

## LABEX MILYON

### 1. PROGRESS OF THE PROJECT

#### 1.0 Overview of the initial project

The mathematics and fundamental computer science (M&FCS) communities in the Lyon – Saint – Étienne area are gathered in three internationally recognized research units (UMR): the Institut Camille Jordan (ICJ) <http://math.univ-lyon1.fr>, the Laboratoire de l'Informatique du Parallélisme (LIP) <http://www.ens-lyon.fr/LIP/web-n/> and the Unité de Mathématiques Pures et Appliquées (UMPA) <http://www.umpa.ens-lyon.fr>.

At the end of 2010, these UMRs answered a call for proposals of the Future Investment Programs with the project Labex Milyon ("Community of Mathematics and Fundamental Computer Science in Lyon"). The ambition of the project, submitted and initially coordinated by Bertrand Rémy, is to federate the two communities along 3 axes: **research, training, dissemination**.

In **research**, a first goal is to **make Lyon a center of international level, in all fields of the present-day research** in M&FCS. In this direction, two main types of actions are planned: organization of thematic quarters and of international conferences, and an invitation program (senior researchers, postdoctoral fellowships). A second goal is to **enhance collaborations at the interface of M and of FCS**.

In **training**, the project's goals are to **implement an industry-oriented master in applied mathematics**; to **attract selected foreign students in the research oriented programs (including PhD) via a fellowships system**; and to **implement intensified training programs**.

In **dissemination**, a federating goal is **popularization of M&CS knowledge (scientific mediation)** towards schoolchildren, students, general audience, combined with the implementation of innovative approaches to teaching and initiation to research, within a **Maison des Mathématiques et de l'Informatique** (House of M&CS), which did not exist at the time the project was submitted. Concerning the **transfer of knowledge**, the Labex is expected to enhance the interdisciplinary research essentially towards biomathematics and medicine and between M and FCS, to favor technology transfer through emerging structures, already well developed by the LIP, and collaboration with industry (research, industrial theses).

After acceptance of its project, the **Labex Milyon** <http://milyon.universite-lyon.fr> became operational in April 2011.

#### 1.1 Governance

**Milyon: what and how.** A first mission of Milyon is to initiate, support and develop the scientific projects of the M&FSC community in the Lyon area, which coincides with the COMUE Lyon-Saint-Étienne. This is done through founding, organizing and advertising activities. Milyon's activities are coordinated by a board that relies on the expertise of the commissions corresponding to its three axes of action (research, training, dissemination) and, for its strategic decisions, on a scientific committee.

Each year, the board establishes envelopes for the different types of activities described below and launches several calls for proposals towards the three supporting UMRs and beyond (the Rhône-Alpes region). The commissions evaluate and rank the submitted projects. The board decides which projects are funded.

The calls for proposals were satisfactorily organized from the beginning of the project and go now full steam. In research, they concern the organization of thematic quarters (or of international conferences), invitations, postdoctoral fellowships, as well as partial support for different research activities. In training, Milyon launches call for proposals for bachelor, master or PhD fellowships, and for summer/winter schools at PhD level. In scientific mediation, the calls for proposals concern activities proposed by colleagues, associations, artists or art companies, and partial support to national events for young students.

Another mission of Milyon is to structure the activities of the M & CS communities. Among its structuring objectives, we mention especially

- The creation of the Maison des Mathématiques et de l'Informatique
- The creation of an applications and industry oriented research master in mathematics
- The creation of an international research center
- The organization of joint M & FCS research activities

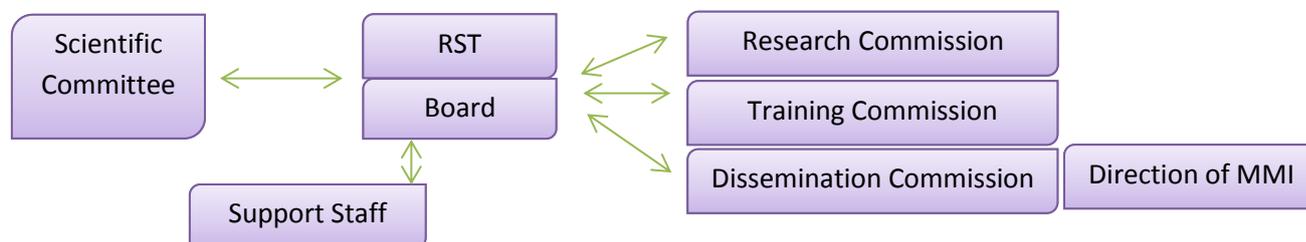
**Organization.** The **initial project scheme** of governance was respected and implemented from the beginning, except that the scientific board has 9 members (instead of 6), and that it was more convenient to operate with an executive board of 9 members (3 per UMR). The support staff was recruited in 2012 and 2014.

In the summer of 2014, the RST of the Labex, Bertrand Rémy, moved from Lyon. This fact combined with the opening to the public of the Maison des Mathématiques et de l'Informatique led to an anticipated renewal of the governance, initially planned to occur at midterm. The **current organization of the governance**, stable for at least the next two years, is presented below.

All the research or higher education institutions (R&HEIs) involved in the Labex (universities, schools, research institutes) are represented in the executive board and/or in the commissions. These RHEIs are the CNRS, École Centrale de Lyon, ÉNS de Lyon, INSA de Lyon, INRIA, Université Claude Bernard Lyon 1, and Université Jean Monnet de Saint-Étienne.

**Governance. The UMRs and their directors (DU) are directly involved in governance's functioning.** The DUs name the members of the board and commissions, after consulting their own governance. DUs were members of the initial board. The newly appointed DUs and, in case of a transition in 2015, the future DUs are part of the actual board, as full or deputy members.

The board is the final decision instance, advised by the commissions. Each member of the board (except the RST) has a deputy. The board meetings are scheduled well in advance. If a full member cannot participate, its deputy replaces him, studies the preliminary documents and participates to the preliminary discussions in view of the meetings.



**Scientific and Technical Responsible (RST):** Petru Mironescu

**Scientific Committee:** Christian Bertin (STMicroelectronics company), Vincent Blondel (UC Louvain), Martin Hyland (Cambridge), Philippe Michel (EPF Lausanne), Felix Otto (MPI Leipzig), Jacob Palis (IMPA Rio de Janeiro), Marcus du Sautoy (Oxford), Alain-Sol Sznitman (ETH Zürich), Karen Vogtmann (Cornell)

**Board:** Sylvie Benzoni (ICJ), Laurent Berger (UMPA), Éric Fleury (LIP), Damien Gaboriau (UMPA), Paulo Gonçalves (LIP), Guillaume Hanrot (LIP), Simon Masnou (ICJ), Petru Mironescu (ICJ), Jean-Claude Sikorav (UMPA)

**Research Commission:** Damien Gaboriau (UMPA, chair), Patrick Baillot (LIP), Itai Ben Yaacov (ICJ), François Brunault (UMPA), Isabelle Guérin-Lassous (LIP), Grégory Miermont (UMPA), Grégory Vial (ICJ)

**Training Commission:** Guillaume Hanrot (LIP, chair), Laure Gonnord (LIP), Daniel Hirschkoﬀ (LIP), Philippe Malbos (ICJ), Christophe Sabot (ICJ), Denis Serre (UMPA), Paul Vigneaux (UMPA)

**Dissemination Commission:** Petru Mironescu (ICJ, chair), Gilles Aldon (IFÉ), Vincent Calvez (UMPA), Olivier Druet (ICJ), Gilles Fedak (LIP), Christian Mercat (IREM), Nathalie Revol (LIP)

**Direction of MMI:** Jérôme Germoni (Director), Régis Goiffon (ICJ), Natacha Portier (LIP), Frédéric Déglise (UMPA) (Deputy Directors)

**Support Staff:** Carine Sevestre (Project Manager), Séverine Voisin (Communication Officer)

Each commission is chaired by a member of the board, who plans its meetings and stimulates the discussions concerning the policy of the Labex in the respective field.

