I love the culture, as well as how the people of Japan all collectively live very peacefully and respectfully. It has been an incredible experience, and I will definitely travel to Japan as much as possible in the future to explore more of the country!

9. Adviser's remarks (if any):

Research Report

JSPS Summer Program 2022
Research Report

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| 1. Name: Dr. Rachael STOCKDALE | (ID No. |
| | SSP20112) |
| 2. Current affiliation: Queen's University Belfast | |
| 3. Research fields and specialties: Humanities | |
| 4. Host institution: International Research Center for Japanese Studies | |
| 5. Host researcher: Prof. Edward BOYLE | |
| 6. Description of your current research | |
| <p>When I first applied to the JSPS Summer Programme I was in the third year of a PhD at Queen's University Belfast, developing research in the areas of identity, gender studies, queer studies, culture studies, literature and modern languages. Since then, my research advanced, I completed my PhD thesis, and I embarked on new research projects within Europe. However, it was still of the utmost importance to participate in the JSPS programme, as I had not yet had the chance to explore Japanese research areas nor academia in Japan.</p> <p>Thus, having studied Francophone, Hispanophone, Anglophone and Lusophone cultures during my BA and MA at Queen's, I was excited to have the chance to open up my research to Japan. As aforementioned, it would be particularly relevant in the area of identity to open up my research to a global project given the diverse range of societal attitudes and rich source of unused potential for a pioneering international aspect, especially for the unique cross-culture historical perception.</p> <p>During the JSPS programme I was able to study a diverse range of areas, firstly Japanese women's culture from around 1870 – 1930. I became particularly interested in the Meiji State and how it approached gender, for example, the changing position of women with regards to the economy, as stated by Nolte and Hastings, "Second, by 1890 women had become the backbone of the developing Japanese industrial economy" (The Meiji State's Policy Towards Women 1890-1910, Nolte and Hastings, p.5). Furthermore, I became very much interested in the cyclical nature of thinking towards gender and sexuality with regards to women, and how society dictated, and dictates, their expression of themselves as women at different times, whether that is infamous past aphorisms or the modern expectations of working women in terms of work life balance, and, in particular, the balance of family commitments.</p> <p>Furthermore, by engaging with local groups, I learnt the accepted and rejected histories inside and outside of academia. It became clear that the public do not always adhere to or accept the ideals imposed upon women, whether that is it in terms of current expectations</p> | |

or the interpretation of the past. These prescribed ideas are captured well within Nolte and Hastings; “‘Good Wife, Wise mother’ became the guiding aphorism for governmental policy on women, and the phrase resonates in Japanese society still today” (The Meiji State’s Policy Towards Women 1890-1910, Nolte and Hastings, p.8).

In order to fully understand notions of femininity I also studied masculinity, as a counterpart. In particular, I found Karlin’s text “The Gender of Nationalism: Competing Masculinities in Meiji Japan” insightful with regard to the specific timeframe of the Meiji period. This also led to tangential research into gendered areas of theatre in Japan, in particular Noh Theatre and geisha performances, with a focus on the performed gender in each.

I was able to study women’s self-expression and identity at an international level ranging from East to West, drawing upon my own doctoral research of queer women’s voices in the 19th century including American, Armenian and French examples, as well as key relevant texts on theory including “Gender and Japanese Society” by Dolores P. Martinez. There were particular nuances in Japan which had not appeared hitherto in my research.

During the JSPS summer programme I was able to use a variety of resources at the International Research Center for Japanese Studies as my primary research location, but I must also express my thanks to the Waseda University Central Library, Tokyo University of The Arts and Hokkaido University Library.

In terms of community outreach and engagement, I am indebted to the guidance of Dr Naomi Chi who introduced me to invaluable community leaders in the LGBTQ+ and women’s movements. I was able to conduct research on the ground with local activists and onlookers to the women’s movement which gave me a good understanding of the issue of LGBT understanding when it comes to race, age, social class, status etc. Many of these meetings were planned with the verbal agreement that there would be no recorded footage, but rather that they would act as a stepping stone to understanding the importance of differing cultural understandings and perspectives, which was invaluable to my research. I would like to thank every research participant who spoke with me, in particular the LGBTQ+ organisations in Hokkaido.

Having the opportunity to physically attend relevant academic events in Japan was a huge benefit of the programme, in this case, for example, the Kyoto Pride Parade, which led to several networking successes. From a research perspective, it was also important to attend events like these in Japan in order to fully understand the subject matter.

It is also noteworthy to mention the benefits of the general introduction to Japanese academia from my time on the JSPS Summer Programme. Networking was an important component of the programme and allowed for the planning of several future potential research collaborations. Having now met several important scholars from the field carrying out important research across Japan, I feel more acquainted with the field and confident in proposing future collaborations in Japan myself.

I would like to express my gratitude to JSPS for the opportunity to embark upon such an interesting introduction into research in Japan, as well as the International Research Center for Japanese Studies as host institution and Professor Edward Boyle for guiding me as the host academic. Having had such a fruitful research experience in Japan, I am now looking into a future research project, hopefully focusing on similar themes, of LGBTQ+ and women’s identity.

7. Research implementation and results under the program

Title of your research plan:

Women's Queer Identity in Japan

The results included the opening of a previously unexplored area to enable the foundation for future research collaborations as well as several potential expansions. As well as a solid base of introductory research, multiple networking successes and outreach events followed.

Description of the research activities:

Studying of texts and resources at the International Research Center for Japanese Studies I was able to use a variety of resources at the primary research location, but I must also express my thanks to the Waseda University Central Library, Tokyo University of The Arts and Hokkaido University Library. I also participated in outreach opportunities both within and out of academia such as meetings with local groups, LGBTQ+ Kyoto Pride etc.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I have enjoyed my time on the JSPS Summer Programme, and hope to return for future, longer terms research opportunities.

9. Adviser's remarks (if any):

JSPS Summer Program 2021 SP20114 Research Report

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|---|------------------|
| 1. Name: Rebecca Lewis | (ID No. SP20114) |
| 2. Current affiliation: The University of Manchester, UK/Chester Zoo, UK | |
| 3. Research fields and specialties: Biological Sciences | |
| 4. Host institution: Hokkaido University | |
| 5. Host researcher: Masayo Soma | |
| 6. Description of your current research | |
| <p>It is estimated that around 1 in 8 bird species are threatened with extinction and these species face a large range of threats in their native habitat (i.e., <i>in situ</i>). Because of this, conservation interventions, such as <i>ex situ</i> breeding (breeding animals outside of their native habitat e.g., in zoos) are becoming a vital tool for conservation. However, whilst genetic evolution in captive environments is reasonably well-studied, behavioural evolution, particularly of learned traits, is less well understood. My research examines the evolution of sexually selected traits in captive birds, focusing on vocal behaviour, and how changes in these traits may influence conservation programmes and planning.</p> <p>Avian vocal behaviour has a number of important biological functions including species recognition, with many species having distinct vocalizations. Vocalizations, particularly songs, also function in mate choice, with females showing preference for males based on song traits such as amplitude, rate and complexity. In species that learn their songs from a tutor, the learning process can result in a build-up of differences in song between populations, known as dialects. This variation is biologically relevant; many birds respond more strongly to vocalizations from their own dialect, which may impact territory defence and promote assortative mating. If birds do not respond appropriately to songs from different dialects, they may not integrate and breed in the new populations created during conservation interventions. However, song preferences are not well understood for a number of species, and more research is necessary to determine the full extent of song preference and its potential impact on conservation efforts.</p> <p>Much of my work focuses on the Java sparrow (buncho, 文鳥). The Java sparrow is an endangered finch species native to Indonesia. It is common in zoological collections and a common domestic species that is very popular in Japan!</p> | |

7. Research implementation and results under the program

Title of your research plan:

Mate preference in Java Sparrow females

Description of the research activities:

The project I was involved with aimed to determine females' preference for different song categories. We focused on song complexity, which is thought to be a signal of male quality. For this reason, it has been suggested that females may prefer songs with higher complexity, but little is known about females' song preference in the Java sparrow. I designed song stimuli based on available recordings, determining complexity measures such as note repertoire and linearity. These stimuli formed the basis of the mate preference tests. I analyzed video recordings of preference tests that had already taken place, identifying and counting key response behaviors that could be used in later analysis and allowing me to gain experience in behavioral analysis in Java sparrows. I was also able to set up preference tests myself using the stimuli that I had created, which were video recorded and analyzed.

I also used the software Avisoft SASLab Pro to recreate synthetic copies of song notes sung by Java sparrows. Natural song stimuli vary in many different ways, so it can be difficult to determine which aspect of song female birds respond to. These synthetic notes can be used to create artificial song stimuli, which differ in only one aspect of song complexity. This will allow us to better understand which specific aspects of songs females prefer.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I enjoyed my time working in the lab at Hokkaido University. Everyone was very welcoming and supportive and helped me to get settled in. I particularly enjoyed the welcome meal arranged by the lab members. I visited the Kanasi region, where I visited a number of temples and shrines, and saw many historical items, learning more about Japanese culture and history. I also went on bird watching trips with my host researcher and was able to see a lot of new bird species, which I really enjoyed.

9. Adviser's remarks (if any):

I am glad that she could finally land Japan. Thanks to her great effort and this fellowship opportunity, our collaborative research work made good progress. I believe that it would be turned into more than one published paper soon, and hope that this collaboration continues. Overall, I feel so fortunate to be her host, and am thankful also to JSPS for making it possible for her to come.

JSPS Summer Program 2020 Research Report

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| 1. Name: Kyle Liam Walker | (ID No. SP20117) |
| 2. Current affiliation: University of Edinburgh | |
| 3. Research fields and specialties: Engineering Sciences | |
| 4. Host institution: Tohoku University | |
| 5. Host researcher: Dr. Kenjiro Tadakuma/Dr. Satoshi Tadokoro | |
| 6. Description of your current research My current research focuses on developing control methods for underwater vehicles, with the main focus being on control for minimizing disturbances from ocean waves. This involves a large portion of dynamic modelling, specifically modelling for control which was very applicable to my research in Japan. The difference is that in my current research, I focus on rigid bodies, where as in Japan I am focusing on soft bodies. The overall control scheme I am developing uses predictions of disturbances and explicitly considers these within the control, performing corrective control in a proactive manner. | |

7. Research implementation and results under the program

Title of your research plan: Design of Variable Stiffness Continuum Underwater Manipulators based on Jamming

Description of the research activities:

Using my experience of modelling and control of soft continuum manipulators, I wanted to visit Japan to learn the mechanism element from the group I was joining, who are experts in this field. The concept is to build a manipulator which consists of several small elements, which can each move and change the shape of the robot in specific ways; on top of this, when you compress the elements together, the device becomes rigid and can no longer change shape. The group I joined have proved this concept, and I wanted to adapt their idea to add control using motors and cables, with the aim of placing this manipulator underwater on a vehicle.

I spent my time in Japan designing, prototyping and finally building a first proof of concept idea, which I demonstrated to my supervisors. Most of my time was spent designing the control system, conceptualizing how I can control the manipulator without having to physically change the shape with my hands. This led to the proof of concept being built, which was successful. This is the start of the project and with the proof of concept and the knowledge I have gained from this trip, I hope to continue developing the manipulator at my home institution.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am very grateful to have been offered this experience and I loved my time in Japan. The program is a great way to fund research trips to Japan and along with the work I completed at the University I had an amazing time experiencing the cultural side of Japan. Particularly the traditional side of Japan, such as enjoying Imoni and visiting all of the Izakayas, along with other Japanese cities at the weekends. I highly recommend the program to any researcher thinking of applying.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Robert Walker | (ID No. SP20119) |
| 2. Current affiliation: University of Bristol | |
| 3. Research fields and specialties: Social Sciences and Medical, Dental and Pharmaceutical Sciences | |
| 4. Host institution: Kobe University | |
| 5. Host researcher: Kazuhiro Harada | |
| 6. Description of your current research My current research focuses on physical activity and sedentary behaviour change in a range of populations. To date, I have researched on projects related to military veterans who are wounded, injured, and/or sick, children, and Japanese older adults. I use a mixture of qualitative and quantitative methodologies to explore and create behaviour change strategies to promote physical activity behaviour, apply behaviour change frameworks, such as the Theoretical Domains Framework and Behaviour Change Wheel. I employ a range of techniques including structural equation modelling, confirmatory and exploratory factor analyses, regression, framework analysis and thematic analysis. I also utilize stakeholder engagement to co-produce research that is appropriate and acceptable for the target population. I am currently researching on the interdisciplinary Active-6 project at the University of Bristol that is exploring the effects of the COVID-19 pandemic on Year 6 (aged 10-11 years) and their parents' physical activity behaviour and screen viewing. We have identified that children's physical activity behaviour has not recovered to pre-pandemic levels, despite the easing of COVID-19 lockdowns and restrictions. Key factors that influenced this drop in physical activity were emotional overwhelm and physical fatigue experienced by children following the return to a life that more closely represented a pre-pandemic normality. | |

7. Research implementation and results under the program

Title of your research plan:

A cross-sectional exploration of the determinants of exercise behaviour among Japanese older adults

Description of the research activities:

We collected data related to demographic information, affective exercise experiences in childhood, determinants of exercise, and exercise behaviour from 1000 Japanese older adults. We then conducted two analyses on this data set: 1) development of a measurement tool to measure exercise determinants; and 2) explored the effects of affective exercise experience in childhood, demographic information, and determinants of exercise on exercise behaviour. The first analysis is published in the Journal of Aging and Physical Activity where we demonstrated the reliability of our measurement tool of seven unique psychological determinants of exercise among Japanese older adults. The key findings of the second behavioural analysis were: 1) Knowledge of exercise had the greatest direct effect on total, resistance and moderate to strenuous exercise, but no effect on light exercise; 2) Affective exercise experience in childhood had a significant indirect effects on all types of exercise; and 3) Gender had an indirect effect on total, resistance and moderate to strenuous exercise, and a direct effect on affective exercise experiences in childhood. These findings highlight the importance of increasing exercise-related knowledge and promoting positive exercise experiences in childhood for both genders, especially females, for the promotion of exercise behaviour in older adults

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Unfortunately, due to COVID-19, I was unable to complete my homestay in person. However, I was able to talk with a family online, which was very enjoyable and interesting. I was also fortunate to meet researchers from my host institution (Kobe University) and Waseda University to exchange knowledge and ideas which I feel was one of the best parts my Summer Programme and stay in Japan.

