

Form 7/様式7

FY 2013

(Report 1)

JAPAN SOCIETY FOR THE PROMOTION OF SCIENCE (JSPS)
Report on JSPS BRIDGE Fellowship Activities
 by individual BRIDGE Fellows

1. Fellow's BRIDGE Fellowship ID											
BR130203											
2. Affiliated JSPS Alumni Association											
Association des anciens boursiers francophones de la JSPS (France)											
3. Name in Full											
MEILHAN				Jean-Baptiste							
FAMILY				First				Middle			
4. Host Researcher											
Name in Full							Affiliation				
Akira YASUHARA							Tokyo Gakugei University				
5. Period of BRIDGE Fellowship tenure											
From	20		2		2014	To	12		3		2014
	Day	/	Month	/	Year		Day	/	Month	/	Year

7. Please write on the attached form.

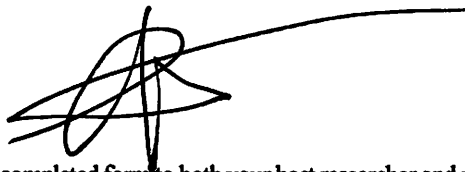
8. Please write on the attached form.

9. Please write on the attached form.

Date: APRIL 9, 2014

NAME (Print): MEILHAN Jean-Baptiste

Signature:

A handwritten signature in black ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

(Notes)

1. Please send this completed form to both your host researcher and your affiliated alumni association as soon as possible after finishing your tenure under the BRIDGE Fellowship program.
2. The names and affiliations of Fellows and hosts and their reports may be given public access.

7. Research network created, sustained and/or strengthened with Japanese researchers through your visit. (Please add lines if needed)

7-1) Research network created:

The BRIDGE Fellowship program allowed me to extend my research network in Japan in several new directions.

Shortly after my arrival to Japan, I was invited on Feb. 24th by Pr. Jun Murakami (Waseda University) to give a talk at his topology seminar. There, I spoke on my recent work with Audoux-Bellingeri-Wagner on the classification of certain ribbon surfaces up to link-homotopy. It turned out that Atsuhiko Mizusawa, a PhD student of J. Murakami at Waseda Univ., currently works on a rather similar problem, namely link-homotopy classification of handlebody knots. This naturally prompted some interesting discussions, and in particular the possibility of using Milnor invariants (which appeared implicitly in my work) for generalizing Mizusawa's first results for the two-component case.

Another new ramification of my research network involves Meijo University, in Nagoya, through by Pr. Fumikazu Nagasato. I was invited to give a 150 min-lecture at the Spring Workshop 2014 on Low-Dimensional Topology and its Ramifications, where I could present an expanded version of the above-mentioned work on welded string links and ribbon surfaces. A large proportion of the audience consisted of Master and Doctoral students and Postdocs from various universities of the country, including Meijo Univ., Osaka City Univ., Nara Women's Univ., Tokyo Univ., Saitama Univ., Tokyo Woman's Christian Univ., Nihon Univ., Tokyo Gakugei Univ. or Aichi Univ. This lecture led to a number of interactions, some of which I hope will reveal fruitful in the future.

I had in particular several promising discussions with several researchers from Osaka (with Seiichi Kamada's research group at OCAMI, but also form Osaka institute of technology), which I plan to further develop in the future.

Is there a possibility of the above network yielding an application for a JSPS program? Yes

If yes, please state the name of the program and researchers who may participate on both sides.

See below (Section 7.3)

7-2) Research network sustained:

This visit was of course the opportunity for me to pursue my collaboration with my host professor, Akira Yasuhara. After the two lectures I gave at Waseda and Nagoya, we actually started a new joint project, which aims in some sense at generalizing my previous recent work. Specifically, we observed that we could define a very natural notion of Milnor invariants for any embedding in 4-space of annuli cobounded by two trivial links – this in particular contains ribbon string links which I considered previously. We started a systematic study of these invariants (topological properties, behavior under closure) and obtained some promising first results.