**Chairs:** Damien Gaboriau for research, Guillaume Hanrot for education, Petru Mironescu for dissemination.

Initially, the board discussed the light demands every month, and the heavy ones four times a year. As the board gained experience and the colleagues got to know better the opportunities offered by the Labex, the **calendar of the governance** stabilized and is now the following.

**1)** Four meetings of the board per year, discussing general strategy and instructing the answers to the call for proposals. The meeting in January is in presence of the ANR representatives, assesses the results of the year n-1, adjusts the budget of the year n, and establishes a preliminary budget for the year n+1. The meeting in September decides the initial budget of the year n+1.

**2)** Calls for "heavy" projects organized by Milyon (essentially, thematic quarters or large international conferences) are twice a year, in March and September. Calls for "light" projects organized or only supported by Milyon (typically, partial support for conferences in the Lyon – Saint-Étienne area) open four times a year.

**3)** Calls for fellowships (postdoctoral, PhD, master) open and end respectively in November/January, November/February, February/May.

**4)** The Maison des Mathématiques et de l'Informatique has its own call for proposals in August/November.

**5)** The appropriate commission evaluates the submitted projects, and makes a proposal to the board. In its proposal and ranking, the commissions take into account the envelope allowed to each type of action. The board takes the final decisions.

**6) DUs and UMRs are actively involved in the evaluation of projects** and in the decision process at several levels. First, DUs are informed of the projects (quarters, conferences, post docs, PhD). So are heads of teaching departments and directors of teaching programs for master fellowships, and the head of the doctoral school for doctoral fellowships. Starting 2015, a **visa of the DU** is required in order to submit a proposal. The opinion of the UMRs (or of the research teams or of the directors of teaching programs) is solicited and considered as a criterion in the evaluation of the programs or candidates. In particular, these units and colleagues are involved in the ranking of the fellowships demands.

The **Project Manager** is in contact with the Université de Lyon for the administration of the Labex. She is in charge of the organization and follow-up of the calls for proposals, and with formalities and contracts for fellows and invited researchers. She is involved in the organization of conferences and thematic quarters and monitors them. She collects the scientific and financial reports concerning these events. She is involved in the construction and monitoring of the budget. She monitors the activity of the Maison des Mathématiques et de l'Informatique (MMI).

The **Communication Officer** is in charge of the enhancement of the communication around the quarters and the conferences, fellowships announcements, as well as the visibility of the Labex and of the MMI. She is also in charge of

the communication of the Labex towards the UMRs (information letters, intranet) and with the global communication around fellowships and teaching programs in M&FCS. She supervises the communication around the activities held under the patronage of the MMI. In particular, she feeds the media with press kits concerning the general audience events organized by the MMI.

The **Scientific and Technical Responsible (RST)** of the Labex proposes the board the general policy of the Labex and, together with the coordinator, supervises and coordinates the current activity of the Labex. He encourages and favors emergence of heavy projects. He is also in charge of the dissemination commission and the advancement of the project MMI. He coordinates the reflection around the activities to be developed in 2017–2019, and stimulates the development of the international projects. He participates to the discussions of the network of the Labex in Mathematics, and represents the Labex in the contacts with the local actors.

The **Director and Deputy Directors of the MMI** are in charge of the current activities of the MMI, and with its development. They organize the future “états généraux de la dissémination scientifique” (convention of the scientific mediation in M&CS, April 2015), which will provide the bases for the development of the MMI starting from the fall 2015. The MMI is relatively autonomous in its each day functioning, organized by the directors and the support staff. However, expenses above 3 K€ have to be approved by the board.

**Monitoring.** After each event (quarter, conference, workshop) organized or supported by the Labex, the organizers produce a **scientific report** and a **financial report**.

In the initial scheme, the **scientific committee** (composed essentially of foreign members) was supposed to participate at the each day decisions of the governance. In practice, the decisional process had to be very reactive, and the scientific committee received once a year the activity report for approval. However, the years 2014–2015 corresponding to the midterm of the Labex, the committee was invited to participate to the Labex day in January 2015, and will be consulted beginning of 2015 in view of the prospective process concerning the years 2017–2019.

In case of students, directors of programs are consulted, and the achievements of students create a feedback used to evaluate the potential of the universities or programs students come from. This helped us identify programs that send good students to Lyon (Chile, Ottawa, among others) and are potential future valuable partners for our programs.

It is too soon to discuss the results of the PhD program (which started in 2014), but the partial support of PhD students was satisfactory (see Section 2A).

As for the postdoctoral program, we monitor the scientific outcome, the insertion into the research teams, as well as the career of the fellows.

The director of the MMI has a **letter of engagement**. Recently nominated (January 2015), he will present its annual activity end of 2015. The previous director produced a detailed account of the activities of the MMI from its beginning. As all the activity reports for various events and activities of Milyon, it is available for the ANR upon request.

By the very nature of its organization, the main activities of the Labex until the end of 2016 are already known. Spring and summer 2015 will be the moment of **prospective, discussions** (involving also the scientific committee) and **decisions** concerning the **policy of the Labex in the years 2017–2019**.

## 1.2 Research

**Project in more detail.** In research, the Labex aims at combining the effects of the presence of the ÉNS de Lyon with the ambitious hiring policy conducted by the Université Lyon 1 and the other R&HEIs the UMRs depend of in order to enhance the place of the Lyon-Saint-Étienne area as the second ranked place in M&FCS in France after the Paris area. This goes through the gradual set up of a structure where the actors of research in M&FCS from around the world meet regularly to discuss recent achievements and collaborate for new discoveries. A first step consists in organizing thematic quarters. A further step consists in evaluating these activities at midterm, and in examining the possibility of the creation of an international research center.

Among the promising directions for meetings, we mention here complexity and algorithms viewed by M and by FCS, multidisciplinary challenges in scientific computing, modeling challenges in information technology, mathematics in biology and medicine. However, an important feature of the project is that it is **open to all research directions**.

In order to enhance the benefit of the quarters, the project plans an invitation program for mid or long term visits of the research teams.

Finally, the project includes a postdoctoral fellowships program.