9. Adviser's remarks (if any):

新型コロナウイルス感染症の流行によって、当初より来日が2年延期されるとともに、来日中の研究・交流活動が大きく制限されたものの、Walker氏は前向きかつ粘り強く事態に対処し、無事にプログラムの終了を迎えている。今回のプログラムを通じて、Walker氏との今後の長期的な学術交流の基盤を築くことができ、Walker氏および受入研究者の双方にとって有意義なものであったと考えている。

JSPS Summer Program 2022 Research Report

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|---|-------------------|
| 1. Name: George Johnson | (ID No. SP20121) |
| 2. Current affiliation: University of Oxford | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: KEK | |
| 5. Host researcher: Professor Kazunori Kohri | |
| 6. Description of your current research: | |
| <p>My research is focused on theoretical properties of black holes, and in particular the mechanisms by which they can evaporate. Classically a black hole will only ever increase in size, since an object which passes its event horizon can never subsequently escape. However, it was shown by Stephen Hawking in 1974 that when quantum-mechanical effects are taken into consideration, black holes can indeed emit particles, and thereby slowly disappear.</p> <p>The rate at which a black hole emits a given particle depends on the nature of the black hole and the nature of the particle. One can ask questions such as: is a black hole more likely to emit an electron or a photon? Or: is a black hole more likely to emit a red photon or a blue photon? The answer to these questions may depend on features of the black hole, such as whether it is spinning, whether it is electrically charged, or indeed simply how big it is. My research concerns questions such as these.</p> <p>More concretely, I have most recently been studying the problem of black hole radiation into higher dimensions. Just as a spinning black hole may emit particles at a faster or slower rate than a stationary one, so higher-dimensional black holes may emit particles at a different rate than a three-dimensional one. The effects can depend on the precise nature of these extra dimensions, and indeed whether the particles themselves experience the extra dimensions (it is possible, for example, for the black hole itself to exist in four dimensions whilst the photons it emits live in only three of them).</p> <p>One conclusion of this research is that, under certain conditions, higher-dimensional black holes disappear much more slowly than ordinary three-dimensional ones. Such a black hole, if produced at some earlier point in the universe, is more likely to exist today than its more rapidly-evaporating 3D counterpart. These black holes would therefore constitute an additional, invisible component of the matter in our universe, and this has curious cosmological implications.</p> | |

7. Research implementation and results under the program:

Title of your research plan:

Black Hole Bubbles in Higher Dimensions

Description of the research activities:

The project I worked on in Japan concerned higher-dimensional black hole solutions, just as in my previous research. Instead of looking at the processes by which they evaporate, however, I studied how such black holes can spontaneously transition from one state to another.

Such spontaneous changes of state are known as phase transitions, and occur all the time in our everyday world, usually as a result of changes in temperature. In this case (as in the case of black hole evaporation), however, the phase transition is a quantum-mechanical process, and can be thought of in terms of quantum tunnelling.

The research focused on how a given configuration of black hole and surrounding matter could suddenly change into a different configuration, perhaps with a differently-sized black hole, or a denser field of surrounding matter. The work considered the rate at which such a process could happen, and how this depends on the parameters of the initial and final configurations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My stay in Japan in the summer of 2022 was one of the most rewarding experiences of my life and I will remember it for a very long time to come. I thoroughly enjoyed the work I did at KEK, my collaboration with Professor Kohri, and my interactions with the other academics, students, and members of staff at the institute.

I also had the opportunity to explore so much of this wonderful country (at weekends and at the very end of my trip, as I was writing up my results), and to thereby experience a completely different way of life from that I was used to. The two-day homestay with the Kotake family was undoubtedly a highlight, and I owe a debt of gratitude to them.

9. Adviser's remarks (if any):

None.

JSPS Summer Program 2022 Research Report

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| 1. Name: Francis José BAUMONT DE OLIVEIRA | (ID No. SP20122) |
| 2. Current affiliation: University of Liverpool | |
| 3. Research fields and specialties: Engineering Sciences | |
| 4. Host institution: Chiba University | |
| 5. Host researcher: Dr. NA LU | |
| <p>6. Description of your current research</p> <p>Francis' PhD research, in collaboration with the Institute for Risk & Uncertainty at the University of Liverpool's School of Engineering and Farm Urban, is titled: "Developing a decision support system (DSS) to enable sustainable growth of vertical farms through environmental impact and financial risk modelling". He has focused on economic viability assessment of indoor vertical farms, otherwise known as plant factories with artificial lighting (PFALs). For the DSS development, Francis has conducted interviews and observations with plant factory pioneers and associated businesses (lighting suppliers, indoor farms, research and development companies, consultants and VF system vendors). The data collection aims to address the lack of baseline data across the sector, as well as inform estimates on start-up costs, labour requirements, pathogen outbreaks, failure rates, etc.. The research collates lessons learned from both operational and shuttered indoor vertical farming projects across different business models and configurations. By understanding the learning curve of this complex sector, more accurate and adaptable forecasting can be conducted for reliable investments with necessary due diligence. The DSS evaluates business sustainability using risk assessment and imprecise data techniques to accomplish this.</p> <p>Impacts include:</p> <ul style="list-style-type: none"> • Development of a collaborative software for economic estimation and business development for vertical farming (available here) • First study on risk in vertical farming, assessing financial risk for entrepreneurs and investors (available here) • Manufacturing principles applied to vertical farming to improve labour efficiency (available here) • Results from interviews and site visits of vertical farms globally summarising lessons learned exploring failure modes and best practices. | |
| <p>7. Research implementation and results under the program</p> <p>Title of your research plan: Risk Perceptions and Labour Efficiency in Japanese Plant Factories</p> <p>Description of the research activities:</p> <p>For the past decade, Japan has been the leading the way in plant factory technology and business. They have been researching plant factories with artificial lighting (PFALs) since the 1970s. They now have approximately 200 PFALs across the country with some of the largest and most profitable (Spread, 808 Factory, greenLand, etc.). Francis collaborated with Chiba University and Japan Plant Factory Association to conduct a series of interviews, site visits, and workshops with plant</p> | |

factory operators to uncover insights into lessons learned, labour efficiency, and risk assessment from all the major PFAL companies in Japan.

The research results from this program were as follows:

2 interviews with profitable PFALs informing a global qualitative study on lessons learned from operating and shuttered indoor vertical farms to be published in “Advances in plant factories: New technologies in indoor vertical farming (ed. Emeritus Prof Toyoki Kozai and Dr Eri Hayashi)”. This revealed insights around economies of scale, drivers for profitability in Japan, labour, technologies and risks.

7 risk assessment workshops with 3 engineering companies that develop PFALs, and 4 PFAL operators to develop a risk register, management plan and risk scoring for PFALs. This will provide the first risk register for understanding common risks and how risks affect PFALs differently to greenhouses and traditional farms. This will be used in a publication, Francis’ thesis, and will direct research to mitigate these risks.

10 site-visits to 808 Factory (Shizuoka), A-Plus Factory (Fukushima), greenLand (Shizuoka), ESPEC MIC (Haneda Lab), Plant X (Tokyo), Osaka Metropolitan University (Osaka), Spread (Kyoto), Obayashi (Kashinowha Campus), Planet Hydroculture (Kashinowha Campus), and Dome Plant Factory (Kashinowha Campus). These visits inform management practices, automation and technology cost-benefit analyses, and photographs may be used to demonstrate practical labour efficiency improvements in Francis’ PhD thesis.

2 conferences: Japan-Netherlands Greenhouse Robotics Network reception – Dutch embassy in Tokyo, Japan 11th July 2022 and Greenhouse Horticulture & Plant Factory Exhibition / Conference (GPEC) at Big Sight, Tokyo 20th-22nd July.

Research collaboration with Dr Eri Hayashi on Risk Assessment of Japanese PFALs who added valuable input on site-visits, interviews and workshops.

Research discussions on labour efficiency protocols for tracking with Prof. Ohyama informed further research on manufacturing principles applied to farms. Research discussion on economics and business modelling with Kazuya Uraisami which revealed the lack of available production and financial data for state-of-the-art PFALs in Japan. Financial risk assessment model was executed and shared so that PFALs can be evaluated in the absence of precise data.

Participated in and attended Dr Na Lu international classes alongside internships at Obayashi Plant Factory and Eco-Green Plant Hydroculture.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I had a wonderful summer in Japan. This trip has accelerated my research and career immensely, working with world-class researchers and plant factories. More importantly, I cultivated connections that I hope will last a life-time. I’d like to use this opportunity to acknowledge my mentors throughout this trip, Lu Na-sensei and Dr. Eri Hayashi, as well as my colleague Hiramatsu-san. You all made this a life-changing experience which I will treasure forever! Thank you. Thanks to JSPS for making this possible.

Cultural experiences:

- Homestay over several days with Family in Shizuoka Prefecture
- Peace ceremony in Hiroshima
- Climbing Mt. Fuji for the sunrise with other JSPS fellows
- Witnessing Ukai ancient fishing and going to Daimonji Festival in Kyoto

9. Adviser's remarks (if any):

Francis did a great job during his stay in Japan, including doing his own research, sharing knowledge and helping students. Thanks JSPS for giving us this opportunity to increase the interaction between the two countries. We will continue knowledge exchanges and cooperation in the future.

JSPS Summer Program 2022
Research Report

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|---|-------------------|
| 1. Name: Emma Thomas | (ID No. SP20123) |
| 2. Current affiliation: University of Leicester | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: Tohoku University | |
| 5. Host researcher: Professor Yasumasa Kasaba | |
| 6. Description of your current research | |
| <p>My current research at Leicester focuses on identifying the aurorae of Uranus through infrared observations and to use these to extend our understanding of the planet's upper atmosphere and magnetosphere. Much of the data analysis of Uranus's magnetosphere is built up from our previous analysis of other outer planet magnetospheres (Bagenal, 1992). A particular example is comparing H_3^+ emissions from Jupiter, when studying Uranus, is extremely helpful because we can find H_3^+ signals hundreds of times stronger (Drossart et al, 1989, Trafton et al, 1993). At Jupiter, H_3^+ spectra have been used to derive upper atmosphere temperatures (Miller et al, 1990) and velocities (Stallard et al, 2002), critical variables in understanding the dynamics of Jupiter's upper atmosphere. These techniques have gone on to be used at Saturn (O'Donoghue et al, 2014) and Uranus (Melin et al, 2011). Hence by strengthening our data and refining our data analysis at Jupiter, these will in turn benefit my goal in identifying the infra-red aurora at Uranus.</p> | |
| 7. Research implementation and results under the program | |
| Title of your research plan: | |
| Analysing Jupiter's Aurorae in Ultraviolet and Infrared with Hisaki/EXCEED and IRTF/iSHELL. | |
| Description of the research activities: | |
| <p>Jupiter's magnetic field has stood as a prime example of how little we know about our solar system. Since first detections of the planet's radio signals in the mid 20th century, emitted due to the rotation of the planet's magnetic field, we have uncovered a new field of electrodynamics in our solar system, the Outer planet aurora. Auroras are particularly useful as they emit over a spectrum of wavelengths, from radio, infrared (IR), visible, ultraviolet (UV) and X-ray. The visual displays are not just for decoration, the shape, brightness and changes in the aurora act as indicators of what is going on in a planet's magnetic field, its surrounding environment (the solar wind) and any internal processes in its upper atmosphere due to the intrinsic link of Jupiter's magnetic field which sweeps through all of these regions. Previous investigations of combined IR and UV wavelength observations (Clarke, et al, 2004, Radioti et al, 2011 and 2013) have shown that morphologically the aurora appear similar to one another in both wavelengths. However quantitatively the brightness or power output in either wavelength has been shown to differ from one another with suggestions being due to internal factors effecting the IR emissions and the longer duration of emission events in the IR wavelength. It should be noted that the investigations discussed above only, observed a singular auroral event at Jupiter over a span of a few minutes.</p> | |
| To investigate if this pattern was consistent over more than a singular instance, several | |

simultaneous observations must be taken and analysed. This was achieved by taking 17 days of observations between 2016 and 2021, where simultaneous UV and infrared IR observations of either the northern or southern aurora at Jupiter were captured by the Hisaki satellite and IRTF telescope. Due to a loss in the guiding of Hisaki from mid-2016 onwards, meaning the aurora could be off center from the satellites narrow slit across the northern hemisphere of Jupiter, we elected to take a Jovian day average over all observation events.

Over all 17 events, only 7 are presented in Figure 1, this is due to either Hisaki and IRTF observing opposite aurora (and hence a fair comparison cannot be made) and due to time restrictions, a majority of shorter duration events (from the IR observations) were not included. Our conclusions from Figure 1a suggest that UV and IR power output (as Total Emission is the rate of which energy is lost from the upper atmosphere) are not correlated with one another, though current thoughts are that the lower UV power output points could be due to a combination of the southern aurora being observed and the loss of guiding reducing the found power output found from the northern aurora.

A positive quadrative relationship was identified for the UV power output when compared to the IR temperature. This goes against previous models (Tao, et al., 2011) which suggest the power output should remain unaffected. It is thought that this is because UV emissions tend to occur at lower altitudes than IR (350 km instead of 500 to 1500 km) and hence the temperature variations observed in IR does not mean the same for the UV temperature.

IR column density similar to total emission suggested no correlation with UV power output, though initial discussions suggest that the value found for the 25th January 2017 appear unusually high, possibly affected by a coronal mass ejection or plasma injection from Io prior to the investigation. Hence due to IR's longer duration of emission, this would not be observed in the UV but strong IR emissions could remain for an hour following the event. Overall, we summarise that continued work, in both the number of simultaneous observations along with accounting for internal and external affects, must be completed to decide if the physical parameters for UV or IR can be used as an estimate for the other.

