

# KSC Newsletter

Issue 6

## KAGRA joined International GW Network

### Signed up LIGO-Virgo-KAGRA MoA for joint observation

On October 4, 2019, KAGRA held a ceremony to mark the completion of the detector. The ceremony was in the site, and after the play of the music of *kagura* (the traditional Shinto-style ritual music) by local children's musical group, Takaaki Kajita, our PI, pushed a button with U Tokyo Executive Vice President Kohei Miyazono to demonstrate the detector in motion. In the evening of the day, the signing ceremony of a memorandum of agreement (MoA) on a research collaboration between KAGRA, LIGO and Virgo were held.

This MoA makes KAGRA an equal partner of LIGO and Virgo, and once KAGRA satisfied the criteria for joining observation then all the scientific achievements will be presented as LIGO-Virgo-KAGRA collaboration. KAGRA is definitely close to the production phase after the ten-year construction and installation period. 🍏



(Above) Pose for photos after signing a MoA. (from left) EGO vice president Christian Olivetto, Virgo spokesperson Jo van den Brand, KAGRA principal investigator Takaaki Kajita, LIGO Executive Director David Reitze, KSC board chair Hisaaki Shinkai, and KAGRA vice PI Masatake Ohashi. At ANA Crowne Plaza hotel Toyama, October 4, 2019. [Photo courtesy of Hida City]



(Right above) The ceremony at the site. Playing *kagura* music by local shrine musicians. (Right below) Takaaki Kajita and U Tokyo Vice President Kohei Miyazono switched on the green button, and it locked. [Photos courtesy of H. Oobayashi.]



## Directions LVK-MoA and Our required actions

### LVK-MoA and its background we should understand

The signed MoA consists from three parts: the main part [JGW-M1910663], Attachment A [JGW-M1910664], and Letter of Intent (LoI) for KAGRA to join the O3 run [JGW-M1910813].

The main part (10 pages) describes the concept of the collaboration, the definitions of terms, and the explanations of purposes. The Attachment A (17 pages) rules how we organize the collaboration with more detailed procedures. These two are completely equivalent with the MoA between LIGO and Virgo (LV) which was signed up in March 2020. During the round table discussion between LV and K at the LV collaboration meeting in Warsaw in September, we actually heard an opinion that integrating KAGRA as an equal-level partner is a little bit early. It is true that KAGRA is just newly constructed detector, and the KAGRA members do not have any experience of the real observation and real data analysis of detections. However, LV welcomed us and proceeded to form the collaboration together for promoting science. We therefore have an obligation to meet expectations. That is, we have to catch up with their detectors' sensitivity as soon as possible, and we have to participate and lead the science discussions as much as possible. KAGRA members are expected to join the weekly telecons, participate in LVK meetings, contribute as paper-writing teams, and plan our future together.

The third part LoI (3 pages) is of the conditions to KAGRA for participating current ongoing Observation-3 run. In order to declare the joint LVK observation, we have to pass the checklist of the data flows, and to pass the minimum sensitivity at a certain level. Once approved, then we can co-author to the observational results. Until KAGRA produces the data, the authorship to joint observation papers will be in the pending status and the same rule as LV members will be applied; that is, the authorship will be approved after one year contribution from the sign-up date (in our case, October 1, 2020). We regarded that these are reasonable requirements, and started LVK network of gravitational wave science.

Some statistics of the LVK collaboration are shown below:



### Our required actions to LVK-MoA

After signed the MoA, KAGRA should observe the LVK policies. Among then, here we comment the following issues.

First of all, all the results and discussions in the collaboration are confidential until information is disclosed. From November, for example, "Observational Science Highlight" is circulated by email<sup>1</sup>, which includes

<sup>1</sup> <https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=10997>

confidential ongoing analysis. Do not leak. Do not comment in a meeting, do not talk to a non-collaborator, do not tweet. This rule is also applied when you deal with data.

In the Attachment A, the concept of “**Observational Result**” forms the central idea of publication and presentation. “Observational Result” is defined as *any first statement of an astrophysical, cosmological, or fundamental physics nature derived from LIGO, GEO, VIRGO, or KAGRA gravitational wave data*. Regarding such “Observational Result”, LVK policy prioritizes our own publication policy. (At the coming face-to-face meeting at RESCEU in December, we plan to amend our publication policy as such.)

We signed MoA in October, when O3a period was over. However, since we discuss in our telecons<sup>2</sup> both O3a and O3b data simultaneously, the short author-list publication rules will also applied to us even for O3a data. That is, we need to report our progress regularly to the working group telecons, and get the approval of LVK collaboration before submitting short author-list paper if we use results in public domain.

We also assign dozen persons to LVK joint committees. Many of us should participate LVK collaboration meeting (twice a year) from the next one. We will host LVK collaboration meeting at somewhere in near future...

Please understand that we are in the transient phase, and let’s make it together. [Hisaaki Shinkai](#) 🍏

## Collaboration **New KSC board started**

At the face-to-face meeting in Toyama, August, the ballots of the new **KSC board** was opened, and five

### **KSC board** from August 2019 to August 2020.

Hisaaki Shinkai (OIT, chair)  
Shinji Miyoki (ICRR, vice chair)  
Chunglee Kim (Ewha Womans U, vice-vice chair)  
Hideyuki Tagoshi (ICRR)  
Tomotada Akutsu (NAOJ)

Zhoujian Cao (BNU, China region)  
Hyung-Won Lee (Inje U, Korea region)  
Ray-Kuang Lee (NTHU, Taiwan region)  
Hiroataka Yuzurihara (ICRR, post-doc)  
Tomohiro Yamada (ICRR, student)

members were decided. Among them, **Hisaaki Shinkai** accepted to take the chair, **Shinji Miyoki** works as vice chair, and **Chunglee Kim** as vice-vice chair. Including regional representatives, post-doc & student representatives, ten members started the new KSC board.

KSC board assigned the new **committee of publication control (CPC)**, which is now belong to KSC, and **Norikatsu Mio** takes the chair for the next year. A couple of rules are determined: Term of CPC committee is two years, and half members will be changed every August.

From October, new **author-list committee** is assigned. **Kentaro Somiya** accepted to work as the chair for the next year. In October, according to the LVK-MoA, KSC board assigned **LVK joint committee members** as KAGRA co-chairs. Please refer the KSC organization chart in the next page. This chart is maintained in our wiki.<sup>3</sup>

The KSC board recently has tried to improve the accessibility of wiki pages.<sup>4</sup> Our wiki now has FAQ (Frequently Asked Questions) page<sup>5</sup>, Your Action Required page<sup>6</sup>, O3a/O3b information page<sup>7</sup>, etc. If you are interested in blushing up the design of them, you are really welcome.

<sup>2</sup> I guess many of you began attending weekly telecons with LV on each particular research subjects.

<sup>3</sup> <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/KSC#Organization>