**Achievements.** The **thematic quarters** program needed some time to start functioning. At the very beginning of the Labex, it was easier to organize prestige conferences around the **doctorate honoris causa** of highly recognized scientists. The first two such events were

- Workshop and doctorate honoris causa of John Mather (Princeton), organizer Albert Fathi, Juin 2012
- Turing days and doctorate honoris causa of Leslie Valiant (Harvard), organizer Éric Fleury, July 2012

A third similar event followed in 2013:

- Conference on Geometry of groups and doctorate honoris causa of Grigory Margulis (Fields medalist, Yale), organizer Georges Tomanov, Juin 2013

The **thematic quarters** started in 2013 and, with the exception of one activity, the **program is complete** up to the end of 2016 (for the past activities, the websites are indicated in Section 2A). The quarters are respectively

- Trimester in Mathematical Biology (main organizer Vincent Calvez), March–June 2013
- Trimester in Compilation, Languages and Architecture (main organizer Alain Darté), April–July 2013
- Weeks “Mathematical Structures of Computation” (main organizer Patrick Baillot), January–February 2014
- “Bimester” on Algebraic Groups (main organizer Nicolas Ressayre), June–July 2014

- Month "Resource Optimization for Exascale Systems: Models and Algorithms" (main organizer Frédéric Vivien), July 2014
- Month "Analysis in Action" (main organizer Petru Mironescu), August—October 2014
- Trimester in Analysis and doctorate honoris causa of Luigi Ambrosio (Scuola Normale Superiore di Pisa) (main organizer Albert Fathi), September—December 2015
- Month "Space-time Modeling of the Risks in Hydrology and Climate" (main organizer Anne-Laure Fougères), Juin 2016
- Trimester on High Performance Computing (main organizer Violaine Louvet), April—Juin 2016

The board will select in April 2015 the remaining slot for 2016, based on a call ending in March 2015.

A new direction that emerged from the discussions with colleagues and results of calls for proposals is organization of **prestigious (inter)national conferences** as an alternative tool for increasing the attractiveness of the Lyon area. The above thematic quarters program is completed by the organization of

- The Congress of the French Society of Applied and Industrial Mathematics SMAI 2015 (main organizer Francis Filbet), Juin 2015
- The Conference Equadiff 2015 (main organizer Sylvie Benzoni), July 2015
- The Workshop GRETSI 2015 (co-president Paulo Gonçalves), September 2015

As we will see in more detail in Section 2A, in addition to these activities which are endowed mainly or significantly by the Labex, Milyon provides **partial support** to an **important number of present-day research meetings** in the Lyon—Saint-Étienne area or the Rhône—Alpes region. Milyon also supports shorter events related to the international policy of the Université de Lyon (in direction of the 5 specific targets of the university, like the ToDai—ÉNS forums joint with the University of Tokyo), or to the activity of our most prominent colleagues (like a conference for the 60 years of Étienne Ghys).

We may thus consider that the thematic meetings part of the program, after a slow start, is **fully operational** and **functions well**. For the scientific description, see Section 2A.

The **invitation program** was initially intended to come with the thematic quarters. As most of the activities of the Labex, the program started in 2012 and is now **operational**. In practice, **several invitations enhanced these quarters** (see Section 2A, especially the trimester in Mathematical Biology, the "Bimester" on Algebraic Groups, and the Trimester in Analysis), or gave the opportunity of realizing **present-day research activities** of more modest size. A typical achievement in the second direction is the invitation of Pr Ivan Smith (Cambridge), who visited UMPA for one month in 2012 and gave a series of lectures on Fukaya categories to the "symplectic workgroup", in one of the top research teams of UMPA. However, the most beneficial outcome was the possibility to **boost research** by short visits related to very focused projects including publications. In total, the Labex supported 9 months of invited senior researchers, with a significant impact on the scientific production of Milyon.

We continue with a comment on this program. The **flexibility** of the invitation procedure is highly appreciated by colleagues, and is a **valuable complement** of the invited professors programs of the establishments. In addition, the program gave us the opportunity to invite top researchers that do not fit the scheme of the invited professors programs (like the senior Intel researcher Peter Tang in 2015, or the brilliant PhD student John Pardon in 2014).

The **postdoctoral program** (details in Section 2A) started in the fall 2011. The figures are: 1 position in 2011—2012, 2 positions for 2012—2014, 2 positions for 2013—2015, 6 positions for 2014—2016, and 3 positions for 2015—2017 and beyond. In addition, the program provided **partial support** to 4 postdoctoral fellows for a total of 33 months. The overall appreciation is that the program is **fully operational** and highly **successful** in terms of **attractiveness** and **scientific activity**. After 80 candidates for the first edition, the number of applications stabilized around 115, and we were able to attract to Lyon the candidates we have ranked in the top positions. An example we are proud of: Christopher Henderson (PhD 2015 Stanford, selected for the 2015 program) postponed a U Chicago postdoctoral offer in order to come in the Mathematical Biology team at UMPA.

**To be done.** The research center is not on the way. As planned in the initial project, 2015 will be the year of the evaluation of the chances in succeeding in the creation of such a center. This is imbricated with several other pending projects (future of the project Maison des Mathématiques et de l'Informatique, the place of these two projects within the Initiative d'Excellence project of the Université de Lyon, the creation of a national foundation for dissemination in M&CS based in Lyon, the creation of a Maison des Sciences in Lyon).

In any circumstance, the board will adopt before the end of the year a **letter of mission** for the RST of the Labex **for 2016—2019**. This applies to all the aspects of the activity of the Labex.

In a different direction, the scientific committee, the research commission and the board will evaluate the impact of the organization of large international conferences (attractiveness vs important implication required from the organizers) and will decide whether such activities will continue in 2017—2019.

**Difficulties.** The initial project underestimated the difficulty of finding a structure adapted to hosting a research center, and also probably the difficulties of fundraising.

The current paragraph concerns difficulties that are not specific to the research activities. The Université de Lyon is in charge of the administrative management of the Labex. This leads to a needlessly long chain of decisions and forces us to work with too expensive operators (especially for travels and catering). It is also quite difficult to reimburse invited researchers for travel and hotel expenses.

**In short. The research programs go full steam ahead.** The challenge of making work together the two communities (M&FCS) was successfully undertaken: the ICJ and the LIP jointly organize three of the nine thematic quarters. The invitation program was adapted to the needs of the research activities. The crux of the second part of the Labex is the possibility of founding and founding a research center.

### 1.3 Training

**Project in more detail.** A first strategy consists in taking advantage of the presence of the ÉNS to **promote excellence for the best students from abroad** through a **system of grants**, and in **promoting**, among the students from the other establishments in the Lyon—Saint-Étienne area, **the most demanding and innovative curricula**. This involves in particular the creation of **two excellence programs** at the university, the bachelor level program “Cursus de Mathématiques Approfondies” in L3 (equivalent of a Honors program), and the master program “Mathématiques en Action”. The project mentions the following directions for “Mathématiques en Action”: “Mathematics for Environment and Industrial Risks”, “Mathematics applied to Biology and Medicine”, and “Mathematics for Material Sciences”.

A complementary program consists in encouraging “local” students to go abroad.

In a different direction, the project favors interactions between M and FCS curricula.

At a most advanced level, the project plans **doctoral fellowships**, and also the enhancement of research seminars for (under)graduate students, and of winter schools in M&CS.

**Achievements.** The **master program “Mathématiques en Action” started in 2013**, as a joint program of Université Lyon 1 and of École Centrale de Lyon. This program attracts students from the École Centrale de Lyon in view of a double diploma (Engineering-Mathematics) and industrial PhDs, as well as students from the Université Lyon 1, ÉNS de Lyon and elsewhere. The program was supported even before its start by an **Associate Professor temporary position (“PAST”) financed by the Labex**, from 2012 up to now. The PAST Professor, the research engineer François Wahl from the Institut Français du Pétrole, collaborates with the pedagogic team of the program, supervises the applications oriented internships of the students, facilitates the contacts with the non academic research, and has scientific collaborations with colleagues involved in the project. In the first year (2013-2014), the program had 15 students enrolled and opened the “Mathematics for Biology and Medicine: Theory and Applications” curriculum. In 2014-2015, the program enrolls 28 students and opened two other curricula: “Environment and Geoscience: From Models to Predictions” and “Fluids and Materials: From Physical Laws to Mathematical Analysis”. **Milyon supports** the advertising of the program and **the teaching hours of the researchers** involved in the program.

