

# RIMS REVIEW 2021

DAVID EISENBUD, YAKOV ELIASHBERG, NALINI JOSHI,  
AND TAKASHI TSUBOI

## CONTENTS

1. Introduction	1
2. Summary of Recommendations	2
3. Assessment of RIMS organization and activities	3
4. Facilities and Resources	6
5. Internationalization	10
6. Outreach	11
7. Appendix A: Members of the Review Committee	12
8. Appendix B. Description of the Evaluation Process	12

## 1. INTRODUCTION

Mathematics is the foundation on which science and technology are built: The global pandemic has put the use of statistics for epidemiology, and for public health generally, in the spotlight. The interaction of mathematics and theoretical physics is currently very strong. The very possibility of internet commerce depends on results in number-theory. These examples could be multiplied indefinitely.

RIMS is a jewel of Japanese mathematics. It is widely known and highly respected by foremost mathematicians around the world, and a great many of them have visited RIMS for conferences or for longer stays. Intellectually, and in fame, RIMS operates on the highest international plane.

Founded in 1963 as a national hub for mathematics, RIMS has broadened its activity to include graduate training at the Masters and Doctoral levels, and serves as an International Joint Usage Research Center.

RIMS runs an extraordinarily large number of workshops and conferences every year. It contributes broadly to the community by providing outreach activities and helping to diversifying the population of mathematicians in Japan.

This review was initiated by RIMS Director Professor Takashi Kumagai. The review committee could not travel to RIMS because of the COVID-19 global pandemic, so RIMS prepared not only the usual documentation of its activities and needs, and the report of the visiting committee of 2018, but also a sequence of video presentations and video interviews with students and junior and senior faculty to inform the committee. As RIMS is a part of Kyoto University, a meeting of the committee with Kyoto University President Minato around the crucial question of space was also arranged.



David Eisenbud, Chair of the Review Committee, March 29, 2021

## 2. SUMMARY OF RECOMMENDATIONS

- (1) RIMS' current physical facilities are not appropriate to its mission as an international center of mathematics. To keep its place as a beacon of Japanese mathematics in the world, it will be important to find larger and better adapted space. A major part of the function of a research institute is to promote collaboration, so if RIMS must be spread out over different buildings, it is very important that they be close to one another. We strongly recommend that the available space be increased and that the space be co-located.
- (2) We applaud the progress made since the 2018 review in securing outside grants. It will be important to build on this success, and ensure a multiplicity of funding sources and a multiplicity of projects.
- (3) We note that two women researchers have been hired since the 2018 review, a good start. It is important that RIMS continue on this path, and actively develop the talent pool so that the number of applications from women researchers can grow; see Section 3.6 for particular suggestions.
- (4) To fully exploit the possibilities of international collaboration, RIMS should advertise more effectively and more widely in media with international reach; See Section 5 for particular suggestions.
- (5) As Journal prices increase, RIMS and other institutions face a growing problem of having sufficient journal access. We recommend that Kyoto University cover the cost of electronic journal expenses, as it is of benefit not only to RIMS but also

to other departments. If some sort of consortium arrangement for electronic journal access is possible, this may be desirable.

- (6) As a government-funded agency, RIMS has a responsibility to help educate the public on the beauty, power and importance of mathematics. We applaud the once-a-year event with lectures for a wide audience, and we recommend looking for further opportunities, especially those that can be promoted on a national scale.

### 3. ASSESSMENT OF RIMS ORGANIZATION AND ACTIVITIES

**3.1. RIMS as a leading International Mathematical Center.** Since its establishment almost 60 years ago, RIMS has played an important role in the organization and acceleration of mathematical research in Japan and worldwide. The certification of RIMS in 2020 as a Joint Usage / Research Center, and in 2018 as an International Joint Usage / Research Center underscored the ever increasing importance and impact of RIMS activities.

The scope and the scale of RIMS activities is very impressive. In 2018 and 2019 RIMS organized 125 international symposia (conferences) and smaller meetings (workshops) intended to promote new international collaboration and advance certain particular problems. RIMS also enables satellite seminars devoted to focused research on a particular topic, or to surveying an area of Mathematics and Mathematical Sciences. RIMS has a successful visitors program that hosted a total of almost 8000 participants, of whom 925 were international, in the 2018 and 2019. 162 of these stayed at RIMS for at least 2 weeks.