<sup>4</sup> <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/>

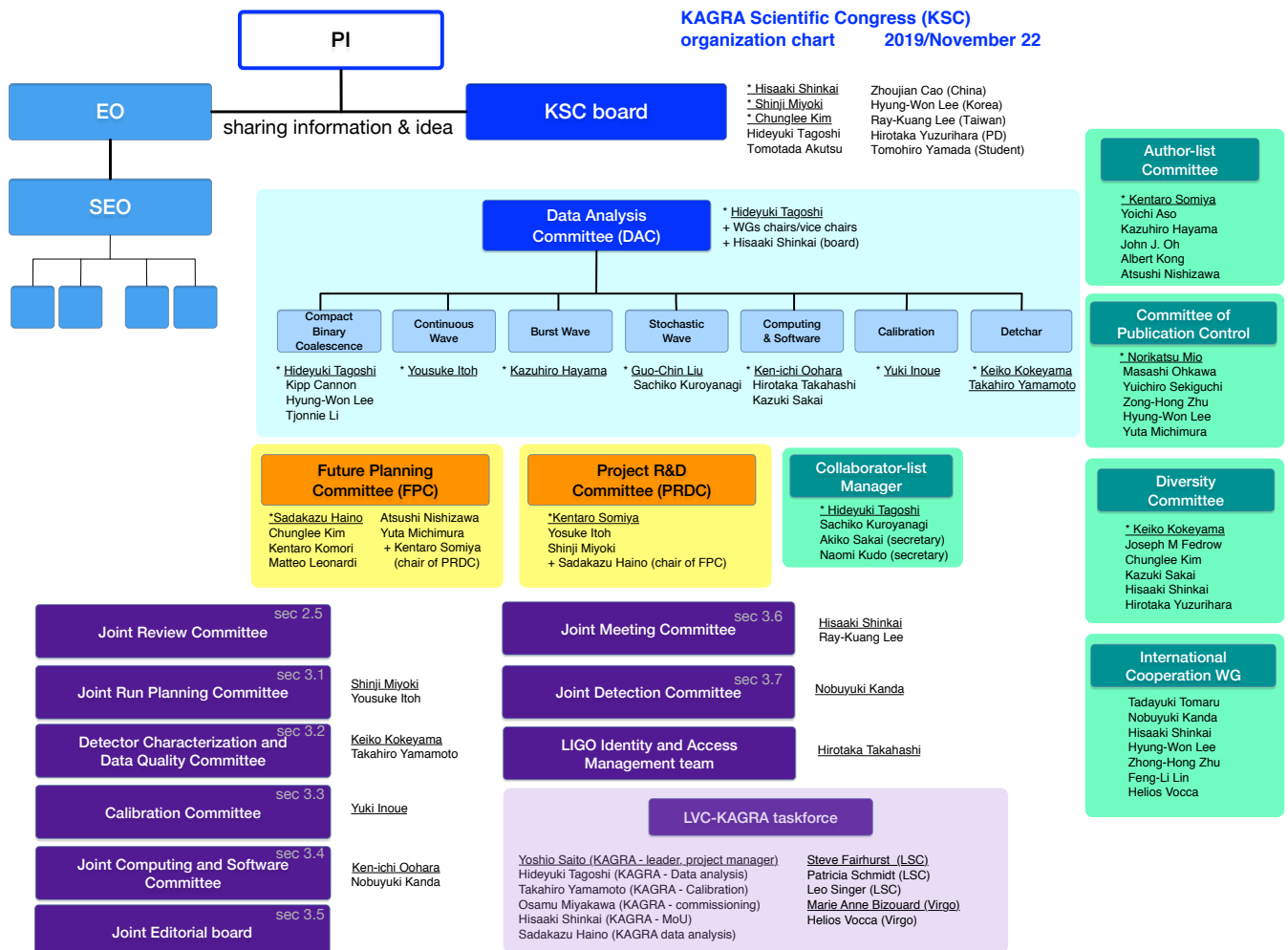
<sup>5</sup> <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/KSC/FAQ>

<sup>6</sup> <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/KSC/YourActionRequired>

<sup>7</sup> <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/KSC/O3b>



## KSC organization chart (as of November 2019)



### Collaboration

## New EO members, SEO set Run Coordinator

Related to the organization, we also introduce the new executive office (EO), and the system engineering office (SEO). From August 2019, EO invited three regional representatives and data analysis committee chair as members. The committee members are: Takaaki Kajita (chair, ICRR), Masaki Ando (UT), Masatake Ohashi (ICRR), Yoshio Saito (ICRR), Nobuyuki Kanda (OCU), Takayuki Tomaru (NAOJ), Yoshiki Moriwaki (U. Toyama), Hisaaki Shinkai (OIT, KSC chair), Helios Vocca (Perugia, Italy), Jaewan Kim (Myongji Univ. Korea), Zong-Hong Zhu (Beijing Normal Univ., China), Sadakazu Haino (Academia Sinica, Taiwan), and Hideyuki Tagoshi (DAC chair, ICRR).

SEO newly assigned the Run Coordinator who coordinates tasks of both the detector and data analysis before and during the ERs and O3. The list of SEO is as follows:

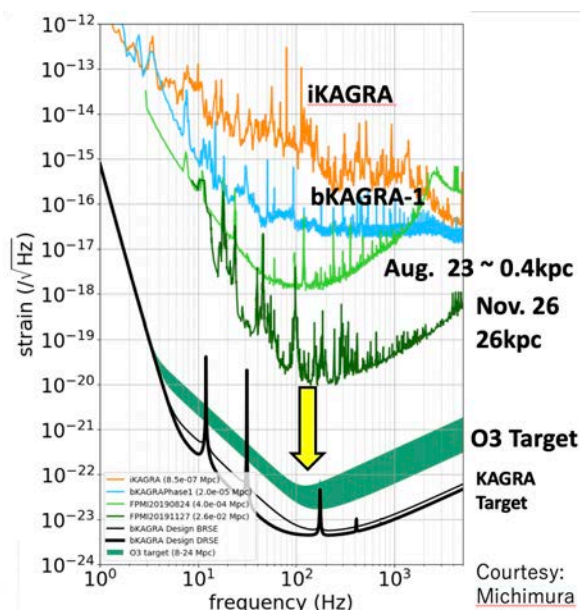
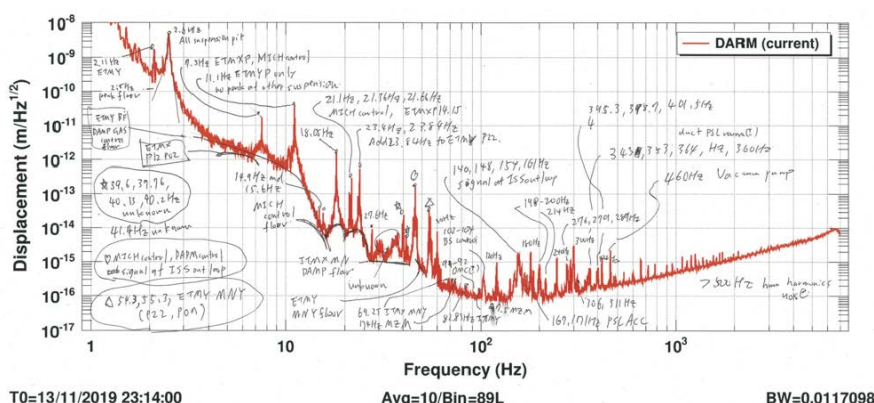
<u>Yoshio Saito</u>	Project manager
<u>Masatake Ohashi</u>	Director, also as Deputy Project Manager
<u>Shinji Miyoki</u>	Run coordinator
<u>Osamu Miyakawa</u>	Commissioning team leader
<u>Takashi Uchiyama</u>	Scheduler
<u>Yoichi Aso</u>	management of VIS/MIF/AOS
<u>Toshikazu Suzuki</u>	management of CRYO tasks
<u>Masaki Ando</u>	design of roadmap
<u>Kentaro Somiya</u>	auditing of budget/schedule

The KSC organization chart is maintained at [\[KSC wiki\]](#), while the organization chart of KAGRA is maintained at [\[JGW-M1706715\]](#).

## Detector

## Count down for the start of joint observation

While we had the ceremony of construct completion in October, KAGRA is now rushing to start observation. Since we announced that we will start observation by the end of 2019, and we also announced that our target in O3 is over 10 Mpc in binary neutron-star range, four orders of sensitivity improvement from that of the first locking in August is necessary. Detector teams are seriously working together in commissioning and noise-huntings. The latest klog shows that the sensitivity curve is gradually improved. We see regularly the locking status more than a couple of hours. Three-more digits. Do not worry. We will try 24-hour engineering run for 7 days from December 17. After noise huntings, we hope that the real observation starts soon.



(Above) Comparison of sensitivity curves.

Courtesy: Yuta Michimura.

(Left) Noise hunting memo. Courtesy: Takaaki Yokozawa & PEM team.

Both are from Yousuke Itoh's viewgraph in JGRG29, November.

## Operator shift &amp; Collaborator shift from December 17

Once our observation starts, then all collaborators are supposed to cooperate as shift takers, either as an operator shift (who is responsible for operation of the detector) or a collaborator shift (who is not). The tasks of the latter is to monitor the system, to log the status, and to make emergency call if something happens (maybe more other tasks).