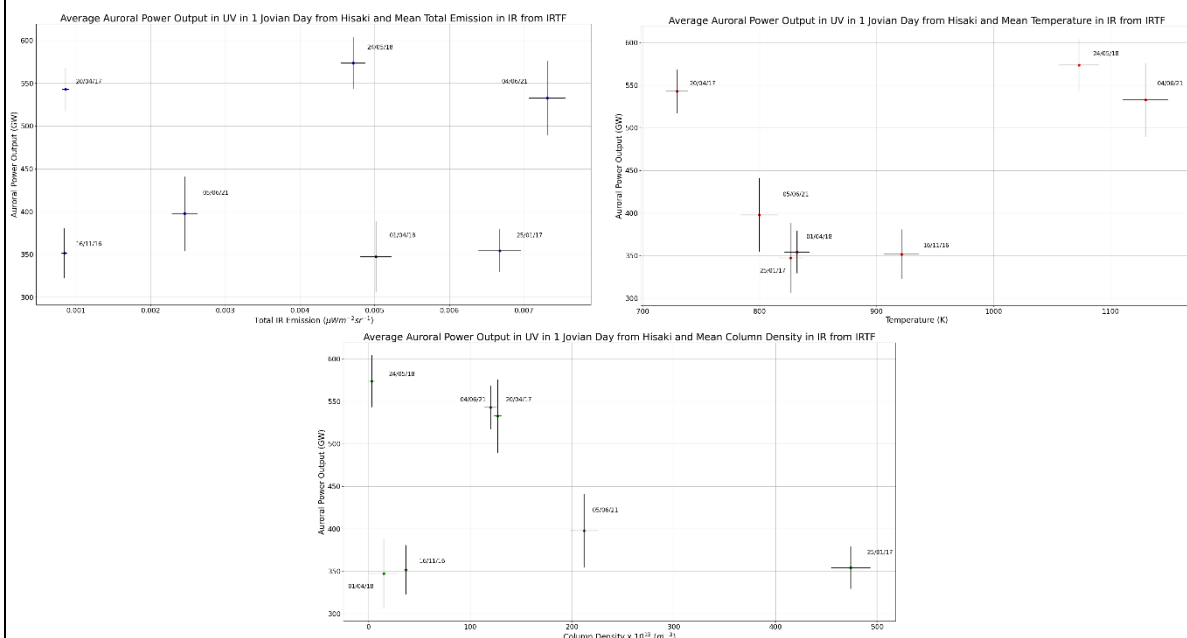


Figure 1. The UV auroral power output over a single Jovian rotation as observed by Hisaki over 7 observations dates between late 2016 and mid-2021. This is compared against (top left) Total IR emission, (top right) IR temperature and (bottom) IR column density over simultaneous observation runs (which can vary between 1 to 8 hours of observation) across the same 7 observation dates as observed by IRTF. The exact time of the 7 observation dates has been annotated onto the figure to distinguish between dates

JSPS Summer Program 2022 Research Report

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|---|------------------|
| 1. Name: Romain FUTSCH | (ID No. SP20201) |
| 2. Current affiliation: University of Bordeaux | |
| 3. Research fields and specialties: Chemistry | |
| 4. Host institution: AIST Nagoya | |
| 5. Host researcher: Dr. Chih-Wei HU | |
| 6. Description of your current research <p>During my Ph.D (2018-2021), my researches focused on the improvement and the industrialization of electrochromic display as anti-counterfeiting device. An electrochromic display aims to change color thanks to an electrical potential difference between two electrodes. They can be printed on flexible substrate such as paper and they can be driven at low voltage for displaying information for IoT applications.</p> <p>At the starting of my work, only one-color change was available and electrochromic display could not be fully printed, the electrolyte composing the device could not be cured resulting in only small-scale fabrication using laboratory equipments.</p> <p>Summary of the different results obtained during the Ph.D:</p> <ul style="list-style-type: none">- Developing several colors by mixing oxides in the electrochromic polymer used. Study the color change with electrochromic (vanadium oxide) and non-electrochromic oxides (iron oxides). Mechanisms studies according to the type of oxide used. Improvement of the color change and study of electrolyte formulation.- Developing a new electrochromic display architecture that was fully printed using several printing techniques: inkjet, screen-printing and flexography.- Large scale production in sheet to sheet (discontinuous) and roll-to-roll (continuous) with more than 1500 devices printed.- Activation of a color change according to a smartphone using the NFC function (very low energy device)- Study of the recyclability and life cycle assessment of the electrochromic device in partnership with another group at the university of Bordeaux. | |

7. Research implementation and results under the program

Title of your research plan: Synthesis of PEDOT:PS:X for color change improvement of gasochromic device.

Dr Chih-Wei HU at AIST is specialized in the color switchable materials for energy efficiency. His latest works focus on gasochromic materials (capacity of some materials to change their color according to a reaction with a gas) especially the ones that can be obtained by chemical reaction. One of the main materials used in printed electronics and for sensors application is the copolymer PEDOT:PSS which is easily synthesized at large-scale. However, this conjugated polymer is showing poor gasochromic properties due to its reduction peak occurring at high voltage compared to the H₂/H⁺ reaction which is used at AIST for controlling the color switch of the layer. One of the solution consists in modifying the PEDOT:PSS during the synthesis by changing its initial structure to shift its reduction peak. Good candidates to achieve it are ionic liquids which according to the mixture of cations and anions can bring different properties to the PEDOT:PSS.

Researches consist therefore in different synthesis of PEDOT:PSS with different elements to improve the gasochromic capacity of this materials.

Description of the research activities:

Different research activities have been done during the period of JSPS:

- Study of different ionic liquid with distinguished properties to form PEDOT:PS:X such as hydrophilic, hydrophobic, protic and acid behaviors.
- Study of different deposition technique: spin-coating, electrochemical deposition, spray coating.
- Study of pigment addition before and after the reaction.
- Understanding some mechanisms.
- Study of formulation.
- Understanding the different behavior according to the gasochromic materials used: oxides, polymer, ferrocyanide salt...

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

- Cultural experiences: visit of different cities such as Tokyo, Kyoto, Osaka, Kobe, Hiroshima, Nagasaki, Nagoya and Nara. Visit of Goto island and Miyajima Islands. Museums all around Japan. Festivals: Gion Matsuri and Hanabi
- Meeting Japanese people at Guest houses
- Hiking at Lake Hakone close to Mt Fuji and Japanese Alps
- Izakaya with colleagues; food experiences

9. Adviser's remarks (if any):

**JSPS Summer Program 2022
Research Report**

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|---|-------------------|
| 1. Name: Lucie HUART | (ID No. SP20205) |
| 2. Current affiliation: Sorbonne Université, Paris | |
| 3. Research fields and specialties: Chemistry & Biological Sciences | |
| 4. Host institution: QST | |
| 5. Host researcher: Akinari YOKOYA | |
| <p>6. Description of your current research</p> <p>Since the beginning of the 20th century, attempts have been made to understand the deleterious effects of X-rays, the properties of which are widely used in medicine for radiotherapy and radiodiagnostics. Indeed, radiotherapy is an effective treatment because of its ability to block the multiplication of tumor cells. During my Ph.D., I studied especially the effect of soft X-rays (200 eV to 2 keV) in liquid aqueous samples. In this range of energy, the ionizing radiation interacts with matter mainly through the photo-electric effect, conducting to electrons ejection. These primary core-ionization effects are known to conduct to lethal effect at the scale of a cell. Although widely studied, the description of the interaction between radiation and matter is still incomplete because it is a complex problem both spatially and temporally. If the interaction of radiation and matter takes place in a very short time interval (of the order of 10-15 s) it induces chemical and biological modifications which impact the system over several hours. Moreover, in a biological environment, water molecules are the main target of ionization. The radiolysis of water and the indirect effects induced on biomolecules by water radicals are therefore of particular interest.</p> <p>My 2-months research project in Japan was to participate in the current study of Dr. Yokoya's team on DNA radiation damage in cells. These studies investigate the cell behavior after irradiation, to describe and improve radiotherapy processes.</p> | |

7. Research implementation and results under the program

Title of your research plan: Investigation of radiation damage to DNA in human cells.

Description of the research activities:

While at Dr. Yokoya's lab at the Quantum Science Technological Institute (QST), I spent the first weeks learning how to take care of human cells. After growing cells, some samples were sent to the photon factory to be exposed to X-rays. After irradiation, I conducted experiments to characterize the cells behavior and compare it to non-irradiated cells. In particular, I quantified cell growth and ATP production in cells, which are key elements for understanding cells' metabolism and their multiplication cycle. I also conducted Reverse-Transfer Polymerase Chain Reaction (RT-PCR) on several mutated human clone culture cells which are progenies of the cells exposed to X-rays. They harbor a large DNA-deletion site around HPRT gene locus. Using, the RT-PCR technic, I tried to provide some new information on genomic alterations caused by ionizing radiation. More precisely, high-energy ionizing radiation, such as X-rays, are well-known to create DNA strand breaks. Such damage can induce gross chromosome rearrangements, which potentially evolve into carcinogenesis. It is, therefore, important to investigate the deletion patterns. These results contributed to a short communication paper submitted to the Journal of Radiation Research.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The JSPS summer program was an incredible opportunity to experience Japan by really immersing into the work-life routine while traveling around on the weekends. My research in the laboratory in Tokai-mura allowed me to discover the countryside Japanese life. I had the opportunity to have some Japanese lessons, practicing Karate and participated to a traditional tea ceremony. Dr. Yokoya, students, and co-workers at the QST as well as JAEA (Ibaraki Prefecture) were extremely friendly and accommodating, providing not only an excellent work environment but encouragement, advice, and friendship. Thanks to these amazing people, I learned a lot, in the lab, as well as in the everyday life! My stay in Japan was really interesting and I'm going to miss it here !

9. Adviser's remarks (if any):

JSPS Summer Program 2022**Research Report**

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|---|-------------------|
| 1. Name: Marie Potvain | (ID No. SP20211) |
| 2. Current affiliation : Université Paris Cité – Cité du Genre | |
| 3. Research fields and specialties: Humanities, Social Sciences | |
| 4. Host institution: Tokyo Gakugei University and Chuo University | |
| 5. Host researcher: Joshua Paul Dale | |
| 6. Description of your current research | |
| <p>My fellowship follows my master research in social anthropology. I studied pole dancing as a leisure activity in France and analyzed gender issues related to it. This investigation interrogated pole dancers' motivations and representations. In France, it is depicted by consumers as sporty, tough, beautiful, feminine, and empowering.</p> <p>Pole dancing became a fitness activity during 1990's but it remains bound to striptease from where it came from. In a recurrent movement of rejection, pole dancers tend to link it with other practices such as circus. However, the essence of recreational pole dancing retains a sensual, danced, transgressive aspect.</p> <p>Nowadays, it is institutionalized through international federations and is turned into a sport. Its erotic aspect is evacuated. It persists however under a second form called exotic pole –less popular in France--which is anchored in a more sensual style and aesthetic. In schools, pole dance is erected according to sporting standards : the pole submits female and male bodies to similar constraints, but movements are always thought through the two poles of masculinity and femininity. It is a strongly feminized activity but men participate according to an often adapted style. It is moreover by the masculinization of the practice that it became recognized as a sport by adding new movements.</p> <p>Pole dancing allows for a special way of dealing with gender. It allows physical, artistic performances but also gender performativity. Pole dance shows that today's trend is not as much the abolition of the poles between masculinity and femininity but an articulation of them through the appropriation of gender characteristics, thus challenging heteronormativity and hegemonic gender considerations. The aim is to recreate masculinities and femininities through the performance "revisited" by offering more freedom without suffering from stigmatization in this space of controlled expression.</p> <p>As my research progressed, my attention turned to Japan, a country where pole dancing has a strong presence and is associated with notions of spectacle and performance in a very artistic way but also with strong gender fluidity in its practice. While in France (as in most Western countries) its sexualized aspect is depreciated and its sports and gymnastic sides have become hegemonic, it seems that in Japan, the erotic aspect is often cultivated by both women and men, often by investing in androgynous figures. Eventually, research on pole dance allows us to articulate the fundamental question of the relationship between body cultures -in terms of appearance and physical capacity- and the construction of gender identities.</p> | |

7. Research implementation and results under the program

Title of your research plan:

The Comparison of French and Japanese pole dancing : a study on gender issues raised by this new leisure activity.

Description of the research activities:

In Japan I continued the researched carried out in France. I used similar methods :

- Participative observation : I went to 5 different pole dancing studios in Tokyo, one in Kyoto and one in Osaka and took courses from beginner to advanced level.
- Observation : I saw pole dance performance in showcases and show clubs
- Interviews : I did formal interviews with pole dancers and gathered informal conversations.
- Literature reviewing

As a non-Japanese speaker, I also could focus on the use of the body. Observation was my main way to understand the practice. I recorded the interviews on audio files and all my observations in a fieldwork notebook.

Two months is quite short for this kind of study but I achieved some interesting results. First, pole dancing in Japan suffers less from its erotic image as polers don't totally separate it from fitness practice. A lot of pole dancers achieving an advanced level are involved in cabaret, show clubs and bars, but also perform in showcases. Pole dancing in clubs doesn't have a long history in Japan and it began not long before the leisure practice. Therefore, pole dancing has little connections with striptease as performers rarely undress but it is sometimes combined with other performances as drag queen or belly dance. Shows are common and choreography is an important part of learning. Pole dancing is more considered as a dancing performance, not far from ballet, including costumes, music and acting than just a sporty activity. Also, that's why during classes the emphasis is on flexibility and fluidity rather than on physical preparation and strength. Pole dancing performance also allows gender fluidity as both men and women are involved in the practice using similar movements and style. Each performance identity depends less on the performer's gender than on his/her personality.

8. Please add your comments, including any cultural experiences during your stay in Japan (if any):

Carrying out a study in Japan is an intense experience. As a non-Japanese speaker it was interesting to be immersed in a country I had much to learn from. I stayed in Tokyo and it was very different than the first time when I came as a tourist. I developed habits and spent time with JSPS Fellows but also university mates. I did some tourist activities but what I enjoyed the most was just living in Japan, not necessarily visiting it. It changed the way I saw the country and my understanding of the culture. I could meet vibrant and colorful people, observe daily life and assist with beautiful and meaningful festivals across the country.

9. Adviser's remarks (if any):

Ms. Potvain is an excellent researcher and worked very hard during her Fellowship. The results of her research will make an important contribution to her field.