The “Cursus de Mathématiques Approfondies” did not start yet; see however the “to be done” paragraph for its future.

The Labex also **contributed to getting closer the M and FCS programs** (see Section 2D).

The **grants system is operational** starting from 2012, and was widely advertised starting from the end of 2012. The number of candidates has an exponential growth: 5 for 2013—2014, 10 for 2014—2015, 56 for 2015—2016! From the very beginning, the system was intertwined with the Ampère grants system for foreign students, already in place at the ÉNS de Lyon, and with the INRIA grants systems at the LIP. Thus we also consider the Ampère applicants, and candidates benefit of a simplified procedure allowing them to compete for both fellowships. As a consequence, the number of real candidates is higher than the above figures, e.g. over 70 for 2015—2016. **The global level of the candidates is very high.** The number of grants allowed by Milyon was: 2 in 2012—2013, 9 in 2013-2014, 8 in 2014—2015, 10 in 2015—2016. The level of the 2015—2016 candidates particularly impressed the training commission.

In addition to the Milyon grants, the Labex took advantage of an interesting operation initiated by the French Embassy in Chile, in cooperation with the Chilean Mathematical Society. Students among the very top of their generation arrive in Lyon for second year research master programs in M&FCS at the ÉNS de Lyon, and the Labex supports half of their grants (the other half being for the French Embassy). In this program, we have attracted **3 excellent Chilean students each year since 2012**. One of them is currently PhD student in CS after an M2 in M.

The **doctoral program** started in a light version (complements to doctoral fellowships), and continues with a limited version of the program initially planned. The main reason was that the endowment received by the Labex was sensibly lower than the one solicited (roughly speaking, 9 M€ vs 16.5 M€), so that not all packages of the Labex could be undertaken at their planned strength. In 2012—2014, 13 PhD students from abroad benefited of the Milyon support for ingoing mobility for a total of 56 months.

Concerning the doctoral scholarships fully endowed by Milyon, the Labex has a **limited doctoral program**, with call for proposals for 2014—2017 and 2015—2018. This is an **attractiveness program** (focused on students with “non Lyon” education). In 2014, four among the 10 submitted PhD subjects were funded. The call for the 3 PhD grants starting in 2015 is currently running. The opportunity of an extra call for 2016—2019 will be evaluated this year.

In the direction of winter/summer schools for master and PhD students, which are valuable tools for enhancing the attractiveness of research oriented curricula and of the doctoral school, the Labex provided substantial support to 3 schools and partial support to 5 other schools; see Section 2A for more.

**Difficulties.** The master fellowships did not attract numerous students from the very beginning. However, a worldwide advertisement proved useful, and now the number of applicants is fully satisfactory.

The Labex had to help overcoming the Université Lyon 1 rules for the opening of a course (at least 12 students enrolled, which is exorbitant for second year research oriented master programs in M or FCS) and to support substantially the opening of courses. Rules better adapted to research masters would allow the Labex to reinvest the envelope devoted to teaching hours in master grants or in new innovative curricula.

The “Cursus de Mathématiques Approfondies” did not start yet. One of the reasons is that the impact of the L3 fellowships in the launching of this program is limited for the moment: two students in 2014—2015, one in 2015—2016. Yet it is to be noted that these grants helped us identify promising programs (in Algeria, Senegal and Togo) that form good students attracted by the L3 programs.

**To be done.** The budgetary restrictions in the HEIs are not favorable to programs requiring new resources. However, starting from the fall 2015 the “Cursus de Mathématiques Approfondies” program will be initiated in a form which does not involve new courses as follows: personal tutorship for a limited number of gifted students, including the Milyon fellows, combined with a program mixing courses at the Université Lyon 1 with courses at the ÉNS de Lyon, and with

participation at the undergraduate research seminar. The Labex will support this program with grants, worldwide advertising and support to the research seminar.

A plan to be put in practice is the following. Use Milyon's founding capacities to send colleagues for mid-term visits in countries with strong potential for Milyon's programs in order to stimulate research and students exchanges. This worked already very well in Romania and Vietnam on the CS side.

**In short.** Although the "Mathématiques en Action" program could have started even without the Labex, the support of Milyon was important for the success of the program, as it helped to substantially enhance the pedagogic team and to allow the intervention of researchers in the curricula. This program is an important step towards attracting students to research oriented Applied Mathematics and industrial PhDs, and a **research program enrolling 28 students after only two years of existence is a sound success.**

The "**Cursus de Mathématiques Approfondies**" is **difficult to implement**, but the way to do it seems reasonable. A difficulty stems in the fact that the bachelor level grants have limited impact for the time being.

The **master grants system** is **competitive**: it attracts an important number of candidates, and many good ones.

The **doctoral fellowships** program was adapted to the Milyon's budget and combines a **partial support program** with few fully **endowed fellowships**.

Milyon enhanced the attractiveness of the training programs by initiating or supporting several schools.

## 1.4 Result exploitation

**Project in more detail.** Milyon is an important actor in the field of scientific mediation, which tries to re-connect research in M&FCS to Society. The main tool in federating and amplifying the existent activities, like "Math $\alpha$ Lyon" (two days of mathematical experiments with young students, supervised by two mathematicians) or "A mathematician in the classroom" (a researcher providing a lively and attractive description of the research in Mathematics in front of last year high school students), is the **creation of a "Maison des Mathématiques et de l'Informatique"** (MMI) proposing activities and events all over the year, on a regular basis. The project suggests the following activities: accommodation of classrooms for experimental activities, series of conferences for a broad audience, teaching scientific divulgation to future teachers, temporary exhibitions. All in a **place exclusively dedicated to establishing a contact between M & CS researchers and society.**

For the most motivated students, the MMI is a place of excellence, training for the many kinds of mathematical contests. In a complementary direction, Milyon organizes **summer camps for gifted young students**. The project consists in gathering around 100 young students from all around the world for a series of lectures provided by distinguished mathematicians on present-day mathematics.

**Achievements.** The **MMI opened** virtually in October 2012 and **physically in March 2014**. The house corresponds to the initial plan: a conference room with 40 places, three offices, an exhibition room that also serves as experimental mathematics place in presence of schoolchildren. The MMI will stay in its present location (near the ÉNS de Lyon) until the end of 2018.

The delay between the virtual and physical opening is due to the necessity of adapting the house to the security constraints related to the reception of schoolchildren.

The first director of the MMI, Vincent Borrelli (2012–2014), put the bases of the physical opening of the MMI, as well as of collaborations with the partners of the MMI (associations, theater companies, artists) and launched several exhibitions. The current director, Jérôme Germoni (2015–) has the mission of extending the activities towards the civil society (like joint projects with the association Ébulliscience in the schools of the neighborhood of the MMI) and transforming the MMI in a structure that will live beyond the end of Milyon (December 2019) by organizing, jointly with the RST of the Labex, the search of founding and of a legal personality to the MMI.