**3.2. Research at RIMS.** The mathematical research produced by the full and associate professors at RIMS is outstanding. They publish in highly rated journals, and receive invitations to deliver named lectures and colloquia across the mathematical sciences. Three members of the RIMS faculty were invited speakers at the recent International Congresses of Mathematicians, which took place in 2014 in Seoul, and in 2018 in Rio de Janeiro. In the last 4 years, RIMS full professors delivered over 20 invited lectures at major meetings around the world. The area of expertise of the current 12 full professors of RIMS covers a broad area of mathematics: these include traditional strengths in algebraic geometry, representation theory and number

theory, but also areas of analysis, differential geometry, symplectic geometry, topology, operator algebras, probability, fluid dynamics, discrete mathematics, logic and computer science, mathematical physics, Quantum Field Theory.

Operating at this level of mathematical achievement requires high calibre researchers, who are given time, opportunity and support to develop their research. RIMS currently employs 12 full professors, 10 associate professors, 3 lecturers and 11 assistant professors. Positions at all levels except Full Professor are filled after openly advertised searches. Those at full, associate professor and lecturer levels have permanent appointments, while assistant professors are appointed for 7 years with the possibility of renewal for further 3 years. Most of the assistant professors in recent years have moved to permanent faculty positions elsewhere in Japan well before their terms expired; this underscores the high quality of RIMS junior faculty. The number of appointments at the top two levels is limited by Kyoto University. There are also project appointments and postdoctoral appointments that are dependent on externally funded grants.

The researchers interviewed for this review were very satisfied with their position at RIMS. However, some expressed concern that offices are located across 5 different buildings on campus, making spontaneous conversations and collaborations difficult, especially for the younger researchers. This problem has been exacerbated during the COVID-19 pandemic, although seminars and workshops have continued online.

**3.3. Workshops, Conferences and Symposia.** In 2019 alone, RIMS hosted 19 Workshops, 64 Symposia, 5 Satellite Seminars and 2 Review Seminars, serving a total of 4103 participants, of whom 542 were from abroad. The series seem to be well organized and well managed by a system of internal and external review committees.

**3.4. RIMS' Graduate Program.** As noted in previous reviews, the attraction of graduate students to RIMS is constrained by longstanding circumstances. Students in Japan tend to stay in the same geographic location, rather than moving elsewhere to pursue undergraduate or graduate study. RIMS researchers typically do not teach undergraduate students, so the recruitment of graduate students relies on reputation rather than personal knowledge.

Although it is possible in principle for RIMS to recruit students internationally, very few scholarships are available. The review committee recommends that RIMS considers seeking philanthropic funding to overcome this problem.

Students choose their advisors early in the program. Although this often works well, it has the potential to cause isolation and may lead to students acquiring a narrow view of the field. The review committee recommends that RIMS encourage networking among students in different groups, including joint seminars with the Department of Mathematics at Kyoto University and informal seminars where students could learn about each other's research.

Despite some effort, the number of female students in the doctoral program remains very low, and in the current cohort of students there are no female PhD students at all. The pool of female applicants is very small. To help change this unacceptable situation, RIMS should incorporate additional programs that will increase the pool; some possibilities are suggested in Section 3.6.

RIMS students are generally quite successful in finding jobs after completing their doctoral studies. In 2018 and 2019, 3 students obtained jobs as faculty members at Japanese universities, 7 found postdoctoral research positions and 3 were employed in industry.

It is excellent that RIMS, together with the Department of Mathematics, operates the Mathematics unit of the Japan Gateway: Kyoto University Top Global (KTGU) Program. Through KTGU, RIMS enables international experiences for graduate students by inviting top-ranked international researchers to give intensive lecture series, selecting and inviting researchers to act as additional supervisors, and providing opportunities for students to visit abroad.

RIMS also has a vibrant research program for young postdoctoral mathematicians. In 2017-2020 RIMS had 42 researchers at this level, and also hired 2 graduate students in the framework of the "Sendan project". Furthermore, three postdocs per year are hired as "RIMS Research Fellows", a group of young researchers is hired as "RIMS Project Fellows" associated with a RIMS Research Project, and RIMS accepts post-doctoral fellows funded by the Japan Society for the Promotion of Science (JSPS).