JSPS Summer Program 2022
Research Report

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|---|-------------------|
| 1. Name: DEVEZIS Vianney | (ID No. SP20215) |
| 2. Current affiliation: Université Bordeaux Montaigne (France) | |
| 3. Research fields and specialties: Humanities | |
| 4. Host institution: 岡山大学 | |
| 5. Host researcher: 萩原直幸先生 | |
| 6. Description of your current research <p>国立療養所大島青松園に入所していた元ハンセン病患者の詩人・塔和子の詩における「いのち」について、歌手の沢知恵の歌を通して、民族批評 (ethnocritic) 的研究をしています。民族批評は、ある作品におけるシンボリックなものを中心とする分析方法です。現在は、沢知恵の『かかわらなければ～塔和子をうたう』というアルバムを取り上げ、沢さんを通して塔和子の詩を分析しています。研究文脈として、ディディエ・ファッサンの「いのち」の人類学を参照しており、「いのち」に対する価値観、政治や倫理や社会生活と人生の間の緊張関係などから塔和子の詩にある「いのち」を読み解いています。今回のフィールドワークにおける文献調査やフィールド調査から得られたデータによって、博士論文の第三章での議論において「いのち」について考えたいと思います。参考文献からは新しい思考が生まれました。例えば、ハンセン病が慢性感染症である結核と同様なものとして受け取られた時から、元ハンセン病患者が社会復帰可能である (和田, 2017 : p.56) ということから、ディディエ・ファッサンの「いのち」の人類学にある普遍的なアプローチの必要性を強調したいと思います。また、文献調査とフィールド調査をする中で長島愛生園園長であった光田健輔についても考察するようになりました。目下、光田健輔の皮肉と否認の問題に着目していません。患者たちのより良い暮らしへの叫び声であったハンガーストライキに対して、「騒ぎたてるような悪法ではない」法律 (旧らい予防法) について患者たちを上から見る光田健輔です (光田, 1958 : p. 225)。ところで、長島愛生園・曙教会の礼拝に出席して、沢さんと讃美歌を歌った時に、沢さんの声の力に驚きました。入所者の男性信者の声に合わせて沢さんが自身の声域を低くしてアルトで歌ったおかげで、讃美歌を歌う道筋に導かれ、安心安全な気持ちをいただきました。この気持ちは神と沢知恵への畏れであり、と同時に権力に屈することでもあるのではないかと感じました。長島愛生園でそのような気持ちになったことは、どこか光田健輔とつながるものがあるのではないのでしょうか。</p> <p>参考文献 :</p> <p>光田健輔, 「愛生園日記: ライとたたかった六十年の記録」, 毎日新聞社, 1958.</p> <p>和田 謙一郎, 「戦後らい法制の検証」, 晃洋書房, 2017.</p> | |

7. Research implementation and results under the program

Title of your research plan:

《元ハンセン病患者であり詩人として生きること：塔和子（1929 - 2013）の詩における「いのち」の民族批評（ethnocritic）— 沢知恵（1970-）を通して》

Description of the research activities:

「ハンセン病」、「沢知恵」、「塔和子」、「いのち」、「かかわり」について参考文献を検索した後に分析を始めました。それを行いながら、8月20日、塔和子が住んでいた大島青松園——現在、瀬戸内芸術祭開催中——に見学に行くことができました。8月21日に長島愛生園の長島曙教会の礼拝に沢知恵さんと一緒に出席することができました。その翌日、8月22日の香川県民ホール・レクザムホールでの「被災地の復興支援について考えるコンサート——沢知恵ピアノ弾き語り」を聴きに行き、事前に作成していたアンケートを聴衆に対して実施しました。8月28日にもう一度大島青松園を訪ね、現地のキリスト教会霊交会の礼拝に沢知恵さんらと出席しました。9月10日には沢知恵さんの家で夕食をいただきながら話をうかがい、9月14日に沢知恵さんのラジオ番組「沢知恵日曜日の音楽室」の収録に出演しました。9月15日、東京で行われた沢さんのコンサートにはコロナウイルスの影響により出席が許されませんでした。事前に作成したアンケート用紙を沢さんに配布・回収していただきました。

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

フィールドワーク以外の文化的活動と言えば、新型コロナウイルス感染症のせいで長らく会えなかった方々と久しぶりの再会を楽しむことができました。例えば、早稲田大学に留学していた時の手話サークルの友人がレストランで働きながら絵を描いているのですが、その友人の絵が深い印象に残りました。そのように頑張っている日本人の若者は偉いと感じます。

9. Adviser's remarks (if any):

本人や沢知恵さんと一緒に大島青松園や長島愛生園を訪問し、また沢さんのコンサートを聴くことができ、私自身、非常に感銘を受け、勉強になりました。今回のフィールドワークで多くの収穫があったと思われませんが（文献、インタビュー、アンケート等）、それらのデータをうまく活かして、意義ある成果（博士論文）を出してもらいたいと願っています。

【SP20302】

JSPS Summer Program 2022 (SP20302) Research Report

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| 1. Name: Julia Belger | (ID No. SP20302) |
| 2. Current affiliation: Max Planck Institute for Human and Cognitive Brain Sciences and University Hospital Leipzig (MPI-CBS; Leipzig, Germany) | |
| 3. Research fields and specialties: Medical, Dental and Pharmaceutical Sciences | |
| 4. Host institution: National Rehabilitation Center for Persons with Disabilities (NRCD; Tokorozawa, Japan) | |
| 5. Host researcher: Dr. Noritaka Kawashima | |
| 6. Description of your current research <p>My current research focuses on the clinical applications of immersive Virtual Reality (VR) for the clinical assessment of visuospatial neglect in stroke patients. Neglect is characterized by a lack of attention to stimuli in the contralesional field and frequently occurs after a right hemisphere stroke. During the acute and subacute post-stroke phases, conventional neuropsychological paper-and-pencil tests (e.g., cancellation, line bisection, and copying tasks) and behavioral observations (e.g., ipsilesional head and eye deviations) indicate the presence of neglect. However, these frequently used assessment tools insufficiently identify subtle and compensated forms during the chronic phase and inadequately reflect everyday challenges with neglect.</p> <p>To overcome these limitations, I developed a neuropsychological test battery using immersive VR to investigate whether a novel three-dimensional road-crossing task (iVRoad) can validly detect mild symptoms of neglect. The application of immersive VR represents a promising solution to improve the detection of even milder forms of neglect by simulating tasks relevant to everyday life, thereby assessing functional performance. For analysis and feature selection, I moreover used machine learning techniques. Importantly, eye tracking is a promising and effective method for the detection of discrete neglect symptoms, as the visual attention can be measured with temporal and spatial resolution. It is therefore noteworthy to investigate the eye movement behavior of neglect patients (e.g., visual search pattern and pupil diameter) that can be regarded as direct measures of attention.</p> | |

7. Research implementation and results under the program

Title of your research plan:

The application of a driving simulator as a clinical assessment tool for visuospatial neglect after stroke

Description of the research activities:

During my JSPS fellowship, I conducted research at the NRCD in Tokorozawa (Saitama prefecture) under the guidance of Dr. Noritaka Kawashima. We used a customized driving simulator (including a handle, car seat, accel, and brake) to assess visuospatial neglect after stroke in a real driving simulation. I learned about the driving simulator's functions and applied a left-sided and right-sided version of the system to participants. As part of my internship, we collected data from 20 healthy subjects and four neurological patients. Data analysis and understanding of neglect-specific behavior during driving played a major role in my research activity. I learned how to process eye, head and handle data and define relevant, potentially neglect-specific events. In addition, I wrote read-in scripts, performed pre-processing and primary data processing, and then visualized the relevant data in the R programming language for later discussion in meetings with my team. At the end of my internship, we conducted a feature extraction and investigated which behaviors might be relevant for the driving behavior of neglected patients.

I also discussed with my lab colleagues the pre-processing and data analysis of the eye tracking data I collected in Germany with iVRoad. We plan to work together to complete the data analysis and jointly submit a manuscript to a journal.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Thanks to my Japanese host and colleagues, I better understood Japanese working life and culture. For example, we visited Japanese conferences (e.g., the 46th annual scientific meeting of the Japan Society for Higher Brain Dysfunction in Yamagata), several hospitals, and an exhibition on neurorehabilitation in Tokyo. At these events, I was able to establish contacts with other Japanese scientists who conducted research in my field of interest. In addition, my colleagues took me on trips to further familiarize me with Japanese culture.

9. Adviser's remarks (if any):

JSPS Summer Program 2022
Research Report

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| 1. Name: Philippe BÜRGIN | (ID No. SP20303) |
| 2. Current affiliation: Stattliche Akademie der Bildenden Künste Stuttgart (State Academy of Fine Arts Stuttgart) | |
| 3. Research fields and specialties: Humanities: Cultural Philosophy & Aesthetics | |
| 4. Host institution: University of Tokyo, Department for Aesthetics | |
| 5. Host researcher: Prof. Dr. OTABE Tanehisa | |
| 6. Description of your current research <p>The sublime appears to be a rather marginalized concept in modern aesthetics compared to its counterpart, the beautiful. While beauty is often seen as a well-shaped representation of harmony between opposing faculties (e.g., form and material, reason and sensibility, state and individual), the sublime takes over an opposite role: It embodies irregularity, formlessness and presence. In my research I would like to go beyond this binarity and beyond that still very common notion which sees the sublime only as an experience of overwhelming greatness and power. The sublime can rather be reframed as a paradigm of aesthetics, which is to say that there are structural moments of aesthetics experiences to be found in the sublime that could give a new framework on what actually happens to the spectators if they are confronted with landscapes, artworks and other cultural artefacts. In case of the sublime those structural moments can be identified as its formlessness and presence, its psychological latency in many kinds experiences as well as its inherent inpurposiveness to our perception. Common to all these structural moments, however, is the sublime's feature as an aesthetic analogy to an idea. One of the earliest examples of this thought process can be found in the Ten Commandments' stark ban on any pictorial depiction of God – one shall not make an image of that idea because it simply isn't possible, it is doomed to fail and the admission to the imminent failure is the most important stepping stone to a sublime experience. Wherever an idea shines through is a latent void to be found that demands to be filled by an image; but if no image proves to be sufficient for that task, this should be read as a sign for a sublime experience. By this insufficiency the image stands in for the sublime idea whose sheer presence invoked this subreption in the first place. Such a void cannot only be invoked by something that appears to be overwhelmingly great or powerful, but also by something that seems subtle and subliminal. This is where Japanese aesthetics come into my considerations: There is an argument to be made that Japanese art forms like the tea ceremony, <i>karesansui</i>-gardens, <i>nō</i>-theatre, <i>sumi-e</i>, <i>ukiyo-e</i> (and the like) go beyond what could traditionally be understood as beautiful or fine arts – they are sublime arts in the sense that the performative and abstract moments point towards a void, an idea, something that is beyond our perception (but still within our perception). There is a certain formlessness and presence at play in those art works that emerges from aesthetical standards like <i>wabi-sabi</i>, <i>ichigo-ichie</i> or <i>aware</i> (just to name a few). These formalistic aspects were incorporated into what later became known as modern art; after the end of Japanese isolationism when artists in Europe gained access to Japanese art works, they developed an understanding of art that went far beyond what has been traditionally known as the beautiful form; by incorporating</p> | |

new standards of form and presentation – a certain formlessness and presence (that broke with traditional concepts of artistry) – they incorporated a sublime element into their art. There is a latent sublimity to Japanese art works that can also be found in modern art since the 1850s. What is now understood as modern art, had its origin in a genuinely Japanese understanding of aesthetics that latently inspired artists to deal with aesthetic ideas and to give space for an understanding of art that goes beyond beauty into the realm of the sublime. There is a whole spectrum of structural moments (formlessness, presence, impurposiveness etc.) also to be found in other aesthetics (like in Japan) for which the sublime offers a framework for a deeper, intercultural understanding of the innerworkings of aesthetic experiences.

7. Research implementation and results under the program

Title of your research plan:

A Sublime Lens on the Structural Moments of Aesthetic Experiences in Arts,
Everyday Life and Beyond

Description of the research activities:

As is common for the humanities, my research activities mostly lived from thorough readings of primary and secondary literature as much as from direct discussions with other scholars. For the former purpose I was allowed access to the laboratory and library of the department of aesthetics and the faculty of letters at the University of Tokyo, where I could find many books written in German, English and French that helped me with my research. For the latter purpose I was introduced by my host professor to two of his students who work in a similar field of study as I do and I was also invited to the annual conference of the Japanese Schelling Society where I could listen to many interesting presentations and have some thorough discussion with the participants. For both purposes I also used my connections to the German East Asian Society (OAG) in Tokyo where I had access to the library and the cultural program. I also want to underline the importance of several field trips I could undertake to get in touch with many facets of Japanese arts, since the study of aesthetics also strongly lives from experiencing performances and artworks for oneself.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

My research was deeply enriched by the wide facets of cultural experiences I could garner during my stay. In addition to my readings on Japanese arts and aesthetics I had the possibility to visit several museums, talk to curators, gallerists and artists, experience Japanese gardens and a performance of Noh-theatre. All those experiences have reinforced my idea that there are many latent structural moments of the sublime to be found in Japanese art that can thoroughly help to recontextualize the way modern art is understood in Western traditions of thought.

9. Adviser's remarks (if any):

I would like to thank my host professor for his enriching remarks on my research and particularly for his recommendation to further my research into other parts of Japanese philosophy (for example the thinking of Watsuji Tetsurō), Zen-aesthetics and the notion of *dō* (道).

JSPS Summer Program 2022 Research Report

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| 1. Name: Korbinian ECKSTEIN | (ID No. SP22304) |
| 2. Current affiliation: University of Queensland, Australia | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: University of Tokyo, Japan | |
| 5. Host researcher: Prof. Hideaki KUZUOKA | |
| <p>6. Description of your current research</p> <p>The research project is about developing a mixed reality (MR) application as a game for health. Although I studied physics and work mainly with magnetic resonance imaging, I collaborated in several projects pertaining to upper limb amputation and I partook in this project mainly as software developer.</p> <p>The target audience of this MR application are patients with an amputated hand, of which many experience strong phantom limb pain. The general goal of the mixed reality application is to create the illusion that the patient still has his lost limb, which is expected to reduce the phantom limb pain. The MR application is developed for the Microsoft HoloLens 2 and requires a myoelectric armband for controlling hand movements and an inertial measurement unit to track the position of the arm without requiring external sensors. To increase the feeling of agency when the patient controls the virtual arm, the game offers multiple ways of interacting with the MR environment and provides rich feedback of current interactions in the form of vibration, visual and auditive feedback.</p> <p>The next stage of the project will be the application in a patient study to evaluate its effectiveness in reducing phantom limb pain and its contribution in motivating patients to regularly use the application.</p> | |

7. Research implementation and results under the program

Title of your research plan: Implementing a mixed reality application as a game for health on the Microsoft HoloLens 2

Description of the research activities:

Central requirements of the mixed reality application are intuitive and responsive interactions with the virtual environment using the real tracked hand and the virtual hand that is simulated at the amputated arm.