The MMI has a specific budget, devoted to its own activities or to supporting the activities of the partner associations. As we will see in Section 3.4, MMI proposes activities with schoolchildren or young students in classrooms and at the MMI, temporary exhibitions, conferences for general (possibly with solid scientific background) audience, training for mathematical contests, collaboration to arts and drama events, a research seminar for undergraduate students. **For the most appreciated events, like Math $\alpha$ Lyon, the agenda is already complete for more than two years.**

The **summer camps** for gifted students were made possible by a joint initiative Milyon-Bremen. The Milyon founding and a Volkswagen Foundation founding on the German side contributed to the organization of six such camps, from 2011 to 2016, alternatively in Bremen and Lyon. The 2012 edition in Lyon ("ISSMYS"), organized by Étienne Ghys, attracted 109 students from 45 countries, for a series of 18 conferences. The 2014 edition ("MOMISSS"), organized by Christian Mercat, proposed 8 conferences to 81 participants from 38 countries, selected from more than 300 candidates.

In addition to the summer camps, the MMI organizes **national** research oriented **events** for schoolchildren like the Math.en.jeans congresses 2014 and 2016, and provides partial support to the participation of secondary or high school classes to such events.

**Difficulties.** The initial plan was to open the MMI in the city center. This could not have been done; the Labex envelope was not sufficient for renting in such a place, and the Lyon City Council did not have any solution to propose. **Opening the MMI was possible thanks to the enthusiastic support of the ÉNS de Lyon**, which provided a physical place to the house, **and of the Université Lyon 1**, which included the activity of the director of the MMI into its teaching load. Direction of the MMI is an almost full time activity that would not have been possible otherwise.

Another major difficulty is related to co-founding administration. Two of the natural partners of Milyon for mediation activities are the Cap'Maths consortium and the Animath association, which co-fund mediation activities nationwide. The fact that the MMI lacks, for the time being, of legal personality, prevents it from receiving directly such founding. The Université de Lyon, which administrates the Milyon endowing, declining administrating co-founding, the MMI has to acquire a legal personality in the near future. The HEIs we contacted were unable to propose us a convenient solution.

Finally, the actions of the MMI are largely based on volunteering. This is not only due to the enthusiasm of the colleagues involved in these activities, but also on the lack of concrete recognition of mediation activities vs the research or academic ones. This is a major problem, and solution is not in view.

**To be done.** One of Milyon's top priorities is to **secure the MMI's existence and founding beyond 2019**. Discussions with the CNRS concerning the legal personality of the MMI are on the way. So are discussions for the creation (horizon 2017–2018) of either a national foundation for mediation in M & CS, or a local foundation supporting both the mediation activity and a research center.

The "états généraux de la diffusion" will be held in April 2015, and will put the basis of the development of the activities of the MMI in the future. One of the hot topics will be the training of teachers for the future computer science class hours (to start in 2015).

The MMI will enhance its presence in schools (discussions to be held during the spring 2015), probably in collaboration with partner associations like Ébulliscience.

The MMI projects to involve the R&HEIs that are less present in its current activities, especially INRIA and the engineering schools École Centrale de Lyon and INSA de Lyon. The perspectives of development are more challenging in CS, where the tradition of mediation is less developed than in M.

Starting fall 2015, the MMI will supervise part of the master students internships, by training them to math education through experiments, in the spirit of the activities the MMI promotes in schools.

**In short.** After a delayed start due to technical difficulties, the **MMI develops very quickly** its activities. While the near future is very promising, the **major challenges** are related to the **MMI's durability**, and with its mid and long-term development: (private) founding for the MMI via a foundation, and "professionalization" of its activity.

The **summer camps attracted a very high level audience (190 students among the best in the world)**. Thanks to this two flagship activities, Lyon became a major place in scientific mediation.

## 1.5 Visibility, outreach, sharing and promotion actions of the Labex

**Done.** From the very beginning, the website of Milyon <http://milyon.universite-lyon.fr> was hosted by the Université de Lyon. The MMI website <http://math.univ-lyon1.fr/mmi/> is operational since the end of 2012. The two websites present updated agendas of the activities, as well as general information and information about the grants system.

In February 2014, the Labex hired a communication officer, for the time being for two years, but most likely finally for a longer period. Since her arrival, the officer enhanced the communication around the Labex activities.

### Realizations:

- 1) Worldwide advertisement of grants system via posters, flyers and communication through an address list.
- 2) Advertisement of the events via the CNRS information letter, the Université de Lyon 1 websites and information letter (including a zoom on the activity of the researcher Vincent Calvez), and of the ÉNS de Lyon website (in particular for the Milyon grants).
- 3) Press kits for the mediation events, including support for national activities (national press kit for the Forum des Mathématiques Vivantes, 21–22 March 2015). Moreover, several mediation activities are advertised via the Association of Mathematics Teachers and the websites of Cap'Maths and Animath.
- 4) Goodies and visual advertising for the mediation activities, including press insertions.
- 5) Milyon has a sponsoring agreement with the CNRS mediation website Image des mathématiques.

### In addition:

- 6) All the research activities supported by the Labex mention the Labex and PIA support. So do the postdoctoral fellows and PhD students. In principle, the same occurs for the publications, but progress is still to be made.
- 7) The trimester "Resource Optimization for Exascale Systems: Models and Algorithms" as well as the grants systems were advertised by AMS notices.
- 8) The Labex participated to the inter-Labex event "Journée scientifique de l'Université de Lyon", November 5<sup>th</sup> 2014, with a presentation of the MMI.
- 9) Grants and training programs are advertised via the Labex network website.

The **major communication event** of the Labex was the "**Journée de restitution du Labex Milyon**", January 13<sup>th</sup> 2015, in presence of research vice-presidents of the R&HEIs and of the scientific committee of Milyon. This day gave a realistic description of the activities and achievements of Milyon, including a visit of the MMI and a presentation of some of its activities (see Section 2A).

**On the way.** The intranet will soon be operational. The websites of MMI and Milyon will be upgraded in 2015.

Webpages of the Labex visitors and publications are in progress.

Global envelope for communication (excluding salary): 10 K€/year in 2012–2014, and 35 K€ in 2015.

## 2. LABEL AND ASSOCIATED FOUNDING IMPACT

### A) Scientific achievement description

#### A1. Research

##### A1.1 Initiation of the projects, thematic quarters and conferences

As mentioned in Section 1, the "heavy" scientific events organized by Milyon are thematic quarters and international conferences. The preparation of such events being made several years in advance, Milyon started by organizing two

meetings around the doctorate honoris causa of prestigious scientists working in excellence fields of the research in Lyon (dynamical systems, complexity). In parallel, Milyon launched within the three UMRs calls for proposals for the organization of thematic quarters. Now that Milyon goes full steam, the calls for proposals concern three or four quarters per year. Total founding for such events went as follows: 70 K€ in 2012, 200 K€ in 2013, 250 K€ in 2014, 195 K€ in 2015, and more than 225 K€ in 2016. This is to be compared with the 900 K€/year envelope received by the Labex.

Projects are selected via two calls for projects each year. Advised by the research commission, the committee evaluates the scientific and attractiveness impact of the proposed events, the adequacy of the required founding, as well as the co-founding effort made by the organizers.

We next present the quarters, conferences and doctorates honoris causa organized by Milyon.