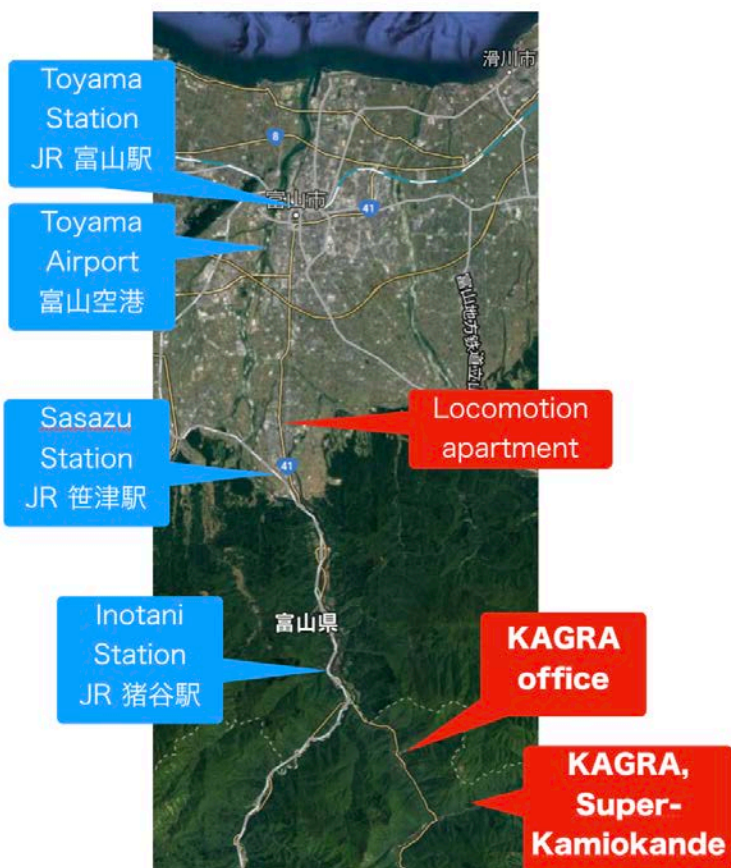
Region	Shift Candidate	Assigned Weeks	Contact Person
Japan	142	82	Osamu Miyakawa
Taiwan	27	16	Guo-Chin Liu
China	26	16	Zong-Hong Zhu
Korea	21	12	Hyung-Won Lee
Italy	11	6	Helios Vocca
Hong Kong	3	2	Tjonnie Li
USA	1	1	Lan Nguyen Quynh

As is shown in [\[JGW-M1809380\]](#), all shifts are formulated with 3 times a day, pairing two for each, 7 days period starting every Tuesday. Detector team is now calling to fill in [the calendar](#) with first-come base. When we called shift candidates in April, more than 260 names were collected. However, since the period is set to 7 days, some of you will miss this chance. For more details, please contact to [kagra-shift@icrr.u-tokyo.ac.jp](mailto:kagra-shift@icrr.u-tokyo.ac.jp) or the person in the table.



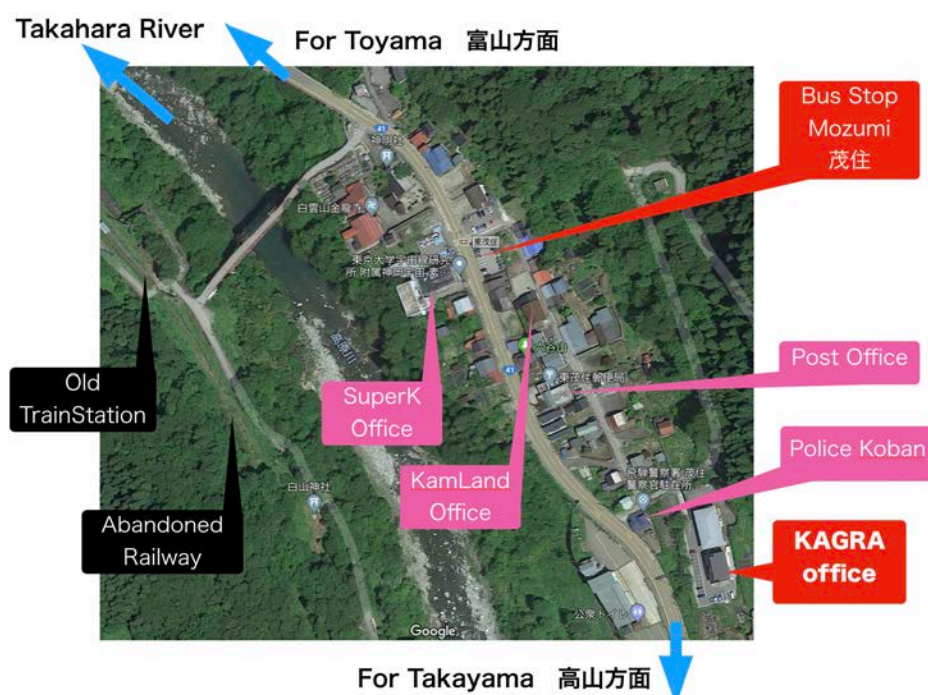
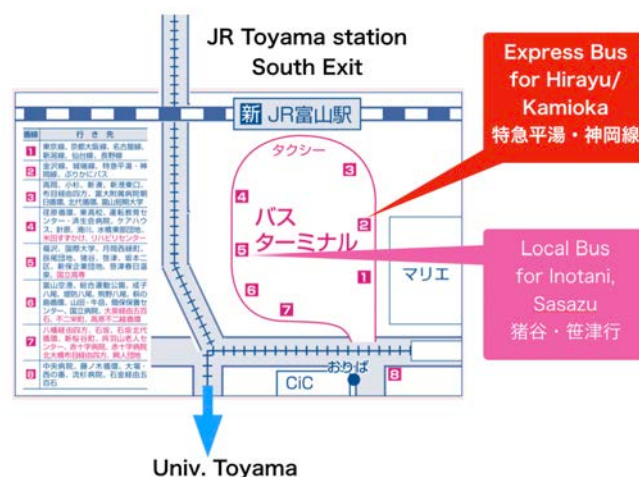
## Welcome Brief Guide to Mozumi, KAGRA office

For those who are beginners of the KAGRA site (especially for shift participants), the wiki page information<sup>8</sup> and shift guide [\[JGW-M1809380\]](http://jgw-m1809380) is useful. This article tries to help complementary to such official guide. When I first visit the site, I remember it was full of unknowns.



First of all, KAGRA office is located in Higashi-Mozumi village, 38.5 km south from JR Toyama station, one-hour driving distance. No shops around nearby. Preparing your own food and drinks is necessary. If snow, then it'll be one-meter depth easily. So prepare your snow shoes.

The best way to the KAGRA office is to use Express Bus for Hirayu-Onsen (Spa) from Toyama station at BusStop 2. You can buy a bus ticket at the office, saying "For Mozumi by express bus", 1390 JPY, or post-pay by cash in the bus. Bus takes you 64 minutes to Mozumi.



The express bus runs only a couple of times a day. So you should check out the time table in advance.

Left map is a local one from the bus stop of Mozumi to the KAGRA office. It's 5 minute distance. Nothing there, you won't miss it. You can meet with wild bear 🐻 by luck.

Another side of the river, you will find abandoned railway. Kamioka line was operated between JR Inotani and Okuhida-Onsenguchi (20km) until December 2006.

<sup>8</sup> <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA#access>

Site people call the accommodation “Locomotion”. It’s the name of the apartment, 20 minutes driving distance heading back to Toyama from Mozumi. KAGRA rents a couple of rooms, and we use each room by sharing with a couple of us. You need to bring your toothbrush, toothpaste, shampoo, towel, .... You can cook at the kitchen. Coin laundry is at the parking. In walking distance, there are a couple of restaurants, supermarket, and a Seven-Eleven store. Takayuki Tomaru recommended Yakitori restaurant, Akiyoshi 秋吉, which is at the next to the *Locomotion*. It is good with reasonable price. Five-minute walk to south, you will find a good sushi restaurant, Ban-ya-no-sushi 番やのすし. Five-minute walk to north (for Toyama station), McDonald is open until midnight.