At the Kuzuoka lab, we improved and extended the existing prototype application to be usable in studies with patients. Larger work packages were A) the investigation of new motion tracking sensors, B) the implementation of scene understanding features, C) a new user interface for therapists, and D) improved hand interactions.

- A) To track the position of the remaining stump of the amputated hand, inertial measurement unit (IMU) sensors are attached at the upper and lower arm. We adapted the Bluetooth interface to be usable with a new IMU sensor with low latency.
- B) Microsoft provides a scene understanding package for the HoloLens 2 that contains features to recognize the floor, the walls, and suitable platforms in a room. We applied these functions to create scenes that adapt to the current room by placing objects in unoccupied spaces and to create interactive elements on platforms walls.
- C) We developed a new desktop user interface to setup the myoelectric control and to guide the patient through the mixed reality experience. The desktop application connects to the HoloLens and is used to by a therapist to configure the attached sensors and virtual arm. It further provides a video stream from the HoloLens to observe the experience of the patient in the mixed reality scene with controls to restart or change to a different scene.
- D) In order to present an interesting and intuitive mixed reality environment, we extended the possible ways of interacting with objects. The real and virtual hand can now both be used to push or balance virtual objects and to grab and carry objects around. Special consideration was required to make it easy to grab objects, even with limited or unsteady control of the hand as is often the case in patients.

The project was performed in collaboration with students of the Kuzuoka lab.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The lab was very welcoming and especially Professor Kuzuoka was always supportive, provided feedback and encouraged future collaborations.

During the time of the stay, it was very helpful to be in JSPS chat groups to find out about interesting events to join and for helping each other with the regulations due to covid. For me, a good way to meet Japanese people was through sports, climbing and acrobatics. Also the Japanese food was great. I didn't cook once while in Japan, as there are so many options for amazing Japanese food, and even regular items at the konbini were delicious.

As the lab kindly booked a room for me in the adjacent university dorm, I had the opportunity to live in walking distance of the university.

I even tried a Japanese escape room, thinking it would be mostly about finding hidden keys and solving riddles with symbols, but it turned out to be guided by an Actor and required frequent interactions in Japanese and reading documents. Although I could understand only half of what was happening, it was still a very exciting and memorable adventure.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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|---|-------------------|
| 1. Name: Niclas Heinsdorf | (ID No. SP20305) |
| 2. Current affiliation: Max-Planck Institute for Solid State Research | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: University of Tokyo | |
| 5. Host researcher: Prof. Hosho Katsura | |
| 6. Description of your current research In my current affiliation with the Max-Planck institute in Stuttgart, I am mostly working on the so-called Topology of Quantum Materials. Many of these topological phases have been discovered only recently and exhibit novel and exotic physical properties that offer many promising potential applications in future electronics such as quantum computers or spintronic devices. We perform calculations and simulations to classify and discover new topological materials, collaborating with experimental physicists and chemists. | |

7. Research implementation and results under the program

Title of your research plan:

Topology of Many-Body Excitations in quasi one-dimensional systems

Description of the research activities:

In Japan I worked on the classification of topological phases in quasi one-dimensional systems. As stated above, topological phases of matter are some of the most sought-after materials today. However, most of the material classifications rely on having an effective non-interacting model, whereas we are interested in interacting many-body systems. Using state-of-the-art numerical methods that include these kind of interactions we perform a study on a quantum paramagnet and can show that its predicted topological phase remains robust even when many-body interactions are included.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The research quality and environment at the university of Tokyo was excellent. Many of my coworkers became friends quickly. They showed me around the city, invited me to various activities and gave me lots of advice on what to do in Tokyo.

My host professor was extremely accomodating and organized scientific discussions with colleagues in other universities as well.

9. Adviser's remarks (if any):

**JSPS Summer Program 2022
Research Report**

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|---|-------------------|
| 1. Name: Daniel Holzhacker | (ID No. SP20306) |
| 2. Current affiliation: Justus-Liebig University Giessen, Germany | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: Yamagata University, Faculty of Engineering, Department of Organic Electronics | |
| 5. Host researcher: Professor Tsukasa Yoshida | |
| 6. Description of your current research <p>My research focused on aqueous dye-sensitized solar cells (DSSCs). DSSCs are a concept of solar cells based on the application of dyes which can absorb light and convert it into electric energy. In order to build a functioning cell, three components are necessary: the photoanode (including the dye), a counter electrode and a liquid electrolyte (containing a redox-mediator for charge transport) to connect the electrodes.</p> <p>The most efficient DSSCs employ a significant amount of hazardous and critical materials: platinum is a common counter electrode material, dyes frequently contain ruthenium, the redox-mediators are cobalt-based, and the solvent of the electrolyte solution is acetonitrile. All these materials are either precious metals (platinum, ruthenium) or hazardous substances (cobalt is carcinogenic and acetonitrile is toxic). Thus, to increase the sustainability of DSSCs, the substitution of these materials can be desirable.</p> <p>I studied the challenges arising from substituting the aforementioned materials with all-organic materials/molecules and water as a solvent, respectively.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Synthesis of copper zinc tin oxide (CZTO)

Description of the research activities:

My research in the group of Professor Yoshida focused on the synthesis of CZTO according to two routes found in literature: (1) co-precipitation and (2) microwave-assisted synthesis.

The co-precipitation approach yielded unsatisfying results, as from x-ray analysis (x-ray diffraction, XRD) the formation of the desired product CZTO could not be validated.

The microwave-assisted approach describes the synthesis of the sulfur analogue (copper zinc tin sulfide, CZTS) of the desired product. After the synthesis of the sulfide was successfully carried out according to XRD analysis, the synthesis of CZTO was attempted. A high-temperature treatment of CZTS yielded a black powder, however, elemental analysis revealed that no zinc was present in the product. Elemental analysis revealed that, contrary to the expectations from XRD, also in the sulfide only slight traces of zinc were present. On the other hand, the elemental analysis showed that the conversion of the sulfide to the oxide by a high-temperature treatment was successful.

In future research, the synthesis of CZTO will be further pursued.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

After two years of not being able to participate in the JSPS summer program due to the Covid19-pandemic, I was very happy to finally start the program this year. I sincerely enjoyed the time in Yonezawa. Since also the IRES program (partnership with the University of Vermont, USA) could be re-iterated, many trips to beautiful places in Japan were possible, e.g. to Niigata, Tsuruoka, Zao, Tokyo, Kyoto, Osaka.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Johanna Janssen | (ID No. SP20308) |
| 2. Current affiliation: RWTH Aachen University, Germany | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: RIKEN, Center for Emergent Matter Science (CEMS) | |
| 5. Host researcher: Prof. Koji ISHIBASHI | |
| <p>6. Description of your current research</p> <p>During my PhD project, I investigate the semiconductor ZnSe regarding its potential and feasibility as host material for spin qubits in gate defined quantum dots (GDQD). By adding Mg, the band structure and thereby electrical properties of the material can be altered and ZnSe/(Zn,Mg)Se heterostructures are predicted to provide very promising inherent material properties for the realization of GDQDs. For these investigations, a variety of different samples was grown, fabricated, and measured in our institute.</p> <p>Within this research, ohmic contacts are a basic requirement both for electrical characterization of typical material properties as well as the realization of electrical devices. For our target structure, the ohmic contacts must provide low resistivity especially at cryogenic temperatures < 10 K. We investigated different doping and contacting methods and could realize excellent ohmic contacts by co-doping of a ZnSe layer with Cl during molecular beam epitaxy (MBE) growth in combination with in-situ deposition of metal contacts.</p> <p>In addition to low resistivity, local doping of the material only below the contact region is required. Therefore, we developed a local doping method based on a sophisticated regrowth process. With this method, high-quality localized ohmic contacts in combination with an in-situ deposited gate dielectric could be successfully fabricated.</p> <p>Moreover, the preparation of a 2-dimensional electron gas is in our case a prerequisite for the realization of GDQDs. This can be achieved by fabricating specifically designed ZnSe/(Zn,Mg)Se quantum well structures. We use band structure simulations to estimate a suitable variety of heterostructure layer stacks and grow several samples with varying ZnSe and (Zn,Mg)Se layer thicknesses, different magnesium concentrations and doping concentrations. The electrical properties of these structures are subsequently measured.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Investigation of TiN with different N concentrations for the use as high Q resonators and nanowire contacts

Description of the research activities:

During my stay at RIKEN, I participated in the research on semiconductor-superconductor hybrid structures as potential building blocks for qubit structures like the gatemon or the Andreev qubit. I got the opportunity to work in the institute's different cleanrooms as well as to work with cryostats which allow to cool down the samples to temperatures significantly below 1 K.

My host group investigates semiconductor nanowire-based Josephson junctions as potential structures for the realization of Andreev qubits. As vortices induced in the structures by an out-of-plane magnetic field have a negative influence on the measurements, one current project is to optimize the fabricated circuits and reduce the uncontrolled formation and movement of these vortices by making use of flux trapping in the cooling down process. The material should hereby change its property from normal conducting to superconducting during cooling down while already exposed to the magnetic field. For this, a material needs to be found which critical temperature—the temperature at which it turns superconducting—lies below the critical temperature of the installed magnet. Therefore, we investigated TiN with different N concentrations. The TiN was sputtered on a sapphire substrate and structured using UV lithography. Subsequently, we cooled down the devices in a He-3 cryostat with a base temperature of about 0.25 K, determined the critical temperature T_c as well as the critical magnetic field and investigated the properties of selected resonator structures. We fabricated about ten samples with different N concentrations. However, despite a large variation of the N flux during TiN deposition, no significant change or trend in T_c could be determined. For further investigations, a heat element will be installed in the deposition machine to heat the substrate during the deposition process.

Moreover, we wanted to investigate InAs nanowires with an Al full-shell, which are provided by Forschungszentrum Jülich, Germany. We contacted the nanowires with the most promising TiN and could observe features indicating that we measured electrical transport through the Al shell. However, comparison with previous results showed that further optimization of both nanowires and contacts is still necessary.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I am very grateful to JSPS, to my host professor, and to my host institution for giving me the opportunity to conduct research in Japan, especially regarding the two years delay due to the COVID-19 pandemic and the resulting amount of additional administrative work. It was a highly interesting experience to live and work at a Japanese research center. I really enjoyed working together with my colleagues and furthermore got the opportunity to experience Tokyo as well as the surrounding countryside, in particular the mountain areas with the gorgeous autumn colors. There is far too much to see and too many nice people to meet in such a short period of time!

JSPS Summer Program 2022 Research Report

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|---|------------------|
| 1. Name: Robert Jirasek | (ID No. SP20309) |
| 2. Current affiliation: Brandenburg University of Technology Cottbus – Senftenberg, Chair of Hybrid Structures – Structural Concrete, Germany | |
| 3. Research fields and specialties: Engineering Sciences | |
| 4. Host institution: The University of Tokyo, Department of Civil Engineering, Bridge and Wind Engineering Laboratory | |
| 5. Host researcher: Dr. Tomonori Nagayama, Professor | |
| 6. Description of your current research <p>My current research focus is on the development and realization of lightweight transformable structures based on active-bending with controlled transformation and simultaneous vibration mitigation for real-world applications (e.g., multi-functional pavilions, transformable roofs). The considered structures exhibit geometrical non-linearities, due to large transformations. Modeling in the classical linear time-invariant (LTI) framework is thus not expedient. For this reason, the linear parameter-varying (LPV) framework is investigated for modeling and control design.</p> <p>For the example of a simplified actuated transformable structure, an LPV model was derived based on a finite element model and validated in simulation by comparison with data from a non-linear transient analysis of the finite element model. Moreover, LPV control design methods were investigated for this structure and validated in simulation.</p> <p>Recently, one segment of an active hybrid roof structure concept was realized at the Chair of Hybrid Structures – Structural Concrete for experimental investigations. The structural concept consists of a number of 16 segments, which can be transformed (opened and closed), based on active-bending by an actuation of the lower support. Active vibration control is realized by actuators attached at the upper supports.</p> <p>The previously investigated methods of LPV modeling and control based on a finite element model, which were applied to a simplified transformable structure, are currently transferred and applied to the structural prototype followed by an experimental validation.</p> | |

7. Research implementation and results under the program

Title of your research plan:

System identification of an active hybrid roof structure prototype

Description of the research activities:

As described in the section on current research, the dynamic behavior of transformable structures with large transformations can be derived in the linear parameter-varying (LPV) framework on the basis of finite element models. However, as a prototype structure is available, such LPV models can be directly identified from experimental data, which is generally termed system identification.

During the research stay at the Bridge and Wind Engineering Laboratory, two methods of system identification for LPV models were investigated in detail. Both these methods require two steps, 1) identification of local linear models and 2) merging the local linear models into a global LPV description. The first step is similar to both methods, whereas for the second step the procedures differ.

In the first step local linear models (LTI models) are identified for fixed transformation states. These LTI models describe the structural dynamic behavior in the vicinity of these transformation states. For the identification of these LTI models different approaches such as system realization using information matrix (SRIM) and subspace methods were applied and compared. Finally, SRIM was used for the LTI model identification, as it reliably estimates even the higher damped structural modes. The experimental input/output data, which is necessary to apply these system identification methods was derived with the realized prototype structure in advance of the research stay. Thereby, the prototype structure was excited for fixed transformation states using a pseudo random binary signal as input to excite a wide range of frequencies. As output, acceleration data at different locations of the structure was collected.

In the second step, the identified local LTI models are to be “merged” into one LPV model, which describes the dynamic structural behavior over the whole transformation range. The two investigated methods differ in the way they achieve this “merging” into a global model. The first method uses a balancing transformation and a sign treatment of the local LTI models to generate a coherent state basis. Then the local LTI models can be interpolated, which results in a grid-based LPV model. The second method minimizes the distance of the frequency responses between the local LTI models and a template LPV model. This results in an LPV model in linear fractional representation.

In a future step, the derived LPV models of both methods will be validated with experimental data of the prototype structure.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The research stay at the Bridge and Wind Engineering Laboratory of the University of Tokyo, made possible by the JSPS Summer Program, was a special experience for me. I have learned a lot during this time, both on a professional and on a personal level, and I am very grateful for the many discussions and helpful comments from the professors and the colleagues on topics related to my research. Moreover, I am very thankful for the insights into the research of the Bridge and Wind Engineering Laboratory that were given to me by professors and colleagues.

Culturally, the hike to the top of Mount Fuji was certainly one of the highlights. Tokyo impressed me among other things with its great museums and gardens, especially the Nezu Museum and the Tokyo National Museum.