• **Turing days and doctorate honoris causa of Leslie Valiant**, July 2<sup>nd</sup>–4<sup>th</sup> 2012 (main organizer Éric Fleury (LIP), Milyon founding 35 K€)

2012 was the centennial year of the birth of Alain Turing, scientist celebrated by both mathematicians and computer scientists. His interdisciplinary approach to problems is a symbol of the interactions Milyon wants to develop between the M & CS communities. The fascinating personality of the mathematician, founder of computer science, and philosopher, gave the organizers the opportunity to imagine the Turing days as a mix of scientific mediation, research, and prestige event.

This started with a general audience multidisciplinary (computer science, philosophy, epistemology, etc.) day around the heritage of Alain Turing and the influence of the notion of universal machine. This day was also the occasion of a doctorate honoris causa of the ÉNS de Lyon ceremony for Leslie Valiant, fundamental computer scientist, Jefferson Coolidge Professor at Harvard, winner of the Turing prize (awarded since 1966 by the Association for Computing Machinery) in 2010, and of several other prestigious prizes (Nevanlinna, Knuth, etc.).

A second event was the conference on "Turing's heritage: Logic, Computation & Complexity". During these events, more than 200 participants had the opportunity to hear 19 prestigious lecturers (among them, Leslie Valiant, Gérard Berry from the Collège de France and the philosopher Gilles Dowek). The detailed program is available at <http://www.turing2012.fr>.

On this occasion, master students realized a Turing machine, made popular by a CNRS movie that attracted more than 100 000 views [the-turing-machine-comes-true](http://www.turing2012.fr). This machine became a major attraction of the mediation activities of Milyon.

The days were completed by a GDR CNRS "Informatique Mathématique" workshop on "Complexity and Finite Models".

The general audience impact of the days was very noticeable. Le Monde, the CNRS journal, and the DocSciences magazine covered the events.

• **Recent Progress in Lagrangian and Hamiltonian Dynamics – a conference in Honor of John Norman Mather 70<sup>th</sup> Birthday, and doctorate honoris causa of John Mather**, June 4<sup>th</sup>–9<sup>th</sup> 2012 (main organizer Albert Fathi (UMPA), Milyon founding 35 K€)

This congress gathered 80 participants from Brazil, Canada, Chine, Croatia, France, Germany, Great Britain, Israel, Italy, Japan, Mexico, Russia, Uruguay, on the occasion of the 70<sup>th</sup> birthday of John Mather, Professor at Princeton and member of the National Academy of Science, well known for his work in Hamiltonian dynamics and singularity theory.

An important number of lectures were devoted to the Arnold diffusion, a hot subject in Hamiltonian Dynamics related to the recent work of John Mather. Some of world's best experts in this field (P. Bernard, S. Bolotin, C.-Q. Cheng, R. de la Llave, A. Delshams, V. Gelfreich, J.-P. Marco, K. Zhang) presented the most recent developments in this direction.

The conference covered a wide range of other present-day topics in system dynamics and beyond, through lectures delivered by prestigious mathematicians, including several Fields medalists (V. Bangert, H. Hofer, K. Khanin, R. Moeckel, L. Polterovich, C. Villani, J.-C. Yoccoz, L.S. Young).

During the conference, a significant number of PhD students and post-doc researchers met some of the most important recent contributors in Lagrangian and Hamiltonian dynamics; this led to very enriching discussions.

In honor of his important contributions, John Mather was awarded a doctorate honoris causa of the ÉNS de Lyon.

• **Trimester "Mathematics and Biology"**, February–June 2013 (14 organizers, main organizers Vincent Calvez (UMPA), Fabien Crauste (ICJ), Milyon founding 150 K€), <http://mathbio2013.sciencesconf.org>

**The trimester was a sound achievement of Milyon.** The organizers brought together mathematicians, physicists, biologists, and researchers in medicine to a series of interdisciplinary research oriented events. A cumulated audience of more than 400 participants attended four conferences, a spring school and a workshop. A noticeable fact is that organizers were from all the communities involved: mathematics, biology, medicine, and physics.

The **conference "Biological invasions and evolutionary biology, stochastic and deterministic models"**, March 11<sup>th</sup>–15<sup>th</sup> 2013, gathered 90 participants for 25 talks and 10 posters. The originality of the program consisted in presenting the complementary views of mathematicians from the PDEs and probabilities communities, as well of evolutionary biologists. 15 mathematicians and 10 biologists from Australia, Austria, Canada, China, France, GB, The Netherlands, Portugal, Spain, USA gave the talks. Among them, we mention the presence of leading experts (Henri Berestycki, Laurent Desvillettes, Pierre-Emmanuel Jabin, Sylvie Méléard, etc.) and of some of the most promising young mathematicians (Sepideh Mirrahimi, Amandine Véber, etc.). The organizers let an important time for free discussions, in order to favor the contacts between the two communities.

The conference focused on space evolution of heterogeneous populations, genetic flux, impact of climate change on evolution, ecology, evolution of invasive species, structured populations, adaptive dynamics, and epidemiology. It led to several **significant developments**, especially by Vincent Calvez and coauthors, on the evolution of the dispersion of populations, and the evolution of the aging of populations. **Vincent Calvez (UMPA) considers this trimester (by the visibility given by its organization, and by the research themes it suggested) as crucial in his win of a 2015 ERC starting grant.**

Among the fallouts of the conference: a co-tutelle PhD in mathematics and biology, and the decision to exchange every two years in a series of conferences (next one: Lyon 2015).

The **“Mathematical Modeling in Cell Biology” conference**, March 25<sup>th</sup>–29<sup>th</sup> 2013, gathered 70 participants who followed 15 full lectures and 9 short lectures by junior participants. This time, the involved communities were those of applied mathematicians and of (experimental or theoretical) physicists specialists of cell biology problems. The purpose of the meeting was twofold: to favor the interactions between the two communities, and to initiate the mathematical study of several new physically pertinent models. The lecturers were from Austria, Chile, France, Germany, GB, and USA. The junior participants delivered beautiful lectures, and scientific exchanges were very animated and fruitful.

The **“Mathematical modeling: A powerful tool for anti cancer drug development” day**, April 12<sup>th</sup> 2013, was an intense event in presence of mathematicians, doctors, researchers in medicine, representatives of corporate pharmaceutical companies (Roche, Astra Zeneca, Merck Serono), contract research organizations (Pharsight, Novadiscovery, Cosmo). An introductory session presented the issues raised by biologists and clinical scientists about drug development. Four specialized sessions (Overview of model-based drug development, From preclinical to clinical settings: translational approaches, Relationships between tumor dynamics and clinical benefits, Modeling of system biology) followed.

The day was a huge success by the number of participants (almost 60), the quality of the talks and discussions, and the presence of leading clinical scientists experts in modeling (René Bruno, Jean-Yves Blay, Gilles Freyer). A survey in European Journal of Cancer will synthesize the conclusions of the discussions, and the participants decided to meet again on a regular basis.

The **“Systems Biology Approaches for Infectious Processes” conference**, May 13<sup>th</sup>–15<sup>th</sup> 2013, brought together biologists, biochemists, geneticists, biophysicists, epidemiologists, mathematicians and physicists. More than 110 participants assisted to four sessions (Microbiology, Immune responses, Evolution of pathogen agents, Epidemiology). The keynote speakers were Jacky Snoep (biochemists, South Africa), Jason McDermott (computational biologist, USA), Yoram Louzoun (mathematician, Israel), Ron Germain (biologist, USA), Alain Perelson (biophysicist, USA), Paul Sharp (geneticist, GB), Michael Lässig (theoretical physicist, Germany), Christophe Fraser (epidemiologist, GB), Alain Barrat (physicist, France). The presence of representatives of corporate pharmaceutical industry (Merial, Sanofi-Pasteur) showed the potential interest of the emerging approaches to infectious processes discussed during the conference.