The Locomotion is in front of the bus stop, Kami-Futasugi 上二杉. Only local bus (runs every 30 minutes) stops.

The way to Mozumi (KAGRA office) from Kami-Futasugi is a little bit tricky. You need to transfer the bus at Sasazu (or Inotani), from the local bus to the express bus. No local people around at the bus stop. Only us.

The right figure is from the official guide [\[JGW-M1809380\]](#). Consult this document with bus time table. Good luck to your arrival.

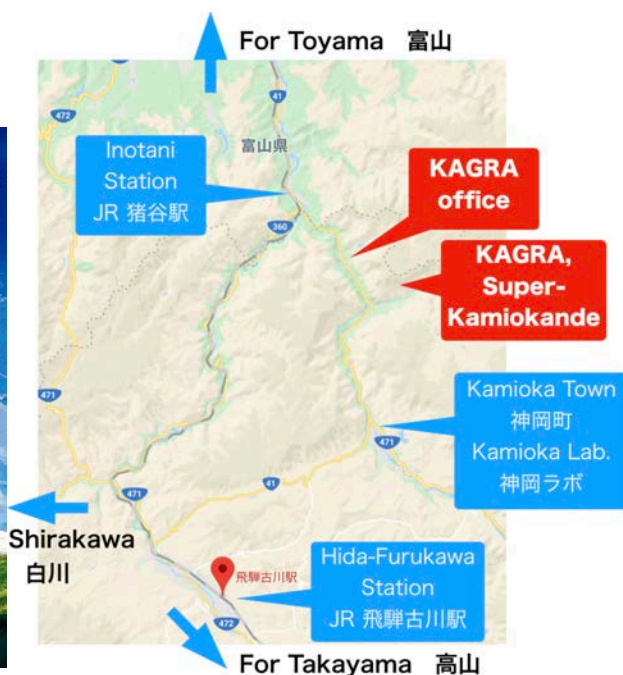
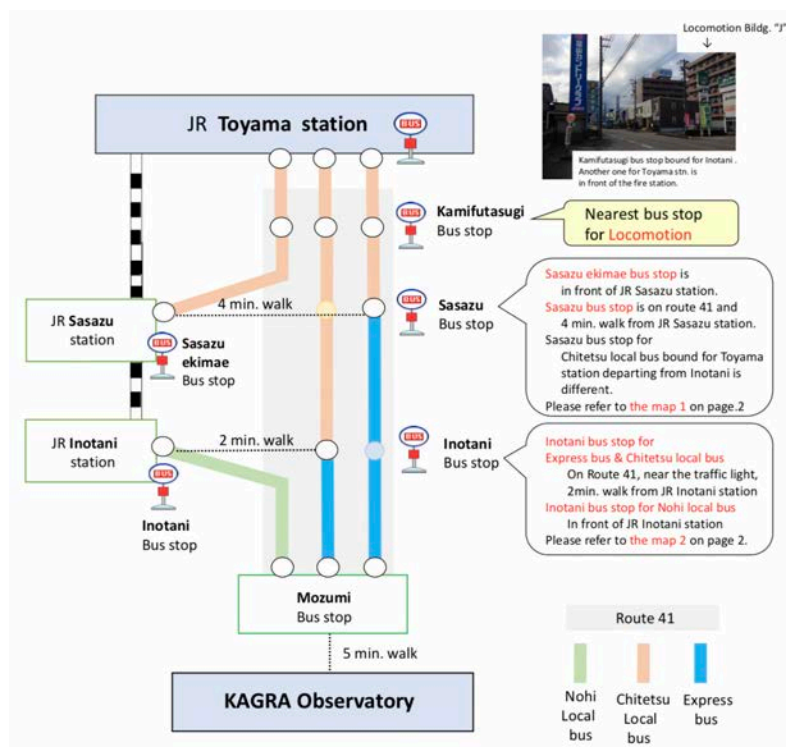
In summer time, you can access easily to the Japan North Alps. Toyama station is the starting point of the Kurobe-Tateyama Alpine Route. With train, cable car, and bus, you can reach Murodo 室堂 (2450m), the entrance to Mt. Tateyama 立山 (3015m). With further trolley

bus, ropeway, and cable car, you will arrive at Kurobe Dam, one of the biggest dam in Japan, completed in 1963.

By 20 minutes drive to south from Mozumi, at Kamioka Lab in the Kamioka road station, you can purchase a jigsaw puzzle of Super-Kamiokande.

Hida-Furukawa town is famous for a couple of real-life locations of the movie, “Your Name”.

Enjoy your stay. 🍏





## Public Relations

## Mass of media propagate KAGRA's completion

KAGRA's completion ceremony and MoA signing ceremony on October 4th, 2019 were opened to mass media. In addition, KAGRA's experimental hall and arm tunnel were previewed by media on September 30th and media briefing was held between the completion and signing ceremonies. The news that KAGRA is completed and joins world's network attracted reporters' attention and all the events were attended by more than 40 media people. These media events resulted a lot of news articles spanning from local newspapers to Japan-wide networks. Now, KAGRA's completion is really well-known to the people and a lot of science supporters are awaiting its observation start!



## Café KAGRA returns

Following the last year's event (see KSC Newsletter #3), Café KAGRA returned on October 5th at Kamioka library in Kamioka downtown. This time, while the café master was switched to Mr. Yuichi Takayanagi, the director of Tamarokuto Science Museum, he moderated relaxing conversations among the guests. Since all the guests were the members of KAGRA's naming committee, naturally the topic turned into about the name of KAGRA. Takayanagi said "The name 'KAGRA' is lovely. We can easily understand it is an instrument in Kamioka and it observes gravitational waves. Moreover, the name KAGRA contrasts with other telescopes end with IGO." The audience enjoyed a fantastic hour of an autumn day in Kamioka.



## Science Café in Gifu City

Gifu Shimbun newspaper company holds a series of Science Café in the headquarters of the company. On November 9th, Dr. Takafumi Ushiba, ICRR's project assistant professor gave a talk entitled "Gravitational Wave Telescope KAGRA starts observation - a new challenge from Kamioka -" in the science café. The audience, spans from junior high-school students to senior science fans, listened to the talk with deep interest. After the talk, a lot of questions including highly technical ones were asked from the audience. The Q&A session continued until the closing time of the building.