RIMS budget problems adversely affect the PhD and postdoctoral programs. An urgent issue for RIMS is to secure an increase in the PhD and post-doctoral researcher employment budget.

**3.5. International Joint Usage Research Center.** International cooperation in mathematical research has always been an important part of RIMS' activity. With its designation in 2018 as International

Joint Usage Research Center, internationalization is even more central. There are currently 4 JU/RC in Japan that are related to Mathematics and Mathematical Sciences, but RIMS is the only one whose mission includes all core mathematical subjects.

The number of international participants grew from 257 in 2017 to 383 in 2018 and 543 in 2019. RIMS has international academic research agreements with a large number of leading mathematical organizations around the world. Further, RIMS created an International Advisory Board which whose members are Professors J.-P. Bourguignon, M. Barlow, M. Reid and M. Kotani.

**3.6. Diversity.** The development and growth of the mathematical community relies on diversity. However, the entry pipeline into mathematical sciences in Japan is dominated by men and the proportion of women entering undergraduate and graduate study in this area has remained very low for decades. While this makes recruitment to RIMS heavily skewed towards male candidates, the review committee was of the opinion that RIMS could do more to develop the applicant pool and broaden the entry pipeline across Japan. We suggest the following actions.

While the number of women in mathematics may be very low in Japan, this is not the case internationally. RIMS should put in place guidelines for all applications for workshops and research programs to require that the organizing committees include more than one gender and that the participant list include the names of an appropriate number of women who will be invited to participate.

All organizers of events at RIMS should be required to subscribe to a code of conduct before their applications can be considered and all participants should also agree to such a code before they can register to attend any RIMS-endorsed event. RIMS should provide a statement of procedures for dealing with breaches of collegiality, including the name and contact details of an external ombudsperson who will consider appeals. (If such an office already exists at Kyoto University, it could simply be referenced.) Examples of codes and procedures documents are available at cognate institutions such as MSRI and Banff International Research Station (BIRS).

RIMS should consider holding events featuring women speakers, including international speakers (since there are relatively few women mathematicians in Japan). Male mathematicians should be invited to participate in such events, but the opportunity to speak should be primarily reserved for women and people of diverse gender.

Such events for women in mathematics could create mentoring networks involving students and researchers that could continue beyond the event. They might include the introduction of undergraduate students to possible mentors, and might provide platforms to enable research projects between mentor and mentee. A good model is the network formed by the “Women in Number Theory” workshops at BIRS.

#### 4. FACILITIES AND RESOURCES

**4.1. Space.** With its three missions, RIMS needs lecture halls, offices for faculty, short and long term visitors, postdoctoral fellows and Ph.D. students. It also needs seminar rooms, and meeting/discussion rooms. The reports of the three previous external review committees emphasized that RIMS is seriously handicapped by the space available. The offices of faculty members are not appropriate for their range of activities, which include work in education, research and administration. There is a shortage of discussion spaces and seminar rooms that could facilitate collaboration and discussion among the young researchers, and there are not enough individual offices for the international visitors.

After the previous assessment in 2018, RIMS took a 5-year lease on 8 rooms in the Maskawa Building. The rented space is used for normal activity of RIMS and we hope that the University will find a way to provide space to RIMS without charging rent.

Even with the added space, visitors are frequently asked to share rooms and the average office space in square meters is small. The space allotted to RIMS is just a fraction of the government standard for institutions of this size (71% without the rented space and 77% with the rented space—and this is apparently without taking into account the large number of senior visitors, both long and short-term). In particular, the office space for long-term senior visitors from abroad is inadequate.

The review report of 2018 pointed to the seriousness of the problem created by RIMS offices being split into four distinct buildings, some at considerable distance from the others. The fact that RIMS began renting space in Maskawa Building relieved some of the pressure but worsened the splitting problem. This problem causes a loss of RIMS’ cohesion. For mathematical research, face-to-face discussions are of paramount importance. The splitting problem reduces opportunities for members and visitors to meet and discuss outside

their own research groups, which is of essential importance to produce unexpected encounters of knowledge and ideas. Such an inappropriate situation tends to cause isolation of researchers, and post-doctoral fellows. The geographic separation of the faculty lessens their interaction.