At the **“Multiscale modeling in life sciences” spring school**, May 27<sup>th</sup>–31<sup>st</sup> 2013, 50 participants from Austria, France, Germany, Poland, USA followed lectures delivered by Arnaud Chauvière, Pierre Degond, Bard Ermentrout, Denis Thieffry, Raphaël Voituriez.

The last event of the trimester was a **Conference in the honor of Mickael Mackey’s 70<sup>th</sup> birthday**, June 3<sup>rd</sup>–6<sup>th</sup> 2013. Almost 70 participants from 18 countries had the opportunity to exchange with mathematicians and biologists working around the research themes of Mickael Mackey (delayed equations, stochastic equations, neurosciences, genes regulation, cell cycles, oscillatory dynamics, etc.). The conference enhanced the visibility of local mathematicians active in these fields. A volume of original research articles submitted by the participants will appear in Mathematical Modeling of Natural Phenomena.

A final **overview of the trimester**: Milyon gave young promising mathematicians from Lyon (Vincent Calvez, Fabien Crauste, Thomas Lepoutre, Laurent Pujo-Menjouet) the opportunity to organize an important international event, extremely original in its conception, that boosted the visibility of mathematical biology in Lyon, and opened very interesting and challenging research perspectives. Clearly, this would have been much more difficult to achieve without an “-ex” structure. Trimester’s activity was enforced by three one-month invitations (Peter Kim –Australia, Mark Koury – USA, Malay Banerjee –India) that gave rise to courses, seminars, and the research article [111]. Nine shorter time invitations allowed putting the bases of new promising scientific collaborations.

• **Thematic Quarter on “Compilation: Interactions with Languages and Architectures for High-Performance Computing”**, April–July 2013 (main organizer Alain Darte (LIP), Milyon founding 80 K€), <http://Labexcompilation.ens-lyon.fr>

The quarter was built around the main research interests of the Compsys (COMPilation of embedded SYStems) project-team of LIP and INRIA: development of code analysis and code optimization techniques, for programming or designing embedded computing systems. The team focuses on both back-end optimization and front-end transformations. Recently, teams activity shifted towards compilation for programmable hardware accelerators and the analysis of parallel languages, in particular streaming languages.

Four activities: a spring school, a “keynotes” conference, a conference on compilers for parallel computing and the “French Days on Compiling” attracted 220 participants from numerous countries. The organizers mixed existent events with new created ones; this sounds reasonable in the perspective of a future development of a research center.

**“French Days on Compiling”**, April 2<sup>nd</sup>–4<sup>th</sup> 2013, is a bi-annual event of the French community in compiling <http://compilation.gforge.inria.fr>, which is affiliated to two GDRs of the CNRS (Architecture-Systems-Parallelism, and Software Engineering). The quarter hosted the 6<sup>th</sup> edition (in Annecy), organized by Laure Gonnord and Fabrice Rastello from the Compsys team. The 42 participants assisted to the official opening of the quarter and to the 16 conferences.

Since the founding articles of Paul Feautrier (LIP), the French community is particularly active in the optimization and analysis of polyhedral codes. Worldwide, academic and industrial teams are also active in this field, which became popular thanks to the development of new competitive optimization software, with applications ranging from the analysis and testing of programs to compilers for FPGAs. Despite these promising applications, the research community in these topics is not structured yet, and before 2013 the only scientific event devoted to polyhedral codes was the workshop IMPACT, satellite of the conference HIPEAC 2011 <http://www.hipeac.net>. The **School on polyhedral code analysis and optimizations**, May 13<sup>th</sup>–17<sup>th</sup> 2013, was organized with the double ambition of dissemination towards students and researchers in neighbor research domains, and towards structuring the research in the field, via a website

of the community and a future reference book. Seven different subjects (a half-day for each of them) were presented. After a historical introduction to the domain (P. Feautrier, LIP, and S. Rajopadhye, Colorado State University), the audience was introduced to the main topics, concerning the connections between the exact approaches, which are at the heart of the polyhedral techniques, with the abstract interpretation techniques (lecture of A. Miné, CNRS, ÉNS Paris), respectively with approximation techniques (lecture of B. Creusillet, Silkan company). Other lectures dealt with code transformations (L.-N. Pouchet, UCLA), manipulations of relations over integers (S. Verdoolaege, Leuven, INRIA), compilers for distributed memory (U. Bondhugula, IIS Bangalore, and A. Darte, LIP), and optimization for SIMD parallelism (P. Sadayappan, Ohio State University, and N. Vasilache, Reservoir Labs, New York). 56 participants from Belgium, China, France, GB, India, Ireland, Italy, USA, including researchers from abroad with research interests distinct from polyhedral codes, contributed to the success of the school.

The development of FPGAs, GPGPUs and multi processors, now widely used, but heterogeneous and difficult to program, requires new standards on compilers and programming languages, in terms of performance and software portability. Various research projects and programming languages (PGAS languages, streaming languages, source-to-source programming) try to undertake these challenges. It seemed important to the organizers of the quarter to try to connect the different approaches, in order to understand the different underlying compilation problems, the rationale behind the architectural choices, as well as the performance limitations. In cooperation with the Lyon Calcul federation <http://lyoncalcul.univ-lyon1.fr>, a **Keynotes on HPC Languages** was organized on June 29<sup>th</sup>–July 2<sup>nd</sup> 2013, <http://Labexcompilation.ens-lyon.fr/hpc-languages>. 13 leading experts gave 2 hours keynotes lectures: R. Schreiber (Hewlett Packard Labs), J. Mellor-Crummey and V. Sarkar (Rice), K. Yelick (Berkeley), D. Grove and R. Rabbah (IBM Watson), B. Chamberlain (Cray Inc.), F. Bodin (Rennes 1), R. Badia (UPC Barcelona), A. Cohen (Paris 6, INRIA, ÉNS Paris), Y. Orlarey (Grame), K. Knobe (Intel, Massachussets), P. Sadayappan (Ohio State University). The audience was very important for such an event: 71 participants from Brazil, Denmark, France, India, Italy, The Netherlands, Spain, Sweden, Switzerland, and USA. Several French participants were researchers from industry (STMicroelectronics, CGC, EASii IC, Limagrain, CEA) or from academic laboratories outside the computer science community (Creatis in medical imaging, Institut Jacques Monod in biology, CETHIL in thermic, GRAME in music). The event was highly successful.