Yoshihisa Obayashi 🍏



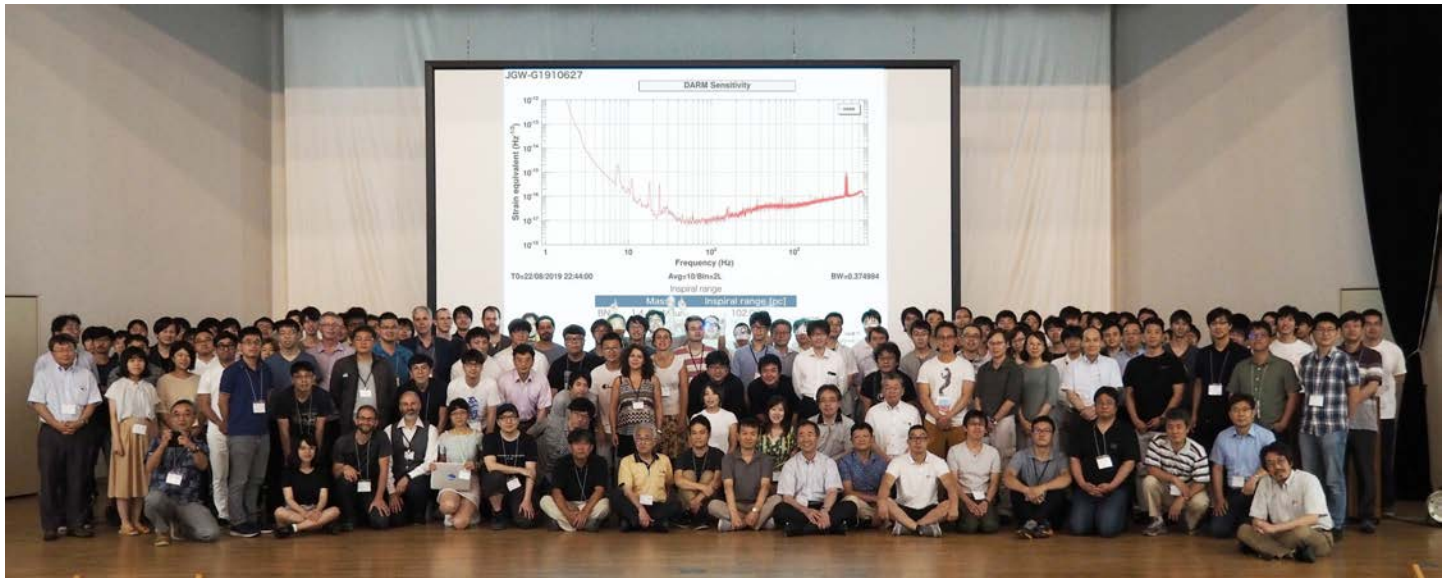


## Previous F2F **Face-to-Face 23 at Univ. Toyama, August 22-24**

Program: <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/LCGT/Meeting/f2f/2019August>

We had a regular summer event at Toyama. The number of the participants was the largest ever, 140 collaborators. On the second day of F2F, the first lock of the detector was reported, and the group photo was taken (below) with that sensitivity curve. Four digits more, but everyone looks sooo happy.

New KSC board members were selected, and the draft of MoA with LIGO/Virgo was approved to go negotiation. Satellite meeting on future upgrade plan was held, where the chair Sadakazu Haino showed the draft of the white paper as a result of future planning committee. Before and after the F2F, thirty colleagues (with one mother of a colleague) visited the KAGRA site. We enjoyed free dinner at the U Toyama cafeteria, with the support of Toyama City. We thank LOC, Moriwaki-san, Yamamoto-san and group of U Toyama, and also especially to Takayama-san for hosting the meeting. 🍏



## Next F2F

## **Face-to-Face 24 at RESCEU, December 4-5**

Program: <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/LCGT/Meeting/f2f/2019Dec>

The group of Research center of the Early Universe (RESCEU) Univ Tokyo kindly hosts our next F2F. The December meeting is for two days, and we expect many thesis presentations. We have received registrations of 111 colleagues. This would be the final meeting before the real operation. We will discuss a couple of our policy revisions, shift systems, and so on. 🍏

## KAGRA MEETING SCHEDULE

Mark your calendar now for the following meetings.

**The 24th KAGRA Face-to-Face meeting** at U. Tokyo, RESCEU, **December 4-5, 2019.**

**LIGO-Virgo-KAGRA collaboration meeting** at Lake Geneva, Wisconsin, USA, **March 16-19, 2020.**

**The 25th KAGRA Face-to-Face meeting** at ICRR U. Tokyo, **April (16-18 or 23-25), 2020.**

**The 7th KAGRA International Workshop**, at National Central U., Taoyuan, Taiwan, **May 29-31, 2020**

## OTHER RELATED GW MEETINGS

Check out <http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/KSC/O3b#MeetingInfo> for KAGRA related one or more generally <https://wiki.ligo.org/LSC/UpcomingConferencesAndMeetings> (Please check them before you plan to organize a meeting, in order to avoid schedule conflict.)

## Report

**Probing Our Universe with Quantum Technologies**

Yuta Michimura



This year's Quantum Electronics workshop was held at Yamanaka Ryo Naito Seminar House, University of Tokyo. Quantum Electronics workshop is an annual workshop organized by the Quantum Electronics Group, which is one of the Professional Groups of the Japan Society of Applied Physics. The theme of this year's workshop was pretty peculiar: *Astro-quantum electronics*. Recent advancement of quantum electronics have enabled very precise measurements in a variety of ways, and there's increasing interest to use them for observing our universe. A quick example is of course laser interferometric gravitational wave detection, and I gave a talk on the current status and quantum technologies to enhance the detector sensitivity. We also invited speakers from variety of fields: cosmology, radio to gamma-ray astronomy, neutrino, dark matter, optical lattice clocks and so on. The speakers focused more on the technologies rather than their science goals, and I enjoyed the workshop very much. I realized again that science is based on technology and there's a plenty of room for collaboration with researchers in applied physics.

For details, visit 応用物理学会 量子エレクトロニクス研究会「宇宙量子エレクトロニクス」  
<https://annex.jsap.or.jp/qe/astro2019.html> (only in Japanese...).

## Report

**Six topics in the Frontiers of Science symposium**

Ayaka Shoda



Frontiers of Science Symposium, which is organized by JSPS, is the symposium to discuss about the advanced topics over six different subject fields. I attended the UK-Japan FoS that is carried out in cooperation with Royal Society in the UK. It was very impressive to know about the state-of-art science. I realized the sci-fi world was coming. Also it was a good opportunity to know researchers in other fields.

Followings are the topics we have discussed about.

- Earth science: Anthropocene (Effects of human on the earth environment)
- Physics/Astronomy: Black holes (GWs and black hole image by EHT)
- Biology: Synthetic Biology (Creating artificial cells that can create protein or re-produce themselves)
- Medical science: Computational brain modeling and brain-computer interfaces (Understanding of the brain functions and combination of the brain and computer.)
- Chemistry: Smart materials (Self-healing materials, such as concrete and ceramics)
- Mathematics: Signal from Noise (Some technics for better understanding of the data, such as one using 3D projection)

Frontiers of Science Symposium by JSPS <https://www.jsps.go.jp/english/e-fos/index.html>

**WE FOUND THAT ...**

English version of KAGRA's introduction movie is online!  
 Thank you international KAGRA fans for waiting. Enjoy!

<https://gwcenter.icrr.u-tokyo.ac.jp/en/archives/1365>





## Poster Award Winners

**"Most Outstanding Presentation Prize" at the F2F Toyama 2019**

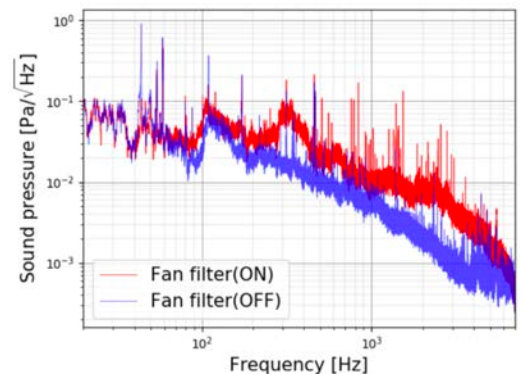
At the 23rd face-to-face meeting Toyama August 2019, we awarded Kiichi Kaihotsu, Yukino Mori (U. Toyama) and Naoki Aritomi (ICRR) for their poster presentations. Two received a certification signed by Kajita-san. H.Shinkai donated his new book draft as the winner's prize.) Here are the abstracts of the winner's works.

**Yukino Mori & Kiichi Kaihotsu (U. Toyama)****New noise search method by portable PEMs**

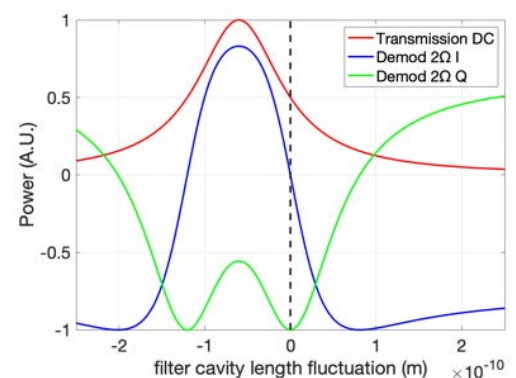
We introduced the new portable PEMs (Physical Environmental Monitors) which are the combination of the Chromebook and USB sensors (microphone, accelerometer, magnetometer, etc). Portable PEMs are useful tools for investigating and hunting the environmental noises. They have several features; we can measure the environmental noises very easily and with any limitation, such as AC electric outlet, cabling, placement and so on. Also, they are light enough to carry in and out, and these useful softwares of the spectrogram were produced by the google app.