I could also meet twice with Yuka Kotorii (who recently completed her PhD at TTTECH and will soon start a postdoc position at Tokyo University) during this visit. Kotorii had just visited Grenoble before this BRIDGE Fellowship program (in February 2014), and this visit to Japan allowed to sustain the mathematical discussion which we initiated in Grenoble : Kotorii attended both my talks at Waseda and Nagoya, which are closely related to her previous work on extending Milnor invariants to virtual links, and which provides a framework for further studies of these invariants and their properties.

Finally, this BRIDGE Fellowship program has been the opportunity to complete my joint work with Sakie Suzuki (Kyushu Univ.) on the relationship between Milnor invariants and the universal sl_2 invariant. We are now almost done and expect to release the paper on the arXiv shortly.

Is there a possibility of the above network yielding an application for a JSPS program? YES

Yes

If yes, please state the name of the program and researchers who may participate on both sides.

See below (Section 7-3)

7-3) Research network strengthened:

An important aspect of my visit during this BRIDGE Fellowship program was my stay to Kyoto, were I could meet with Kazuo Habiro, my former host professor at RIMS (Kyoto University) for my JSPS postdoc fellowship. This was the opportunity to revive an old joint project on Kirby calculus for Y-graphs, which we now hope to complete in the coming month; Kazuo Habiro has planned a visit to Grenoble in June so that we can focus intensively on this project.

Also, during this visit I had new rich interactions with other researchers of Tokyo Gakugei University, beyond those with Akira Yasuhara. On one hand, Kodai Wada and Natsuka Kobayashi, two Masters students of A. Yasuhara, studied Milnor invariants of Brunnian links in terms of that of some lift in the double branched cover over a component. This suggests further investigation that we discussed, and involves a technical result of clasper theory (the IHX relation) which I studied in detail and which we also could discuss. On the other hand, I had several detailed discussions with Kokoro Tanaka on relationship of my recent work on welded and ribbon string links and Finite type invariant theories of Habiro-Kanenobu-Shima and BarNatan-Dansco.

Is there a possibility of the above network yielding an application for a JSPS program?

Yes

If yes, please state the name of the program and researchers who may participate on both sides.

I plan to apply, in a few year, for a long-term invitation program, and work for 10 month in Japan.

One natural choice as a host professor would be Akira Yasuhara (Tokyo Gakugei Univ.), but I also consider strengthening my research network by applying with Kazuo Habiro (RIMS, Kyoto Univ.), or Seiichi Kamada (OCAMI, Osaka) instead.

Before this long-term application, I plan to apply for a joint CNRS-JSPS program in low-dimensional topology. My goal is to gather, in a common network, all the above-mentioned people that are related to my research in Japan. On the french side, I plan to include te memebers of the ANR project VasKho (B. Audoux, P. Bellingeri, E. Wagner, and their PhD students), and several of my colleagues in Grenoble (L. Funar, C. Lescop, and several PhD students)

8. Results of your research and networking activities in Japan

During this BRIDGE Fellowship program, I could complete, pursue and initiate several projects, in collaboration with several Japanese researchers, which I briefly outline below.

First, I completed my project with Sakie Suzuki (Kyushu Univ.) on relating the universal sl_2 invariant and Milnor invariants for string links. This draws new connections between quantum and classical invariants, and brings some topological insight into quantum invariants (for which we still lack a proper understanding). Specifically, our work amounts to showing how certain reductions of the universal sl_2 invariant are captured explicitly by Milnor invariants.

This first joint work, which shall appear on the arXiv in the course of this month, also contains promising ideas for future works. In particular, our formulas can be used to compute and study the still-unknown weight system for the universal sl_2 invariant. As a matter of fact, this particular direction will be the subject of our next project, which we plan to pursue in July 2014, when Sakie Suzuki will visit Grenoble Univ. for two weeks.

Similarly, my visit to Kazuo Habiro at RIMS, Kyoto Univ., has allowed to further develop our collaboration, which aims at giving a complete set of relations for Borromean surgery presentations of 3-manifolds (at least, for homology spheres). We have found how this topological question can be reduced to an analysis of works of A. Putman on the Torelli group of a surface. Most of this final step of the project remains to be done, although we have clarified several key cases already, and K. Habiro will be visiting Grenoble Univ. in June 2014 so that we can hopefully complete this project, now that all the main ideas seem to be in place.