On Wednesday, March 10 (JST) the Review Committee, accompanied by Director Takashi Kumagai and Deputy Director Narutaka Ozawa, met with Kyoto University President Nagahiro Minato to discuss possible solutions to the space problem at RIMS. The committee explained that RIMS is a major source of prestige for Kyoto University, known and esteemed around the world in the company of such venerable institutions as the Institute for Advanced Study in Princeton, USA or the Isaac Newton Institute in Cambridge, England; but that visitors to RIMS must note that the physical facilities made available to RIMS do not measure up to those at other institutes of the same standing. As RIMS is very much an icon of Japanese mathematics, the committee feels that this problem deserves urgent University and even national attention.

President Minato explained some of the difficulties in correcting this situation, but also explained that there is a major planning exercise going on in the University that could result in an improvement for RIMS; and he promised to keep RIMS' need in mind as that planning goes forward. He also told the committee of a beautiful new guesthouse that will become available, and predicted that visitors to RIMS would be among the frequent users of that facility.

**4.2. RIMS activities in the time of COVID.** RIMS activities in 2020 were severely affected by the COVID-19 pandemic. The individual research programs of RIMS faculty continued but, following governmental and Kyoto university regulations, RIMS had to cancel its visitors program and many planned meetings, while converting other meetings to online or hybrid formats. RIMS prepared guidelines for the organizers and participants for all types of meetings in these circumstances.

**4.3. Administrative Staff.** RIMS' staff takes care of around 4000 participants and nearly 500 foreign visitors each year. The staff coordinates the schedules of parallel conferences, prepares for visas and travel and housing for foreign visitors, and processes the large volume of paperwork corresponding to all the services rendered. Supporting the level of activity of the International JU/RC requires a high level of administrative skill. This differs from the standard expectation of administrative staff in a university. Kyoto University



may wish to consider a career-path for staff with such skill to maintain the current high quality.

Providing an excellent research environment and maintaining RIMS' reputation requires an excellent staff. The current quality of support is highly appreciated by both faculty members and visitors.

RIMS' IT staff maintains the computer system and organises computer access for visitors. In the COVID-19 situation, the RIMS staff supports online and hybrid conferences and workshops, and made handbooks for running hybrid meetings. This activity is also very much appreciated by the community.

**4.4. Financial Resources.** RIMS' revenue comes from three sources: Management expenses grants, International JU/RC funds, and competitive external grants (Grant-in-aid of JSPS) won by individual members. There are several pressing problems:

When it was selected as International JU/RC in 2018, RIMS' budget increased—but is now less than it was in 2012. Moreover, Kyoto University funds and International JU/RC funds are gradually decreasing. The International JU/RC budget is not sufficient for its activity, and the deficit is covered by RIMS' management money.

RIMS fosters young researchers, but this program is not financially sound. The employment of postdocs is partly paid by Kashiwara's Chern Medal Award, which will end in this year.

Part of International JU/RC funds are earned in competitions, but RIMS has to organise its program of meetings before the outcome of the competition is known. RIMS has had a high success rate so far, but this is an additional threat to RIMS' operations. It would be very important to reduce the financial risks so that RIMS can plan effectively.

Modern mathematics finds applications in industry so it may be possible for RIMS or its affiliated centers to obtain some corporate funding. Professor Bourguignon, a member of the International Advisory Committee, has had success in doing this for the I.H.E.S near Paris, and may be able to help RIMS start such programs.

**4.5. Computing Facilities.** An Institute of RIMS stature must have a high quality computer network, providing fast and reliable connectivity, and this need will only increase in the future. High quality IT management is also required, especially for hybrid meetings. The magnitude and the success of RIMS meetings under pandemic conditions shows that this requirement is currently fulfilled. However, the committee was told the Wifi may not be strong enough in some rooms.

Most researchers at RIMS have relatively modest computing needs, which are met by desktop and laptop computers purchased using the individual researchers' Grants-in-Aid. However, some groups, such as the numerical analysis group, have much greater needs; some of these are fulfilled by a computer in RIMS' basement, by university supercomputing facilities, and by applying to use the Fugaku computer at RIKEN. RIMS has a terminal room for the use of visitors and students. Computing facilities seems to be sufficient even in this COVID-19 situation.