One example outcome of the noise hunting using this tool is the 300Hz acoustic noise which was found in the center area of the KAGRA. We could identify the origin of the 300Hz acoustic

noise (See left photo); it turned out to be the fan filter unit (FFU) placed in the PR2 clean booth entrance. When we turned off the FFU, the 300Hz noise was decreased (See right figure). If you found a mysterious noise and felt "The signal never disappears!" or "I don't know from where the noise comes!", you may find the origin of such environmental noise by this portable PEMs!. 🍏

**Naoki Aritomi (U. Tokyo)****Control of a Filter Cavity with Coherent Control Sidebands**

The use of a detuned filter cavity together with a frequency independent squeezed light source is a very mature technique for the production of frequency dependent squeezed state. For accurate alignment and length control of the filter cavity, we suggest a new control scheme of the filter cavity with coherent control sidebands which are used to control squeezing angle. Since both coherent control sidebands and squeezed vacuum are aligned to OPO, squeezed vacuum is automatically aligned to the filter cavity with this scheme. We calculated the error signal of the filter cavity with this scheme (figure) and showed that shot noise and PLL noise with this scheme meet the requirement of residual RMS filter cavity length fluctuation. This scheme will be tested with 300 m filter cavity in TAMA. 🍏



Awarded

## Poster Prize at TAUP2019 for Tomohiro Yamada

Tomohiro Yamada (D2 student, ICRR) was awarded Poster Prize at the international conference Topics in Astroparticle and Underground Physics (TAUP2019) at Toyama, September 9-13, 2019. The poster title was "KAGRA Cryogenic Suspension Control toward the Observation Run 3". Congratulations!

Tomohiro sent his contents to the editors:

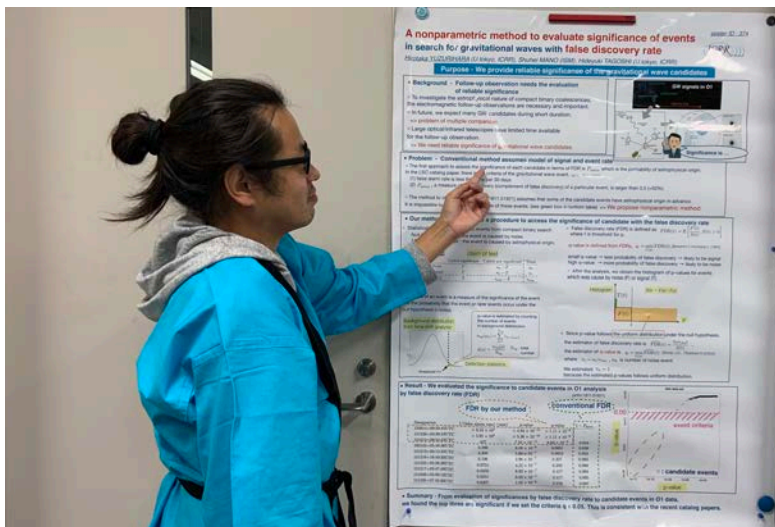
Cryogenic mirror is one of the most advanced technique in KAGRA, and will be adopted in future gravitational wave detectors: Einstein Telescope and Cosmic Explorer. Practically, however, cryogenic environment has some difficulties: 1) material property is changed at low temperature, so we needed to develop a cryogenic compatible suspension, 2) in order to cool down the mirror to 20 K, we need to connect heat links to the suspension, which is already isolated from seismic vibration by room temperature part of Type-A suspension. In this poster, for above two issues, we showed some significant progresses and considerations: 1) we implemented damping filters for the cryogenic suspension, and residual RMS angler fluctuation of the suspension satisfied the requirement for lock-acquisition phase, 2) according to our estimation with practically measured data, vibration via heat links perhaps impairs the sensitivity in several dozen Hertz, therefore, we developed a vibration isolation system for heat links to meet stringent displacement noise requirement. For the next step, towards O3, we need to measure and calculate suspension control noise, furthermore, longitudinal DOF damping control should be considered carefully. We are currently working on the suspension noise-budget to achieve better detector sensitivity in low frequency region. 🍏



Awarded

## Poster Prize at GWWPAW2019 for Hirotaka Yuzurihara

Dr. Hirotaka Yuzurihara (posdoc, ICRR) received a poster award at the international conference Gravitational Wave Physics and Astronomy Workshop (GWWPAW2019) which was held at RESCEU Univ. Tokyo, October 14-17, 2019. Congratulations!



Hirotaka presented a poster, "A nonparametric method to assess significance in search for compact binary coalescences with false discovery rate", which proposes a new method to evaluate the significance of the gravitational wave event with false discovery rate. He demonstrated the proposed method to the results of the analysis the first observing run (O1) data of advanced LIGO. Please see the paper arXiv:1907.00379 for more detail.

(photo) Dr. Yuzurihara with the poster and the Happi as extra prize (Happi is the costume of the Japanese festival). 🍏



## Elected

## Jun'ichi Yokoyama was elected to the president of AAPPS

Jun'ichi Yokoyama, a professor of RESCEU (Research Center of the Early Universe) University of Tokyo, and who is hosting December face-to-face meeting, has been elected as the president of AAPPS, Association of Asia Pacific Physical Societies (<http://www.aapps.org/>), at the council meeting held during APPC14. His term starts from January 2020 for three years.

AAPPS conducts cooperative activities with other major physical societies in the world, such as the Asia Europe Physics Summit (ASEPS) which is a joint meeting between AAPPS and European Physical Society (EPS).

At the IBR meeting held in Toyama in August, he suggested to organize a joint session between KAGRA and Virgo at the forthcoming ASEPS, which received favorable attention. 🍏



## Diversity

## Keiko Kokeyama in Malaysia



Photo courtesy of Jun'ichi Yokoyama

Keiko Kokeyama (ICRR) presented a talk on Demographics of KAGRA collaboration at a Women-in-Physics session of the 14th Asia Pacific Physics Conference (APPC14) November, separately with the status talk of KAGRA. This conference was held at Borneo Convention Centre in Kuching, Borneo island, Malaysia. Remarkably, 65% of physics undergraduate students in Malaysia is female. 🍏

## RECENT KAGRA STATUS TALKS SEE [\[JGW-E1605649\]](#) FOR THE LIST.

meeting/conferences		speaker	JGWdoc
LV collaboration meeting, Warsaw, Poland	Sep. 2019	Hisaaki Shinkai	<a href="#">[JGW-G1910677]</a>
TAUP 2019, Toyama, Japan	Sep. 2019	Masatake Ohashi	<a href="#">[JGW-G1910791]</a>
JPS meeting, Yamagata, Japan	Sep. 2019	Shinji Miyoki	<a href="#">[JGW-G1910803]</a>
LIGO PAC	Oct. 2019	Yoichi Aso	<a href="#">[JGW-G1910885]</a>
GWPAW 2019, Tokyo, Japan	Oct. 2019	Shinji Miyoki	<a href="#">[JGW-G1910884]</a>
GWPAW 2019, Tokyo, Japan	Oct. 2019	Takaaki Kajita	<a href="#">[JGW-G1910902]</a>
4M COCOS, Fukuoka, Japan	Oct. 2019	Yuta Michimura	<a href="#">[JGW-G1910888]</a>
AACP 2019, Malaysia	Nov. 2019	Keiko Kokeyama	<a href="#">[JGW-G1910947]</a>
JGRG 29, Kobe, Japan	Nov. 2019	Yousuke Itoh	<a href="#">[JGW-G1911017]</a>

Awarded

## Student Presentation Award of the PSJ, September

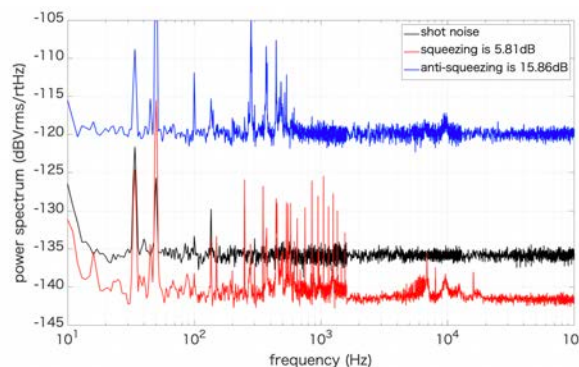
Two KAGRA young colleagues were awarded independently the Student Presentation Award of the Physical Society of Japan in the annual meeting 2019 September.