Finally, and as outlined in the previous sections, most of my research and networking activities during this BRIDGE Fellowship program are in the continuation of my latest works, joint with Audoux-Bellingeri-Wagner, on ribbon knotted objects in 4-space and virtual and welded knot theory (probably because this was the subject of the lectures I gave during this program).

On one hand, I started working with Akira Yasuhara on a welded version of clasper calculus, based on the work of Tadayuki Watanabe (Shimane Univ.) on ribbon presentations of ribbon 2-knots. This will have immediate application, since we can now use our knowledge of classical clasper theory for deriving new results in this new settings: our first goal is to build an explicit representative for the self-virtualization relation on string links which I studied in my previous work, and actually to provide a new proof of the latter in this terms. We can then build on this diagrammatic approach to investigate the connection with the universal invariant of welded knots and links recently defined by BarNatan and Danco, and more precisely give a welded analogue of Habegger-Masbaum's theorem on the Kontsevich integral and Milnor invariant. This and further ideas in this direction were discussed in several occasions with Kokoro Tanaka, and independently with Yuka Kotorii. Actually, another idea involving Yuka Kotorii is to use this welded clasper calculus as a starting point for investigating the virtual case (recall that the welded theory is a quotient of the virtual one). This is a rather interesting program, since the virtual finite type theory is much less known, and in particular we do not know a universal invariant there. Also, Kotorii's idea is to adapt to the welded/virtual settings a formula which I recently obtained with Yasuhara, which relates Milnor invariants to the HOMFLYPT polynomial. This is again interesting, since no virtual extension of this quantum invariant is known at present.

But what currently appears to me as the most promising new project in this direction is the following, which was also initiated by discussions with my host professor Akira Yasuhara. The topological objects that I considered with Audoux-Bellingeri-Wagner, namely ribbon 2-string links, are a special case of embedding in 4-space of disjoint annuli cobounded by two trivial links. The notion of link-homotopy that we studied extends very naturally to this larger class of objects, and we were naturally led to trying to extend my classification result to this more general setting. This is, however, a much more difficult question, since this question can no longer be studied in terms of local moves. However, we showed that Milnor invariants, which are used in the ribbon case, can be very naturally defined in the more general situation, and that they admit several good topological properties, such as concordance invariance, which seem to indicate that they are the appropriate notion to consider in our situation. We also showed that it is well-behaved under several closure operations, and will now attack the question of link-homotopy classification, and more generally the systematic study of these 4-dimensional analogues of Milnor invariants.

9. Contributions to networking between researchers in your alumni association's country and colleagues in Japan

First, during this visit I could meet with several current french JSPS postdocs in mathematics, and discussed the evolution of their research. This is of course important in the perspective of future applications for a permanent position in France. I met with Carlos Moraga, who is currently a JSPS postdoc a Tokyo University with Toshitake Kohno, and with two postdocs at OCAMI (Osaka) working with Seiichi Kamada, namely Victoria Lebed (JSPS) and Arnaud Mortier (invited researcher).

The strongest mathematical interactions occurred with Mortier, who attended my lecture in Nagoya, which we discussed afterwards, and gave an informal seminar on my work at Osaka the following week. We met again in Kyoto that same week, and could discuss further questions and comments that arose in Osaka.

In another direction, I have suggested to my host professor, Akira Yasuhara, to apply for a JSPS postdoc fellowship with Benoit Guerville-Balle. He is a young researcher who recently completed his PhD at the University of Pau under the supervision of Vincent Florens on invariants of hyperplane arrangements. His latest work reveal some potential interaction with low-dimensional topology (and more specifically Milnor invariants) and algebraic geometry, which could lead to a very promising research programme with Akira Yasuhara. The latter is indeed a world expert in Milnor invariants, and this application seems very natural.

Finally, as mentioned already, this visit was also the opportunity to arrange the visits of several japanese researchers to Grenoble in the coming months: Kazuo Habiro in June 2014, Sakie Suzuki in July 2014, and Akira Yasuhara in either June or September.