It should be noted that researchers' own computers and the processor in the RIMS basement need to be renewed every 5 years and software must be updated periodically.

**4.6. Library and Publications.** In mathematics, it is still necessary to maintain a good library, and RIMS' has several challenges in doing so: The library of RIMS is an important national resource, since many smaller universities do not subscribe to a full range of journals. Thus it would be reasonable for the library to be funded nationally, or directly by Kyoto University, but RIMS must presently fund its library largely by itself. Second, there is a space problem in the library because of the increased number of academic books and journals. Finally, the escalation in prices of electronic journals can no longer be addressed by an individual university but should be handled nationally.

RIMS also supports research by its publication activities. It issues three kinds of publications: the journal *Publications of the Research Institute for Mathematical Sciences*, the series *Kokyuroku*, and the *RIMS Kokyuroku Bessatsu* series. Each of the three publications has its own importance. It is important in mathematics to continue the publication activity.

## 5. INTERNATIONALIZATION

In its capacity as an International Joint Usage Research Institute, RIMS has a remarkably large and varied program of workshops and conferences of several types. Most of these workshops are organized by Japanese mathematicians, and we believe that information about the possibilities is relatively widely known in Japan. However, this seems not yet to be the case abroad.

Given RIMS international reputation, we believe that the possibility of organizing events at RIMS should be very attractive to a broad international community. To encourage more applications from abroad, we feel that RIMS should advertise the possibilities more broadly.

The first and simplest way to do this is to add information to the website, which is presently very sparse. The different types of workshop listed should be more clearly distinguished, and the website should say what kinds of events are appropriate for each category. Links to examples of successful workshops of each type should be given, showing things like the number of national and international participants. The available facilities should be made clear: how much space is available (with pictures), how much financial support for domestic and international travel should be spelled out. The process for judging applications should also be clarified: who will make the final decisions, and when they will be made. The data should be available in HTML, not just through downloaded PDFs.

We recommend that the calls for proposal include requirements or at least strong recommendations for national and gender diversity. In particular, women on an organizing committee tend to know women in the field, and can help attract them, which leads to more diverse workshops.

A second step in encouraging international applications and participation is to advertise internationally. The Notices of the American Mathematical Society, the European Mathematical Society Newsletter, the London Mathematical Society Newsletter and other similar publications would all be appropriate venues; some may be willing to accept a short article about the possibilities, in addition.

## 6. OUTREACH

An institution such as RIMS can significantly add to the public awareness—and thus support—of mathematics. RIMS currently hosts a program of lectures for the general public each year in which several RIMS faculty each give a few lectures on some topic of mathematical interest, and these are well-received. However, they are local in character, not fully reflecting RIMS standing as a national and international resource.

We recommend broadening this program in several ways. First, speakers for the public could be chosen from a broader pool, not just from RIMS, and could include speakers from the domains of application of mathematics—it is probably more effective to hear someone from the “outside” say how important mathematics is than to hear a mathematician say the same thing.

Now that recording is easy, RIMS could aspire to present lectures that would be seen and appreciated by a large national audience. The ease of adding captions would even make it possible to include

non-Japanese speakers. YouTube, or something similar, might be a useful platform.

Social media have become important not only for reaching the public, but also for reaching young researchers. Relatively few senior mathematicians are at home with these tools, so RIMS might consider employing a communications specialist who would introduce RIMS in these formats.

Another medium that can have wide distribution is film, made either for television documentaries or for commercial theatres. RIMS could consider producing films about mathematicians or about important societal applications.