9. Adviser's remarks (if any):

While Mr. Jirasek's visit to our laboratory was delayed due to COVID19, he was able to do more experimental work in Germany before his visit to Tokyo. Therefore, in Tokyo, he worked on the system identification using the collected data and we deepened our discussions and research by taking advantage of the data. We appreciate his stay in our laboratory as we learned from his structural control research as well as lectures co-organized with him and his research group.

Also, he participated in research meetings in our laboratory and provided various comments and advice. Our laboratory members appreciate academic and non-academic interactions with him.

JSPS Summer Program 2022 Research Report

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| 1. Name: Ah-Hyun Angela LEE | (ID No. SP20312) |
| 2. Current affiliation: Goethe University Frankfurt | |
| 3. Research fields and specialties: Social Sciences | |
| 4. Host institution: Waseda University | |
| 5. Host researcher: Professor Dr. Naoto Higuchi | |
| 6. Description of your current research <p>The research in Japan was a part of my PhD research project. The PhD project “Toward global solidarity: A comparative study of the ‘comfort women’ museums in South Korea, Japan, and Germany” contributes to opening a discourse on the complexity and multiplicity of the ‘comfort women’ history and memory. With the method of critical discourse analysis, this research project examines and compares the 1) context (temporal, locational backgrounds) and 2) the content (approach, depiction, method) of the ‘comfort women’ museums in South Korea, Japan, and Germany. Furthermore, this project involves interviews with museum directors, researchers, civil organizations, and students to find a way to extend the ‘comfort women’ memory fostering global solidarity.</p> | |

7. Research implementation and results under the program

Title of your research plan:

(Preliminary title of the PhD dissertation) Toward global solidarity: A comparative study of the 'comfort women' museums in South Korea, Japan, and Germany

Description of the research activities:

- 1) I conducted 13 interviews with activists, researchers, artists, exhibition directors in relation to the 'comfort women' activism, peace, and human rights activism.
- 2) I conducted ethnographic research by talking to people in Japan and observing events such as hate speech in front of the Embassy of the Republic of Korea.
- 3) I visited and analyzed the peace memorial museums such as the national museums in Nagasaki, Hiroshima but also that are run by the non-political and non-governmental organizations.

Based on the research activities, I could find out that Japan seen from the outside is different from Japan seen from the inside. I could find out that Japan's civil society is very active in promoting solidarity and peace.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Cosima PRAHM | (ID No. SP20313) |
| 2. Current affiliation: University of Tuebingen, Germany | |
| 3. Research fields and specialties: Medical, Dental and Pharmaceutical Sciences | |
| 4. Host institution: University of Tokyo, Japan | |
| 5. Host researcher: Prof. Hideaki KUZUOKA | |
| <p>6. Description of your current research</p> <p>My main research area can be labeled “TechNeuroRehabilitation” and involves improving technological aspects of the human-machine interface, such as electrodes and algorithms for advanced prosthetic control, and also on improving neuromuscular rehabilitation methods by developing game-based interventions, such as applications for patients to improve their control over the robotic prosthesis or alleviate their pain, especially phantom limb pain (PLP). PLP is a restrictive condition in which patients perceive pain in a non-existent limb, incapacitating them from performing daily activities. I am looking to develop novel documentation and diagnostic approaches as well as therapeutic interventions for patients with impaired hand functionality.</p> <p>This project focuses on phantom limb pain. Mirror Therapy, during which patients look into a mirror reflecting their sound limb and imagining it as healthy on their amputated site, has proven to alleviate that pain. However, it is limited to unilateral movements which take place in a seated position. We want to develop an assistive mixed reality tool to extend conventional Mirror Therapy by enabling users to freely explore their environment and to perform bi-manual tasks. Thereby, the patient's residual limb should be augmented by a superimposed virtual arm that is controlled by the residual limb. This way, the user can explore the virtual and actual reality in a variety of levels and engage in activities solely out of curiosity, without a given task. Therefore, detaching the experience of pain from their mind.</p> | |

7. Research implementation and results under the program

Title of your research plan: Designing and implementing a mixed reality application to alleviate phantom pain in unilateral upper limb amputees

Description of the research activities:

In order to make the best possible use of the time and stay at the research institute in at the Tokyo University and for this project to come to a successful conclusion, I have firstly defined a clear working plan with distinct requirements. In collaboration with students from the lab, with different areas of expertise, we could successfully complete all work packages.

We defined movements and possible interactions based on the patient's group capabilities and limitations. These were subsequently implemented in 3 newly created levels of the XR application. These levels were not goal-oriented, therefore level design differs in this respect from other, more classical approaches. These 3 immersive levels were designed, implemented and debugged in Unity 3D and C#. A new Bluetooth sensor was acquired for recording and processing multiple motion data and adding it to the XR application. All hardware components could successfully communicate with each other. Scene understanding from the MRTK package provided by Microsoft was implemented in our project which also entailed an upgrade from the previous version we used and subsequent debugging. In our last week, we finished the design and implementation of a graphical user interface and linked it with the necessary functionality to easily be used by a medical professional.

We could successfully complete an immersive mixed reality scavenger game that assists and upper limb amputee patients with alleviating their phantom limb pain. The application enables unilateral amputees to engage in bi-manual interactions in a virtual environment that still allows access to the real world. It can be used in a patient evaluation study upon return. Since it is a portable system, the application can be used for both patients staying at the hospital or in an at home setting, and also in either country, Germany or Japan.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Professor Kuzuoka has been a wonderful host and his team has been welcoming me into their lab. The JSPS summer program was a fantastic opportunity to experience Japan by immersing myself into the work at a Japanese University, while also visiting nearby locations on the weekends and experiencing the cultural differences and similarities between Germany and Japan. Besides the tropical heat waves there was also an occasional Taifun during which people were advised to stay at home, even in a big city such as Tokyo. There were so many amazing places with beautiful scenery such as Fuji-san or Takao-san (which I visited on the "mountain" holiday), relaxed in an Onsen or attended local matoris where I enjoyed not only yaki soba but also entertainment by the local school's taiko club. I love matcha, so I made it my mission to try as many matcha desserts

as possible during my stay here.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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|--|------------------|
| 1. Name: Daniel Manfred Schaeffer | (ID No. SP20314) |
| 2. Current affiliation: Deggendorf Institute of Technology, TC Teisnach Sensor Technology | |
| 3. Research fields and specialties: Engineering Sciences | |
| 4. Host institution: Nara Institute of Science and Technology (NAIST) | |
| 5. Host researcher: Prof. Jun OHTA | |
| <p>6. Description of your current research</p> <p>In my PhD I am developing miniaturized fiber optical chips for the guiding and splitting of light. The special feature is that these are made of glass and thus have very good optical characteristics. This means low attenuation, good fiber match and low dispersion, which makes them ideal for my current application in communications technology. In addition, they are also very robust chemically and thermally. For this reason, fiber optics also find an exciting field of application in medical technology and is for example used for small endoscopes.</p> <p>The development and fabrication of miniaturized fiber optical chips requires expertise in many different technical areas. From computer simulation to micromachining, lithography, metrology and data analysis to packaging and interconnection technology. There is a major similarity with the research activities of the Photonic Device Science Laboratory at NAIST. This has led us to start the collaboration within the excellent JSPS Summer Program.</p> <p>The research stay is particularly important for the work on my PhD, as it has given me the opportunity to do research on new applications for fiber and micro-optics, which are different from basic communications technology.</p> | |
| <p>7. Research implementation and results under the program</p> <p style="margin-left: 20px;">Title of your research plan:</p> <p style="margin-left: 20px;">Development and evaluation of miniaturized optical excitation light guiding components for microimaging deep brain activity</p> | |

Description of the research activities:

The Photonic Device Science Laboratory of NAIST is developing microimaging devices for observing brain activities in rodents. The image sensors, which are only about 0.5 mm in size, are mainly used in deep brain regions. By genetically modifying the animals, active brain areas show fluorescence. This means that light of a certain wavelength is absorbed in these areas and emits light again in a characteristic larger wavelength. This can be imaged over time and thus conclusions drawn about the spatial distribution of brain activity. In addition to the actual image sensor, a miniaturized light source is necessary to illuminate the fluorescent fields of interest.

During my research stay at NAIST, I was specifically involved in the development of miniaturized light-guiding optics to improve this illumination. For this purpose, I performed computer simulations to calculate the propagation of the light beams.

In parallel, I fabricated the first components by lithography in a clean room. For this, a 10 μm photoresist layer (SU-8) was spin coated onto a 125 μm thin glass substrate and structured by UV light. The quality of the resulting optical chips was verified with a microscope. A fiber optic measuring station was set up to test the components function. For this purpose, a 473 nm laser was coupled into an optical fiber and aligned with high accuracy to the side of the optical chips. The output of the light was then spatially resolved using an image sensor. To allow optical conditions similar to those in the brain, the measurement was repeated in liquid. Fluorescent particles were added to the liquid and showed a realistic light distribution.

To have the opportunity to duplicate the structures in various materials a silicone mold was fabricated. It was already used for a variant made of NOA63, which has even better optical material properties than the SU-8. The device was successfully tested, too. Further experiment with real mouse brain tissue were conducted, to show the current limitations in the fluorescence application.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The way of working in Japan feels well-structured to me. All employees were very friendly, helpful and courteous.

In my free time, I was able to make many new contacts with international students while playing sports. In addition, the time in Japan was very culturally enriching for me.

9. Adviser's remarks (if any):

Thank you for the great opportunity JSPS has given me with the JSPS Summer program. It was a very interesting and enjoyable experience for me to work in Japan. Among other things, I was shown which challenges both my institute in Germany and NAIST are working on. I would like to establish a long-term cooperation between our two working groups in the future. I am sure that both will benefit from this.

**JSPS Summer Program 2022
Research Report**

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| 1. Name: Dr. Vera ZYWITZA | (ID No. SP20320) |
| 2. Current affiliation: Technology Platform Pluripotent Stem Cells, Max- Delbrück-Center for Molecular Medicine in the Helmholtz Association (MDC), 13125 Berlin, Germany | |
| 3. Research fields and specialties: Biological Sciences | |
| 4. Host institution: Osaka University | |
| 5. Host researcher: Prof. Katsuhiko HAYASHI | |
| 6. Description of your current research <p>The sixth mass extinction, also called Anthropocene extinction, is an ongoing mass extinction event caused by human activities (Ceballos et al., 2020; Kolbert, 2015). With only two females left alive, the northern white rhino (NWR) is probably the most endangered mammal at present. As the remaining females are too old and too sick to be bred naturally, the international BioRescue consortium is developing methods of advanced assisted reproduction and stem cell research to rescue the charismatic animal from extinction (Hildebrandt et al., 2021; Saragusty et al., 2016).</p> <p>Toward this aim, we employ cryopreserved body cells from already deceased NWR individuals to generate induced pluripotent stem cells (iPSCs) (Zywitza et al., 2022; Hayashi et al. <i>under review</i>). iPSCs have the potential to generate each cell type within a body including oocytes and spermatozoa (Takahashi et al. 2007; reviewed in Hayashi et al., 2021). Subsequently, embryos obtained by <i>in vitro</i> fertilization of artificial gametes are carried to term by surrogate mothers. Derivation of healthy, fertile offspring from PSCs has been demonstrated for mice (Hikabe et al., 2016; Ishikura et al., 2021), raising the hope that the modality will be applicable to other mammals, including endangered species such as the NWR, too.</p> <p>While our laboratory in Berlin so far mainly focused on the generation and characterization of NWR-iPSCs (including characterization of source material), our collaboration partners in Japan concentrated on developing a differentiation protocol for the production of primordial germ cell-like cells (PGCLCs), the precursors of oocyte and sperm, from embryonic stem cells (ESCs) derived from the closely related southern white rhino (SWR) (Hildebrandt et al., 2018). After protocol adaption, PGCLCs could also be derived from NWR-iPSCs (Hayashi et al., <i>under review</i>).</p> <p>Currently, our laboratories jointly aim to further optimize the PGCLC induction protocol to enhance the efficiency of PGCLC production from NWR-iPSCs. This includes generation and screening of additional NWR-iPSC lines, and adjusting various protocol parameters. Furthermore, we are working on the next differentiation step towards functional oocytes, which requires co-culturing of PGCLCs and gonadal somatic cells. As gonadal tissue is not available from rhinos, we aim to generate fetal ovarian somatic cell-like cells (FOSLCs, Yoshino et al., 2021) from SWR-ESCs.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Artificial reproduction to rescue endangered species like the northern white rhino from extinction

Description of the research activities:

Prof. Katsuhiko HAYASHI and his team at Osaka University are renowned worldwide for their striking findings in the field of gametogenesis.

During my research stay in his lab, I received an extensive hands-on training on PGCLC, FOSLC and oocyte differentiation. By working with mouse and SWR-ESC cultures in parallel, I gained deep insights into the individual steps and critical points of the protocols, which will help me to adapt procedures for NWR-iPSCs in future.

Towards establishing a FOSLC differentiation protocol from SWR-ESCs, we performed experiments testing several parameters in parallel.

In addition to our practical experiments in the lab, we discussed extensively about the next steps of our joint research and how we can work together most efficiently in order to increase the chances to obtain an NWR calf from iPSCs in time to meet its last two remaining relatives.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Immersing in the work-life routine in Japan was very interesting. Prof. Katsuhiko HAYASHI and his lab members are extremely friendly and welcoming. By discussing their research topics individually in one-to-one meetings, I had the opportunity to gain deep insights into various aspects of gametogenesis, ongoing science and up-to-date research questions in the field. I learned a lot and found the discussions and work atmosphere very inspiring. Especially, I would like to thank Masafumi HAYASHI and Dr. Yuki NAITOU. One night, Prof. Katsuhiko HAYASHI went with us to a typical izakaya. This was a lot of fun and I am glad about the experience and to try local food in Osaka.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Kate Glennon | (ID No. SP20403) |
| 2. Current affiliation: McGill University | |
| 3. Research fields and specialties: Biological Sciences | |
| 4. Host institution: RIKEN Center for Integrative Medical Sciences | |
| 5. Host researcher: Dr. Yukihide Momozawa | |
| 6. Description of your current research This project is investigating germline susceptibility to renal cell carcinoma within the Canadian population. There are large, unexplained, variations in the incidence of renal cell carcinoma (RCC) across the globe. Germline genetic variation contributes strongly to individual differences in susceptibility to cancer, however genetic risk factors for RCC are still poorly understood – indicating the need for large-scale studies investigating susceptibility to RCC among different populations. This project represents the first of such studies among the Canadian population. | |

7. Research implementation and results under the program

Title of your research plan:

Investigating germline susceptibility to renal cell carcinoma within the Canadian population.