[https://www.jps.or.jp/activities/awards/gakusei/2019\\_student\\_presentation\\_award.php](https://www.jps.or.jp/activities/awards/gakusei/2019_student_presentation_award.php)

### Development of Frequency Dependent Squeezing for Gravitational Wave Detectors (2)

Naoki Aritomi (U. Tokyo)

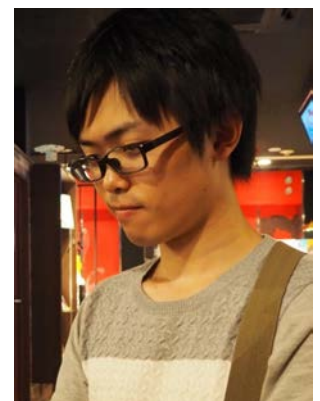
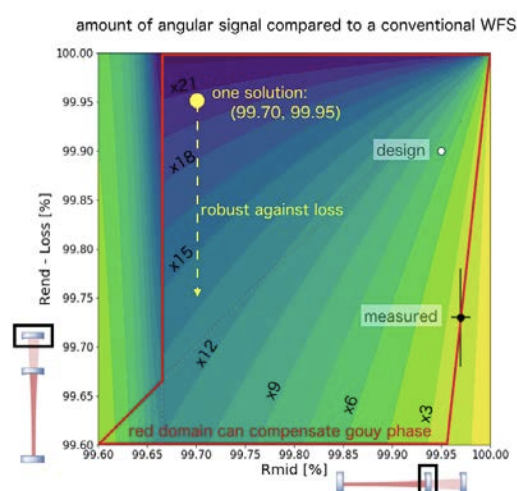
Sensitivity of future gravitational wave detectors will be limited by quantum noise. Especially, the sensitivity will be limited by shot noise at high frequency and by radiation pressure noise at low frequency. To reduce shot noise and radiation pressure noise at the same time, it's necessary to inject frequency dependent squeezed vacuum to an interferometer. The squeezed quadrature rotates by 90 degree around 70 Hz which is the bandwidth of gravitational wave detectors. To realize it, we plan to inject 9 dB frequency independent squeezed vacuum to a 300 m long cavity which is one of TAMA's arms. We succeeded in controlling squeezing angle and achieved 6 dB of squeezing above 20Hz. 🍏



### Development of Phase-III TOBA (Torsion Bar Antenna) for Gravitational Wave Observation (18) : Development of a highly sensitive angular sensor

Yuki Miyazaki (U. Tokyo)

TOBA (Torsion Bar Antenna) is a gravity gradiometer, one of whose aim is to observe newtonian noise. In order that the sensitivity is limited by shot noise above 0.1 Hz, TOBA requires a highly sensitive angular sensor, "Gouy-phase-compensating wave front sensor." It is similar to a conventional wave front sensor but uses coupled two cavities, called main and auxiliary cavity. The auxiliary cavity compensates gouy-phase in the main cavity so that TEM00 and TEM10 can be resonated simultaneously and angular signal is amplified. We found that loss in the auxiliary cavity disturbs the amplification, and designed feasible parameters which will bring enough amplification of angular signal. 🍏





## Science

## Proposals of KAGRA as a dark matter detector

In order to explain rotation curves of galaxy, collision of galaxy clusters, and consistency of cosmic microwave background (CMB) observation, existence of dark matter is a consistent, simplest and plausible idea. However, the problem is, we have never caught them. The current candidates of dark matter are weakly interacting massive particles (WIMPs), primordial black holes (PBHs), and axions (hypothetical particle to resolve CP problem). Many direct/indirect searches have been tried, but we could have only got the prohibit region in its mass range.

真貝 寿明  
2016年9月26日 · 写真  
先週物理学会会場で衝撃を与えた話題になったダークマターが、勤務先でも100円で売られていた。  
"Dark Matter" is now available everywhere in Japan.



いいね! コメントする シェアする

"Dark Matter", a sort of massive chocolate (MACHO) was once sold in Japan, but it's hard to observe it now.

Recently, two groups in the KAGRA collaborators independently proposed a way to find dark matter using interferometric GW detectors. Nagano et al [1] take a model of axion, which makes modulation of phase velocity for the circular polarized photon. They propose to use the arm cavities of interferometric GW detectors to monitor the polarization. These Fabry-Perot cavities can be a detector for axion-like dark matters without any degradation of the sensitivity to GW observation.

Tsuchida et al [2] take a model of WIMPs, and showed how much the motions of a pendulum and mirror in a GW detector will become excited due to the collisions of WIMPs to the mirrors. They discuss how such motions are detectable with sensors of GW interferometers.

Both ideas conclude that we will obtain more strict allowed regions ever in dark matter mass.

[1] K. Nagano, T. Fujita, Y. Michimura, & I. Obata, Phys. Rev. Lett. 123 (2019) 111301. (arXiv:1903.02017)

*Axion Dark Matter Search with Interferometric Gravitational Wave Detectors*

[2] S. Tsuchida, N. Kanda, Y. Itoh, & M. Mori, arXiv: 1909.00654

*Dark Matter Signals on a Laser Interferometer*

## FOR LATEX LOVERS

KAGRA subscribes an online LaTeX editor, **Overleaf** (SharedLaTeX), with Professional level.

<https://www.overleaf.com/>

Personal use of Overleaf is free of charge, so please open your account (email address) by yourself.

This subscription enables us to edit, share and compile tex files online.

If you plan to use Overleaf for your projects, please contact to [kagra-overleaf\\_at\\_icrr.u-tokyo.ac.jp](mailto:kagra-overleaf_at_icrr.u-tokyo.ac.jp)

The manager will create a project and you can share files with your colleagues.

You need to inform the following data for creating a project

-- >>>

Project Name: xxxxx (e.g. TestGR\_Ringdown2019 )

purpose: (brief description, one line)

target journal: xxxx (CQG, PRD, PTEP ) -> default author-list tex will be provided upon request

editors: Name (email address), Name (email address), Name (email address), ....

-- <<<

Please note that editors of each project can be added only by the managers. If a project is opened by above request and your email is registered as an editor, then you can access to the related projects with your account. (So that if you are already an Overleaf user, then you can continue to use your account.)

Please understand that this announcement is for preparing articles between us.

## Newly Joined

**Masafumi Kurachi, research administrator of ICRR Kamioka**

Hello everyone, I am Masafumi Kurachi, a newly hired research administrator working for Kamioka experimental site. You might wonder what the "research administrator" is. My understanding is that it is a person who plays the role of bridging researchers and the administration.

As you might know, ICRR had been designated as one of Joint Usage/Research Centers under the MEXT program, and it was recently promoted to the INTERNATIONAL Joint Usage/Research Center. For the purpose of making this international project successful, ICRR decided to hire two research administrators, one at Kashiwa campus and the other at Kamioka area. I myself was a researcher at that time, but was starting to think about what kind of jobs I could take other than doing physics. When I found the job openings of this research administrator positions, I thought this might be one of very few jobs that I could make the most use of my ability and experience. So I applied for the position. Why did I choose Kamioka rather than Kashiwa? Actually, I didn't choose it. I applied for both positions to maximize the possibility of getting a job, but, in my mind, I was hoping that they would offer a position at Kashiwa so that I can commute from Tokyo, in which I was living with my wife and my daughter. Fortunately, I was invited to the interview, but at that point, I was not told which position I was a candidate for yet. Even after the interview started, I was still not sure for which position they were considering me. Then finally, in the middle of the interview, when Kajita-san asked me his first question, it became obvious. The question was, "Do you have a driver's license?" -- Soon after the interview, I got an offer of the position... at Kamioka, of course.