## 7. APPENDIX A: MEMBERS OF THE REVIEW COMMITTEE

- Yakov Eliashberg [eliash@stanford.edu](mailto:eliash@stanford.edu)  
Department of Mathematics  
Stanford University  
450 Jane Stanford Way  
Stanford, CA 94305-2125
- David Eisenbud (Chair)  
[de@msri.org](mailto:de@msri.org)  
MSRI  
17 Gauss Way  
Berkeley CA 94720
- Nalini Joshi  
[nalini.joshi@sydney.edu.au](mailto:nalini.joshi@sydney.edu.au)  
School of Mathematics and Statistics F07,  
The University of Sydney,  
Sydney, NSW 2006, Australia
- Takashi Tsuboi  
[mail@tsuboi-takashi.sakura.ne.jp](mailto:mail@tsuboi-takashi.sakura.ne.jp)  
Faculty of Engineering, Musashino University  
3-3-3 Ariake Koto-ku, Tokyo 135-8181  
RIKEN iTHEMS  
2-1 Hirosawa Wako-shi, Saitama 351-0198

## 8. APPENDIX B. DESCRIPTION OF THE EVALUATION PROCESS

Already when the Review Committee was organized it was clear that an on-site review would not be realized because of the COVID-19 pandemic. The evaluation was thus performed online, using remote meeting systems.

In early December, 2020, the members of the Review Committee received the self-evaluation report document produced by the RIMS Self-evaluation committee (A. Tamagawa, M. Hasegawa, S. Mochizuki and N. Ozawa). The Review Committee met in Zoom on December 16 to discuss what further information it would like, and sent the resulting list of questions to Professor Takashi Kumagai, Director of RIMS, at the beginning of January 2021. These questions were answered a week later, and the committee also received links to the information RIMS had prepared to help the organizers of hybrid meetings.

In the place of on-site review, the Review Committee was sent a series of videos prepared by RIMS that was accessible from mid January to the end of evaluation process. The contents of the videos were:

- Welcome message from Professor Shigefumi Mori [3min];
- Presentation by the Director of RIMS, Professor Takashi Kumagai [1hr 5min] with [Slides PDF];
- Tour of RIMS buildings (guided by Professor Kaoru Ono)[11min];
- Presentation on the conduct of hybrid Workshops by Professor Takashi Kumagai [11min];
- Interviews with senior faculty members, part 1: Interviews of Professor Tomoyuki Arakawa, Associate Professor David Croydon, Associate Professor Masayuki Kawakita, and Associate Professor Kazushige Terui [46min];
- Interviews with junior faculty members, part 2: Interviews of Lecturer Go Yamashita, Assistant Professor Suguru Ishikawa, Assistant Professor Mayuko Yamashita, and Project Assistant Professor Yu Yang [29min];
- Interviews with other researchers: Collective interview of Dr. Morimichi Kawasaki, Dr. Hideya Watanabe, Dr. Sven Moller and Dr. Kazumi Higashiyama [32min];
- Interviews with students: Collective interview of Kohei Sasaya, Hiroaki Karuo, Youji Fukihara, Zeming Sun and Ryoga Mahara [19min],  
where the interviewer was always Professor Narutaka Ozawa.

On Thursday February 4, 8AM-10 AM JST, Professor Takashi Kumagai, Director of RIMS, accompanied by members of the RIMS Executive Board, made an extended presentation, by Zoom, of the self-evaluation report. This was followed by questions from the reviewers. Then Members of the Review Committee had discussion on additional data necessary for the evaluation. Recognizing that the problem of space was a major issue for RIMS, the review committee decided to write a letter to the President of Kyoto University. This was also discussed at the summarizing session with the RIMS members.

Members of the Review Committee discussed the body of the letter to the President of Kyoto University on February 6, JST, and gathered additional questions and a request for additional data, which were sent to Professor Takashi Kumagai.

On February 9, 8AM-10 AM JST, RIMS members answered the questions and explained on supplementary data by Zoom. Then Members of the Review Committee discussed the structure and preparation of the evaluation report. In the summarizing discussions, the members committed to delivering the report in March. Professor Takashi Kumagai, Director of RIMS, expressed his gratitude to the job of the Review Committee.

On Tuesday February 16 and again on Tuesday February 22 (JST), the Review Committee met to work on the report.

Professor Nagahiro Minato, President of Kyoto University, accepted the Review Committee's request to meet, and the date was set for Wednesday March 10, 9:45-10:30 JST. Members of the Review Committee first meet with RIMS' Director Takashi Kumagai and Deputy Director Narutaka Ozawa, who accompanied them at the meeting with President Minato. The discussions concerned RIMS's space problem, and the review more generally.