Description of the research activities:

Dr. Momozawa's lab has developed a multiplex-PCR based targeted sequencing assay for identifying germline variants in cancer susceptibility genes. Previously, the lab has successfully applied this method to large sample cohorts from various cancer types to identify pathogenic germline variants associated with risk of developing cancer. We aimed to apply this assay to samples from Canadian patients with RCC, with the goal of identifying RCC risk-genes within the Canadian population, as well as assessing differences in risk-genes within different populations with RCC.

We conducted targeted sequencing of 19 RCC-related and 27 cancer-predisposition genes in a cohort of 960 Canadian patients with RCC, to identify risk genes that may be present within the Canadian population. We conducted gene-based association tests were conducted between patients with RCC and non-cancer control data from the gnomAD public database to identify genes with significant association to RCC. We also compared gene burden of pathogenic germline variants between RCC subtype, and between different populations (Japanese, Canadian, European, etc) to identify population-specific patterns in RCC susceptibility.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

As part of the 2020 cohort, my travel to Japan has been delayed significantly due to the Covid-19 pandemic, so I was very happy to finally arrive in Japan! Even though many of the in-person activities, such as the homestay program and the language lessons had to take place virtually, I was still able to meet with and connect with many other JSPS Fellows throughout my time in Japan. Throughout my time here I was able to make weekend trips to Tokyo, Kyoto, Osaka, Hakone, Kamakura, Nara and Kobe, where I was able to visit many temples and shrines, participate in a traditional tea ceremony, visit an onsen, and try lots of local treats. Additionally, Dr. Momozawa and all of my colleagues in the lab were incredibly welcoming and helped to make the most of my time in Japan.

9. Adviser's remarks (if any):

Ms. Kate Glennon has worked very well with our colleagues and completed an original research plan only in two months. This is a great progress. After she come back to Canada, we will keep working together to finalize this project.

Thank you JSPS for supporting her and our collaboration.

JSPS Summer Program 2022 Research Report

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| 1. Name: Darien Yeung | (ID No. SP20408) |
| 2. Current affiliation: University of Manitoba | |
| 3. Research fields and specialties: | |
| Humanities | Social Sciences |
| Chemistry | Engineering Sciences |
| Agricultural Sciences | Biological Sciences |
| Interdisciplinary and Frontier Sciences | Mathematical and Physical Sciences |
| 4. Host institution: Kyoto University | |
| 5. Host researcher: Professor Yasushi Ishihama | |
| 6. Description of your current research | |
| <p>My research involves large-scale studies of proteins and their interactions with each other under biological conditions and challenges such as drug treatments/interventions, infection models, and elucidating mechanisms in cell death. High-throughput proteomics is currently capable of identifying ~4000 proteins in 1 hours for human cell lysates which is projected to contain ~20000 proteins. Current methodologies are insufficient to provide a comprehensive snapshot of the protein machinery involves in many biological processes. High-sensitivity methods such as multi-dimensional chromatography are avenues to uncover 8000-9000 proteins however require long analysis times upwards of 10 hours.</p> <p>Our method Proteome-Selective Isolation Chromatography (P-SLIC) is a way to achieve the number of proteins detectable in multi-dimensional chromatography but attainable in less time in ~3 hours. This is a 2-3x speed-up depending on sample and is done by simplifying the peptides transmitted to the mass spectrometer for analysis which in turn boost ability to identify peptides and proteins.</p> <p>We evaluated both liquid-phase and gas-phase apparatuses to understand the optimal pairing tailored for different samples and in collaboration with our host, Prof. Yasushi Ishihama, we investigate the effectiveness of using gas-phase fractionation and nanospray hydrophilic interaction liquid chromatography (HILIC) in the context of proteomics and P-SLIC.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Investigating the interplay of gas-phase fractionation with trapped ion mobility spectrometry (TIMS) and hydrophilic interaction liquid chromatography (HILIC) for proteomics

Description of the research activities:

The research activity in this research term is broken down into two components (1) gas-phase fractionation with trapped ion mobility spectrometry (GPF-TIMS) and (2) nanospray-based HILIC (nanoHILIC). For GPF-TIMS, we investigated the effect of fractionation bin-sizes and windows and determined that using GPF-TIMS – we are able to achieve 15-30% increase in peptide and protein identifications depending on the method we employ. This increase was most profound when paired with nanoHILIC and using GPF-TIMS, we are able to uncover more peptides and proteins than without.

Our use of nanoHILIC in proteomics is novel where we develop methods compatible with mass spectrometric analysis and have been able to detect 4000-4500 proteins using a linear 1 hour gradient. Non-linear gradients have also been investigated and observed a 15% boost in protein identifications. We use ZIC-HILIC and ZIC-cHILIC sorbents as well as a hybrid of the two and found that ZIC-HILIC had the best charge-separation characteristics much like strong cation exchange, ZIC-cHILIC has potential to be a phosphopeptide analysis column without enrichment, and the hybrid is able to have relatively sharper peaks but needs major refinements to be an effective analytical column for proteomics.

Furthermore, we investigated the use of sliding windows (rather than using one gas-phase window, we change window every 5 minute interval) in GPF-TIMS and found that we are able to improve protein identification in nanoHILIC compared to a static window GPF-TIMS (no window change, resulting in longer run times). The effect is less pronounced in nanoRP (reversed-phase – the conventional chromatography sorbent) which will need to be investigated further.

Finally, we assess the differences in TIMS mobility for different post-translational modifications for applications in health-care research including acetylation, phosphorylation, and tandem-mass tags (TMT). This is a novel aspect for the construction of a prediction model for TIMS mobility for PTMs which have not been found in literature at current submission.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I really appreciated in this exchange the knowledge I learned from all members of the lab in Prof. Ishihama's group. The diversity of subjects in computing, biology and MS and the mentality in terms of troubleshooting and research has improved my ability to be a more robust and efficient researcher.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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|---|-------------------|
| 1. Name: Nicolas LEGENDRE | (ID No. SP20411) |
| 2. Current affiliation: HEC Montréal | |
| 3. Research fields and specialties: Economics and Finance | |
| 4. Host institution: Kwansai Gakuin University | |
| 5. Host researcher: Prof. Masatoshi KATO | |
| <p>6. Description of your current research</p> <p>The current research project investigates the relationship between venture capital (VC) type and start-up growth and exit likelihood. More specifically, this research seeks to address two research questions: (1) what is the role of VC investment on the performance of new firms, and (2) do the effects differ according to the type of VC investor?</p> <p>The growth of new firms accounts for a disproportionate share of a country's employment and economic growth (Adelino et al., 2017; Haltiwanger et al., 2013). However, new firms are known to suffer from severe information asymmetry and other difficulties and, thus, are more likely subject to credit constraints (Berger and Udell, 1998). Accordingly, it is important to investigate mechanisms that promote the flow of capital to new firms. The current research project investigates such a mechanism, specifically the role of VC. VC plays a critical role in the growth of new firms by providing firms with additional resources and skills (Colombo and Grilli, 2010). However, evidence is limited on how the role differs across VC investor types, primarily due to data limitations. The current research project addresses this limitation by examining the separate effects of independent venture capital (IVC) investments and corporate venture capital (CVC) investments on firm performance.</p> <p>To answer these research questions, empirical analyses exploited data from a unique panel-dataset of Japanese start-ups founded from 2012 to 2016. The data provide information on firm-level financials, growth outcome, patent application as well as whether the start-up received a VC investment, the timing of the VC investment, and the VC investment type. Following Chemmanur et al. (2014) and Colombo and Murtinu (2017), we employed a matching procedure to evaluate the treatment effect of receiving a certain type of VC investment on firm growth and exit outcome. More specifically, we extended Colombo and Murtinu's (2017) approach and applied coarsened exact matching (CEM), which addresses imbalance reduction issues associated with "equal percent bias reducing" (EPBR) matching techniques (such as propensity score matching) (Iacus et al., 2011).</p> <p>The results of such analyses are summarized as follows. First, while VC investment does not have a positive effect on sales growth, VC investment has a positive effect on the probability of innovation. Second, IVC investment improves new-firm performance both in terms of innovation and growth. These results are consistent with the argument that different VC investor types have different investment motives. Accordingly, policymakers that seek to promote VC activity to foster new firm performance may need to target specific VC investor types depending on the desired performance outcome.</p> | |

7. Research implementation and results under the program

Title of your research plan:

Does VC investor type matter? Effects of VC involvement on new-firm performance

Description of the research activities:

The first research activity involved conducting a detailed literature review on previous venture capital (VC) effects on firm performance. Specifically, the task focused on the estimation techniques conducted by previous research. The second research activity involved building the appropriate model and estimation technique, based on the detailed literature review results. Third, a research meeting with an academic colleague took place in Japan to discuss the estimation technique. The discussions revealed important insights on the relationship between VC type and subsequent startup performance. More specifically, the meeting revealed that the utilization of more recent matching procedures (ex. CEM) in our investigation can contribute to the literature by improving on previous approaches (such as propensity score matching). The fourth research activity involved obtaining Japanese firm-level data, cleaning the data and building the final sample for analysis. Fifth, the estimation was conducted using the final sample. More specifically, the sample of firms that received VC investments from different types of VCs were matched to non-VC-backed firms to estimate the treatment effect on firm performance. Lastly, the results were interpreted and policy implications were discussed.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

The joint research project in Japan was a fantastic experience. I am deeply grateful for the opportunity to work closely with Professor Masatoshi Kato and expand my academic network through introductions within Kwansei Gakuin University and at other universities such as Kobe University. Moreover, the support staff at Kwansei Gakuin University was excellent and was instrumental to my incredible experience. Similarly, the Japanese people that I had the privilege of meeting outside of academia were incredibly nice and have fostered great friendships. Overall, my experience can be described as: amazing. I look forward to the opportunity to return to Japan.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Brianna Bradley | (ID No. SP20414) |
| 2. Current affiliation: Queen's University | |
| 3. Research fields and specialties: Engineering Sciences Medical, Dental and Pharmaceutical Sciences Biological Sciences | |
| 4. Host institution: Tokyo Medical and Dental University | |
| 5. Host researcher: Associate Professor Yuji Nashimoto | |
| 6. Description of your current research | |
| <p>Conventional drug delivery methods for disease treatment involve the systemic distribution of the therapeutic agent, typically through oral ingestion, nasal administration or transdermal injection. However, this systemic distribution is not desirable when a local delivery of the drug is required, since it reduces the amount of the drug delivered to the target tissue, and adverse side effects from the drug are increased. Targeted drug delivery, in which the drug is transported directly to the target tissue, can be used to minimize these negative effects.</p> <p>Magnetotactic bacteria (MTB), a class of non-pathogenic bacteria that internally grow magnetic nanoparticles, have the potential to be used as targeted drug delivery agents. The nanoparticles inside MTB cause the bacteria to orient and coordinate their movement in response to a magnetic field, a navigation phenomenon called magnetotaxis. Thus, the navigation of MTB can be controlled by applying a magnetic field. This directed navigation creates the opportunity for their use in targeted drug delivery. However, a detailed study of the directed navigation of MTB through a vascular network has yet to be investigated.</p> <p>Dr. Nashimoto has developed microfluidic platforms with an integrated, perfusable vascular network. The main objective for this research project is to introduce the MTB into the vascular network on Dr. Nashimoto's device and direct them using a magnetic field to study their motility and trajectories through the network.</p> <p>The results from this project will provide an understanding of the directed navigation of MTB through a complex vascular network, similar to the <i>in vivo</i> geometries they would experience as targeted drug delivery agents. The results of this project will contribute to the advancement of targeted drug delivery for the treatment of various diseases, including cancer. The use of MTB as targeted drug delivery agents has potential to improve the percentage of drug delivered to the target tissue or organ and reduce the side effects.</p> | |

7. Research implementation and results under the program

Title of your research plan: Navigation of magnetotactic bacteria through a perfusable vascular network in a microfluidic device

Description of the research activities:

I have learned the techniques and processes involved in fabricating and analyzing the microfluidic vascular network device. Upon returning to Canada, I will reproduce the vascular network devices in my home university, then I will conduct the MTB experiments.

During the summer program, I have been trained in aseptic cell culturing techniques, including maintaining cell cultures through media changes, and freezing and thawing techniques. I have learned the fabrication techniques for making microfluidic devices for organ-on-a-chip processes, and I have learned the techniques for loading the cells into the microfluidic device and maintaining their growth while in the device. I have learned the procedures for fixing the cells and immunofluorescence analysis. Finally, I have learned the techniques for processing the images of the vascular network in the microfluidic device.

For the MTB experiments, it is critical that the vascular network forms a lumen structure (the hollow space of the tubular structure) for the MTB to swim through. This was confirmed using confocal microscopy (Figure 1A and B) and by perfusing fluorescent beads with a 6 μm diameter through the vascular network (Figure 1C).

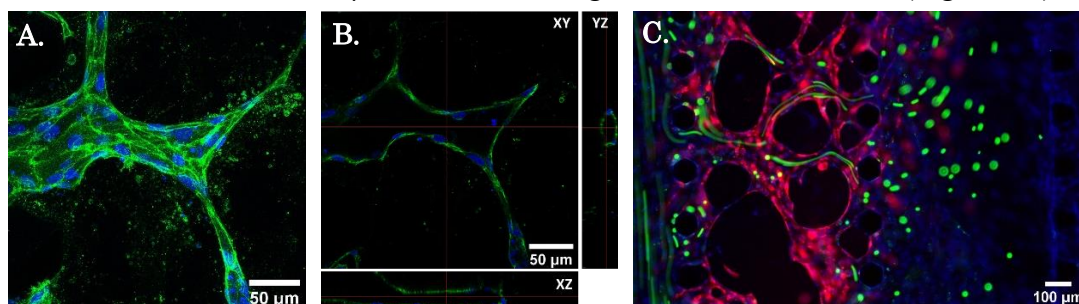


Figure 1. A. A projection image of the vascular structure. Green: CD31, blue: nuclei. B. Orthogonal views showing the lumen structure. C. 6 μm beads (green) perfused through the vascular network. Red: RFP-expressing endothelial cells, blue: nuclei.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

It was truly a pleasure to work with the students, professors, and staff in the group at TMDU. I hope that I'll be able to return to visit them someday soon.