Now it's been about eight months since I moved to Kamioka. I am enjoying working here VERY MUCH. What makes me comfortable is that, here at Kamioka, I can feel that I am really involved in the experimental activities rather direct way. The fact that I can contribute to the KAGRA project is exciting. As a theorist, of course, I never doubted the existence of gravitational waves, however, I never expected that this "gravitational wave age" comes so early. Nowadays, I am interested in the possibility that topologically non-trivial configurations (of Higgs field, for example) played an important role for the history of the early Universe, say, at the age of the electroweak phase transition. For the study of the dynamical picture in such an early period of the Universe, the gravitational wave is the only messenger that gives us the information. I am really proud of being, in some sense, a member of the family of the world-wide network of gravitational wave observation, that has a potential to reveal the mystery of our Universe.



Masafumi Kurachi with Takaaki Kajita & Michiko Kajita

Coming back to my role for KAGRA at the practical level, I consider myself as a person who will support foreign researchers coming to KAGRA so that they can concentrate on research activities without worrying about other things. Those include variety of things, from administrative procedures to anything related to daily life in Japan. If you have any difficulty relating to coming to Japan or staying at Kamioka, I am the person who you should talk to first, especially when you don't even know who is the right person you are supposed to talk to. I will always be here at Kamioka for you. 🍏



## WE HEAR THAT ...

**Jun'ichi Yokoyama** (RESCEU) becomes the president of Association of Asia Pacific Physical Societies, January 2020. (see p13)

**Tomohiro Yamada** (ICRR) was awarded the Poster Prize at the international conference Topics in Astroparticle and Underground Physics (TAUP2019), September 2019. (see p12)

**Naoki Aritomi** (U. Tokyo) was awarded the Student Presentation Award of the Physical Society of Japan in the annual meeting 2019 September. (see p14).

**Yuki Miyazaki** (U. Tokyo) was awarded the Student Presentation Award of the Physical Society of Japan in the annual meeting 2019 September. (see p14).

**Hiroataka Yuzurihara** (ICRR) was awarded the Poster Prize at the international conference Gravitational Wave Physics and Astronomy Workshop (GWPAW2019), October 2019. (see p12)

**Mei Takeda** (Niigata U) was awarded Presentation Award Golden Prize in JGRG29, 2019 November.

**Congratulations!** If you have other news, please notice them to the editors.

## KAGRA COLLABORATION ARTICLES

An arm length stabilization system with vertex injection of auxiliary lasers: a new scheme scalable to longer-baseline gravitational wave detectors

T. Akutsu et al. (KAGRA Collaboration, author-list 2018), submitted to CQG  
[arXiv:1910.00955] <https://arxiv.org/abs/1910.00955>

## ARTICLE ON KAGRA

[Scientific American November 2019](#) >>>>



## WE FOUND THAT ...

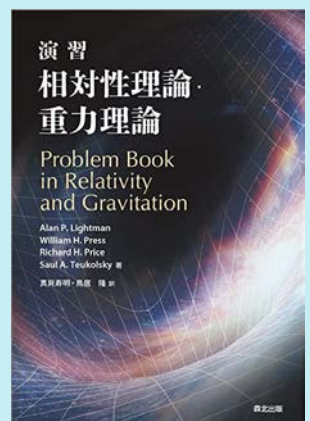
### KAGRA's photo by Enrico Sacchetti

Italy-UK based photographer Enrico Sacchetti visited KAGRA in August 2019 and created photographs. KAGRA collaborator can use these photographs in their presentation, web/printed article etc after the publishment of an article on Scientific American on Nov. 1, 2019. Please display credit "(c) Enrico Sacchetti" when you use. If you want to give any of these to a person outside the KAGRA collaboration, consult [kagra-pub@icrr.u-tokyo.ac.jp](mailto:kagra-pub@icrr.u-tokyo.ac.jp) beforehand. Checkout [\[JGW-G1910918\]](#).

**Hisaaki Shinkai** co-translated "Problem Book in Relativity and Gravitation" by A. P. Lightman, W. H. Press, R. H. Price, and S. A. Teukolsky (1975) into Japanese. The Japanese title is "Enshuu Soutaisei-riron, Jyuryoku-riron" (Morikita Pub.). Translators, Hisaaki Shinkai and Takashi Torii, changed layout of the book, and wrote appendices for recent development of the GR researches 50+ pages. Many errors were corrected, and the whole contents were LaTeXed. The price was unexpectedly high, but the publisher reduced the price from their initial plan.

<https://note.com/morikita/n/nb992df196283>

556 page, 850g. ISBN 978-4627156418, 12,000 JPY + tax.  
published Nov 29, 2019. must buy.



## New Collaborators

Korea Astronomy and Space Science Institute (KASI)

Jeong-Yeol Han (Principal Researcher)

Sungho Lee (Senior Researcher)

Yunjong Kim (Researcher)

Hyeon-Cheol Seong (Researcher)

Chang-Hee Kim (Postdoc)

Kyoto University, Yukawa Institute for Theoretical Physics (YITP)

Shinji Mukohyama (Prof.)

National Astronomical Observatory of Japan (NAOJ)

Tomoya Takiwaki (Assistant Prof.)

National Tsing Hua University

Dung-Sheng Tsai (Postdoc)

Yao-Chin Huang (Postdoc)

Bo-Han Lin (Grad. Student)

Osaka City University

Hideki Ishihara (Prof.)

Ulsan National Institute of Science and Technology (UNIST)

Seungwoo Ha (Research Assistant)

Wuhan Institute of Physics and Mathematics

(WIPM), Chinese Academy of Sciences

Yu-rong Liang (Associate Prof.)

Wei Zhao (Grad. Student)

August 1–November 30, 2019

Collaboration-list committee made their mailing address [kagraros@icrr.u-tokyo.ac.jp](mailto:kagraros@icrr.u-tokyo.ac.jp); ros from a roster.

**If your affiliation address (or email) changes:** Contact to [kagraros@icrr.u-tokyo.ac.jp](mailto:kagraros@icrr.u-tokyo.ac.jp)

**If your group has new members:** Contact to [kagraros@icrr.u-tokyo.ac.jp](mailto:kagraros@icrr.u-tokyo.ac.jp)

**If you have a nice photo:** Let the KSC Newsletter share them.

**If your neighbor is planning to join KAGRA collaboration:** Please suggest to check out our wiki FAQ  
<http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/KSC/FAQ>

## FROM EDITORS

We appreciate many contributors again for this issue.

We are always calling editorial volunteers, and we also want your posts and/or leaks of information.

We finally welcome one new editorial volunteer, Lan.

Please send your inquiries the current editorial staff.

Hisaaki Shinkai (OIT) [hisaaki.shinkai@oit.ac.jp](mailto:hisaaki.shinkai@oit.ac.jp)

Ayaka Shoda (NAOJ) [ayaka.shoda@nao.ac.jp](mailto:ayaka.shoda@nao.ac.jp)

Yoshihisa Obayashi (ICRR) [ooba@icrr.u-tokyo.ac.jp](mailto:ooba@icrr.u-tokyo.ac.jp)

Kentaro Komori (MIT) [kentarok\\_at\\_mit.edu](mailto:kentarok_at_mit.edu)

Quynh Lan Nguyen (UND) [Inguyen3\\_at\\_nd.edu](mailto:Inguyen3_at_nd.edu)

Our dream is still to get the top download counts in JGWdoc.



## KSC Newsletter backnumbers

this issue [JGW-L1911020]

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No. 4 (2019/4) [JGW-L1910057] <https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/DocDB/ShowDocument?docid=10057>

No. 3 (2018/12) [JGW-M1809350] <https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/DocDB/ShowDocument?docid=9350>

No. 2 (2018/8) [JGW-L1808559] <https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/DocDB/ShowDocument?docid=8559>

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