I had so many incredible experiences in Japan: exploring the many activities in Tokyo, visiting Tokyo Disneyland, climbing Mt Fuji, and visiting the shrines and temples in Kyoto to name a few. I'm also very grateful for the opportunity to connect with other JSPS fellows from around the world. It's been the trip of a lifetime!

9. Adviser's remarks (if any):

Brianna Bradley joined our research group and learned a lot about making a vascular network. She introduced a new concept to our group, magnetotaxis using magnetotactic bacteria (MTB), which greatly inspired us. In addition, she showed great leadership and kindly leads our group of students at TMDU. Through the activities, Brianna and our students in TMDU experienced international collaborative research in their early careers, which will be great in Japan and Canada's future. I'm looking forward to developing her project in Canada. I hope she succeeds in the research project in Canada, and we can collaborate on other new research projects in near future.

JSPS Summer Program 2022 Research Report

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| 1. Name: Blake Steven LEDGER | (ID No. SP20418) |
| 2. Current affiliation: McMaster University | |
| 3. Research fields and specialties: Mathematical and Physical Sciences | |
| 4. Host institution: National Astronomical Observatory of Japan, Mitaka Campus, Tokyo | |
| 5. Host researcher: Prof. Daisuke IONO | |
| 6. Description of your current research <p>The research I conducted while participating in the JSPS-Mitacs Summer Research program has contributed towards my PhD at McMaster University, Canada. My research focuses on observational astronomy, using a state-of-the-art telescope in Chile, the Atacama Large Millimeter/submillimeter Array (ALMA), to study the contents of nearby star-forming galaxies in the Universe. ALMA is a next generation, modern telescope facility that allows astronomers to target and explore the clouds of molecular gas which serve as fuel for future stars in galaxies. Japan has a significant role in the development and upkeep of the ALMA facility, and I was able to join Dr. Daisuke Iono and his research group in the ALMA building at the National Astronomical Observatory of Japan (NAOJ). My primary research motivation is to understand how radiation fields in galaxies affect the physical and chemical properties of these molecular clouds. For example, radiation fields can be created from massive stars (UV radiation) or in the vicinity of a super-massive black hole which is accreting material (X-ray radiation). The radiation will then illuminate the molecular gas, altering its physical properties (temperature and density) and chemical structure (reaction pathways and gas abundances). The impact that the radiation fields have on the gas will dictate the future ability of the gas to form new stars, which in turn will affect the future evolution of the galaxy.</p> | |

7. Research implementation and results under the program

Title of your research plan: Dense gas in the galaxy merger NGC 3256

Description of the research activities: While at NAOJ, I worked with Drs. Daisuke Iono and Toshiki Saito to investigate the properties of molecular gas in a large sample of nearby galaxies. Our project began with one source, NGC 3256, but expanded as we utilized the capabilities of the ALMA Science Archive. I identified 16 galaxies which had been previously observed with ALMA in our target molecules, which were the two molecules carbon monoxide (CO) and the cyanide radical (CN). CO and CN are two interesting molecules which tell us about the gas content in galaxies. The expectation is that the presence of CO identifies regions that contain molecular gas, while the presence of CN identifies regions of denser gas which have been exposed to radiation fields. We aimed to investigate the cause of any variations in the observed CN/CO ratio. Using the research facilities of NAOJ, I was able to download, calibrate, process, and analyze the ALMA data for 16 galaxies. The expertise, experience, and guidance of Drs. Iono and Saito made processing and analyzing the ALMA data efficient and productive. I created maps of the CO and CN content for the 16 galaxies and began the comparison of the observed ratios of these two molecules. The outcome of my research in the JSPS program was the near completion of a research publication, which will be submitted shortly after my return to Canada (Ledger, Saito, Iono, et al. *in prep*).

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan, I was able to explore and experience many different parts of Japan and Japanese culture. The people of Japan are extremely kind, patient, respectful, gracious, and generous. I was able to connect with different people at my host institute, NAOJ, where I learned about how research is conducted in Japan and how the university systems work from fellow graduate students. They shared their experiences of living near Tokyo with me and offered suggestions about where to try Japanese foods and where to travel and explore. I was able to explore the Tokyo area, including Asakusa-jinja Shrine, the Tokyo Sky Tree, and the Imperial Palace and its nearby gardens. My colleagues at NAOJ took me hiking up Mount Mitake and to a Japanese hot spring, Tsurutsuru Onsen. We also went on a trip to Nagoya University via the Shinkansen bullet train to give seminar talks. The highlight cultural experience of my stay in Japan was to climb Mount Fuji, staying one night at Fujisan Hotel at an elevation of ~3,400 m, and experiencing the rising Sun from the summit at 4:30 a.m. Thank you, Japan, for an incredible summer.

9. Adviser's remarks (if any):

I truly enjoyed the past two months working with Blake. Together with Dr. Toshiki Saito of the ALMA project, we worked on an astronomical research project to study dense gas properties in star-forming galaxies found in the nearby Universe. While working closely, Dr. Saito and I have found Blake highly talented, motivated, organized, and very easy to work with. Our graduate students and staff members here have enjoyed working and spending time with him as well. He played an integral part in our weekly meetings, showing his latest research results as well as providing important comments to other staff and students in the meeting. I am glad he enjoyed the research and cultural experience here in Tokyo during this summer, and I look forward to collaborating more in the future.

JSPS Summer Program 2022 Research Report

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| 1. Name: Cigdem Cengiz | (ID No. SP20502) |
| 2. Current affiliation: Linköping University | |
| 3. Research fields and specialties: Mathematical Statistics | |
| 4. Host institution: Hiroshima University | |
| 5. Host researcher: Shinpei Imori | |
| 6. Description of your current research | |
| <p>Profile analysis is a multivariate technique that is used for comparing the patterns of variables between groups. We have multivariate observations for each individual and mean levels for each variable are calculated per group. The profile is then obtained by plotting the means for each variable and connecting these points by drawing straight lines.</p> <p>There are three types of tests which are commonly used in profile analysis: test of parallelism, test of levels and test of flatness. In our research, we focus on the parallelism hypothesis and we try to utilize model selection methods to test partial parallelism. Partial parallelism means that the profiles are parallel up to a point and after this point parallel structure between the profiles no longer holds.</p> | |

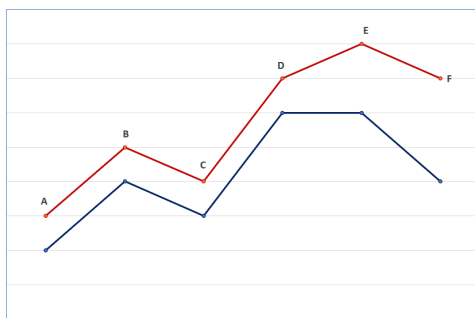
7. Research implementation and results under the program

Title of your research plan:

Model Selection for Partial Parallelism

Description of the research activities:

Our aim is to test partial parallelism between the profiles. To visualize the idea, we can give the following example. Say that we have two groups and the profiles are plotted as below:



As one can see, these two profiles are parallel up to D and we aim to find this point in our research. Testing parallel profiles has been of interest for many years, but there is not much research on the partial behaviours. This question can be interesting in several research areas because one may wish to investigate if there is a change in the patterns of profiles at some point between different groups.

We started our research by defining our model which is a general multivariate linear model (MANOVA).

$$X = MD + E$$

To test if the first s points are parallel, we define the restrictions as

$$C_s M_s F_s = 0$$

After reparameterization, the model becomes

$$X = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} (C'_s)^\circ \\ 0 \end{bmatrix} \theta_1 D + \begin{bmatrix} C'_s \\ 0 \end{bmatrix} \theta_2 F^{\circ'} D + \begin{bmatrix} 0 \\ I \end{bmatrix} M_{p-s} D + \begin{bmatrix} E_1 \\ E_2 \end{bmatrix}$$

This is an extended bilinear regression model EBRM³. Then we simplified this model to

$$X = \begin{bmatrix} (C'_s)^\circ & 0 \\ 0 & I \end{bmatrix} \begin{bmatrix} \theta_1 \\ M_{p-s} \end{bmatrix} D + \begin{bmatrix} C'_s \\ 0 \end{bmatrix} \theta_2 F^{\circ'} D + E$$

which is an EBRM². We set up the hypotheses as

$$H_1 : X = MD + E, \quad C_s M_s F = 0$$

$$A_1 : X = MD + E, \quad \text{no restriction}$$

The likelihood ratio has been calculated as

$$\lambda^{2/N} = \frac{|(\mathbf{A}_1^\circ)' \mathbf{S}_1 \mathbf{A}_1^\circ|}{|(\mathbf{A}_1^\circ)' \mathbf{S}_1 \mathbf{A}_1^\circ + (\mathbf{A}_1^\circ)' \mathbf{X} \mathbf{P}_{D'(DD')^{-1}K} \mathbf{X}' \mathbf{A}_1^\circ|} \sim \Lambda(s-1, N-r(D), r(K))$$

which is a well-known distribution, that is Wilks' lambda.

This was a comparison between two models: one with s parallel points and the other one with no structure. Then we ask the next question. How do we compare two models with different numbers of parallel points because our aim is to find the maximum number of parallel points between the profiles? We can state the hypotheses as

$$H_{01} : C_1 M_1 F_1 = 0$$

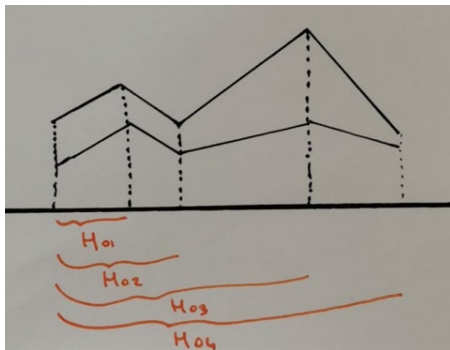
$$H_{02} : C_2 M_2 F_2 = 0$$

⋮

$$H_{0k} : C_k M_k F_k = 0$$

A : There is no structure

Our goal is to find the best(true) hypothesis among $H_{01}, H_{02}, \dots, H_{0k}, A$. To do so, we compare the AICs, which means to find the smallest AIC among the models. To visualize the problem, we give an example:



Here the true model is H_{02} and we aim to find this.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I thank JSPS for this program from the bottom of my heart. I spent 10 weeks at Hiroshima University and had the chance to work with esteemed Dr Shinpei Imori. We started our research before coming to Japan and held several online meetings, but it made a big difference to work face to face, have discussions on board together. It is very hard to discuss mathematical topics online, so this was a great chance to make progress. I continue working with him and we plan to publish a paper together. Dr Imori is a successful young researcher and all the staff at Hiroshima University have been very helpful, so it was a privilege for me to have worked there. I would like to apply to other programs by JSPS to visit again.

I had a chance to explore Japanese culture as well with this program. I visited Kyoto and Matsuyama and explored the beautiful city Hiroshima. Visiting important sites of Hiroshima was very emotional for me and it was a different feeling to be physically there. I met the mother of my host family in Kyoto and she showed me around. I spent time with my host researcher's lovely family and became friends with her wife and children. It was a lot of fun spending time with them and observing Japanese family life.

There are a lot of more things to say, but briefly I am very grateful to JSPS for providing this opportunity to conduct research and experience beautiful moments in Japan. Arigatou gozaimashita.

9. Adviser's remarks (if any):

JSPS Summer Program 2022 Research Report

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| 1. Name: Jing Li | (ID No. SP20509) |
| 2. Current affiliation: Lund University | |
| 3. Research fields and specialties: Engineering Sciences; Water Resources Engineering | |
| 4. Host institution: Nagasaki University | |
| 5. Host researcher: Prof. Kei Nakagawa | |
| 6. Description of your current research My research deals with eutrophic water and toxic algal blooms and how they impact drinking water supply. I am currently developing a digital platform with my project team for managing cyanotoxin risk in drinking water supply and public bathing. During my research visit at Nagasaki University, I also worked on a research project for a publication on establishing a general framework for Swedish cyanobacterial risk assessment by using Swedish national database and a Machine learning method: Random Forest. | |

7. Research implementation and results under the program

Title of your research plan:

Drinking water supply and groundwater utilization in Japan- a case study in Nagasaki and Kumamoto

Description of the research activities:

1. Drinking water treatment plant visit (浦上浄水廠, 6th of July)

Thanks to Prof. Kei Nakagawa's arrangement, together with other three fellows from groundwater research group, we visited Uragami Water Treatment Plant, Nagasaki, which is in the northeast of Nagasaki city. The water treatment plant uses water from Uragami Dam and produces 20,000+/- 20% m³/day and mainly use quicksand purification treatment which is like many surface water treatment plants in Sweden. I also learned Nagasaki city's water networks and waterworks distribution and how they deal with possible algal blooms in the dam. They also use living fish to monitor the water quality. Besides, I did research on drinking water supply in general in Japan, which is impressive and a good reference for many countries.

2. Field visit at groundwater resource, Kumamoto (17-18th of July)

Kumamoto is well known for its groundwater source and a rare region and only region in Japan that 100% using groundwater for drinking water. On one hand, the natural geological structure from volcanic activities by Mt. Aso provides perfect condition for groundwater formation and on the other hand human efforts of constructing facilities contribute recharge the groundwater aquifer. These two factors support a sustainable water supply. Dr. Hiroki Amano from Taokai University guided me around the whole Aso region and visited the source of spring water. It was fantastic to see and feel onsite about their research sites. Afterwards, I did a research study on the groundwater history and supply and management in Kumamoto region and will share with my colleagues back to Sweden.

3. Presentation of my research at the Department of Environment Science (20th of July)

4. Presentation of my research at the Groundwater group (25th of July)

5. Field research in Shimabara (28th of July)

Working together with Prof. Kei and his team, I participated sampling and measurements at 8 locations in Shimabara area for investigation of groundwater pollution by nitrate. I also participate some experiments work in the lab.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):

I was well received by Professor Kei Nakagawa and his team and have had a pleasant time with a lot of new learnings and new experience. I truly appreciate the group and be grateful of what I have received. I am impressed by Japanese working spirit and their seriousness of perfecting whatever they do and being observant and reflective. Thank you for JSPS providing financial support and excellent service for "home stay program", language study and flight arrangement. I wish more collaboration will occur in the future between water resources engineering at Lund University and Nagasaki University and Taokai University.

9. Adviser's remarks (if any):