The 13<sup>th</sup> **Compilers for Parallel Computing conference**, July 3<sup>rd</sup>–5<sup>th</sup> 2013, <http://Labexcompilation.ens-lyon.fr/cpc2013>, was the Lyon edition of a well-established European meeting, which takes place every 18 months. This is a quite uncommon event, to which the participation is possible only on invitation, and with proceedings that are distributed only to the participants. The 47 participants (from Belgium, Canada, France, GB, Japan, The Netherlands, Portugal, Spain, Switzerland, Taiwan, USA) have attended 29 lectures. Program: <http://Labexcompilation.ens-lyon.fr/cpc2013/participants>

A final **overview of the trimester**: Milyon gave the Compsys team the opportunity to increase its visibility in its research domains, to disseminate its expertise in polyhedral codes and to put the ground of new collaborative tools in this field. The trimester relied in part on a successful collaboration between Compsys and the Lyon Calcul federation. This finally led to the joint project of organization of a semester on HPC in 2016, which was approved and is supported by Milyon; see Violaine Louvet's presentation <http://milyon.universite-lyon.fr/Labexday/HPC>

• **Conference "Dynamics on Homogeneous Groups and applications", and doctorate honoris causa of Grigory Margulis**, June 12<sup>th</sup> –14<sup>th</sup> 2013 (main organizer Georges Tomanov (ICJ), Milyon founding 15 K€)

The doctorate honoris causa awarded by the Université Lyon 1 gave Milyon the opportunity to organize a scientific conference around some of the themes that had been considered by G. Margulis during his career. Grigory Margulis received many awards (e.g. Fields medal, Wolf prize) for his mathematical achievements, and they indeed cover a wide spectrum of mathematical themes: ergodic theory, discrete subgroups of Lie groups (from many viewpoints: algebra, geometry, dynamical systems), algebraic group theory, differential geometry, etc.

In order to keep the number of lectures at a reasonable level, some choices of topics had been made. They mainly corresponded to one of G. Margulis' most recent mathematical interests, namely dynamical systems on homogeneous spaces. This choice also allowed the organizers to invite an important number of young colleagues involved in the field. Mathematically, the viewpoint of studying (semisimple, unipotent) flows on quotients of simple groups by lattices is a crucial idea due to Margulis in order to prove long-standing conjectures in number theory. Some conjectures are solved via this viewpoint (e.g. the Oppenheim conjecture on values of quadratic forms, or some problems on diophantine approximations—hopefully eventually leading to Littlewood's conjecture). Some of them are still active fields of research. A noticeable point is the fact that this approach can be combined with representation-theoretic questions. A typical example is the connection between Howe-Moore's theorem on decay of matrix coefficients of unitary representations and Hopf's ergodicity of the geodesic flow in negative curvature.

Numerous internationally recognized mathematicians accepted to come and gave talks on their most recent results. Among them we mention Manfred Einsiedler (ETH Zürich), Anatole Katok (Penn State University), Dima Kleinbock (Brandeis University), Hee Oh (Yale University), Nimish Shah (Ohio University), Barak Weiss (Tel Aviv), Alex Gorodnik (Bristol), Herbert Abels (Bielefeld), Anders Karlsson (Geneva), Elon Lindenstrauss (Jerusalem, also a Fields medalist). Finally, there was a very good balance between experienced and young colleagues.

About 60 participants were officially registered, but the actual figures were much higher. The high quality of the talks and the unexpectedly numerous audience largely contributed to the success of the conference.

• **"Mathematical Structures of Computations" Weeks**, January–February 2014 (organizers Patrick Baillot (LIP), Yves Guiraud (INRIA, Paris 7), Philippe Malbos (ICJ), Milyon founding 75 K€), [SMC2014](http://SMC2014)

The "weeks" were a highly structuring event in certified mathematics, programming languages and the mathematical structures of computation, and interacted with the "Semantics of proofs and certified mathematics" trimester at the Henri Poincaré Institute [SPCM\\_IHP2014](http://SPCM_IHP2014). The event, attended by 235 participants, addressed several aspects of the interactions between Mathematics and Computer Science. On the one hand, mathematical methods play a crucial role in several fields of Computer Science, such as formal verification of programs and the theory of programming languages: logic and proof theory are particularly useful in this direction, and more recently other theories as algebraic topology found interesting applications. On the other hand, concepts and techniques coming from Computer Science have

noticeable applications in Mathematics, e.g. rewriting gives algebraic decision procedures and algorithms to compute homological invariants. The weeks illustrated this crossed enrichment under several aspects centered on the notion of computation.

The **"Recent developments in Type Theory"** week, January 13<sup>th</sup>–17<sup>th</sup> 2014 (organizers P.-L. Curien, CNRS, Paris 7, H. Herbelin, INRIA, Paris 7), was devoted to homotopy type theory, which enriches the correspondence type/formula and proof/program into a correspondence type/space, and interprets the equality type of proof theory in terms of homotopy. It combined winter-school style lectures on Continuation (O. Dany –Aarhus, C.-C. Shan –Indiana), Proving with Side Effects H. Herbelin –Paris 7, D. Ilik –INRIA), and Homotopy Type Theory and Univalent Foundations (N. Gambino –Leeds, D. Licata –Wesleyan University, P. Lumsdaine –Dalhousie University) with ten invited lectures. The 60 participants had the opportunity to explore in depth the extensions of type theories to effects.

The **"Algebra and Computation"** week, January 20<sup>th</sup>–24<sup>th</sup> 2014 (organizers S. Gaussent, ICJ, Y. Guiraud, INRIA, Paris 7, P. Malbos, ICJ), was a follow-up of the "Operads and Rewriting" (2011) and "Algebra and Computing" (2012) conferences devoted to recent developments of computational methods in algebra and to the algebraic formalization of computation. Since the eighties, several results (Anick, Squier, Brown, Dehornoy-Lafont, etc.) have shown the interest of methods originating in rewriting theory in the resolution of algebraic decision problems or of the computation of homological invariants. This allows in particular computing of normal forms, and thus addressing decision problems (Dehn's problems, combinatorics of Coxeter and Artin groups, etc.) through computational methods. The 50 participants followed two courses (P. Dehornoy –Caen, C. Stroppel –Bonn) and ten invited talks that gave an overview of the Garside calculus, Artin groups, diagram algebras in representation theory, and rewriting methods in operad theory.

The **"Directed Algebraic Topology and Concurrency"** week, January 27<sup>th</sup>–31<sup>st</sup> (organizers L. Fajstrup, Aalborg, É. Goubault, CEA LIST, École Polytechnique, S. Mimram, CEA LIST, École Polytechnique), was motivated by the increasing interest in the applications of algebraic topology in the study of concurrency. This new field at the intersection of topology and computer science was started by a series of works that introduced semantics of concurrent programs based on topological spaces, whose points model the states of programs and paths model executions of the program. In this setting, homotopic paths correspond to concurrent programs giving the same result. This point of view has provided new tools in the evaluation of concurrents. The 35 participants attended lectures devoted to the latest developments in this direction coming from directed algebraic topology, and applications of topology to concurrency. The week comprised three courses (D. Feichtner-Kozlov, Bremen, E. Haucourt, CEA LIST, École Polytechnique, R. van Glabbeek, University of New South Wales), and nine invited talks.

Many critical systems (nuclear plants, driving of aircrafts, etc.) depend largely on software tools that need to be efficient but also perfectly safe. For safety purposes, the use of formal proofs is wider and wider spread. However, major difficulties still remain unsolved in practice. Even at the lowest level, validation of basic arithmetic operations is still a real challenge in terms of formal proofs. This motivated the **"Formal Proof, Symbolic Computation and Computer Arithmetic"** week, February 3<sup>rd</sup>–7<sup>th</sup> (organizers N. Brisebarre, LIP, J.-M. Muller, LIP), dedicated to launching new projects related to formal proofs of elementary operations of floating-point arithmetic or of function evaluation processes, of certification of rational/polynomial approximations of solutions of differential equations. The 40 participants attended 10 talks delivered by experts in numerical computing, formal proof, and symbolic computation.

Logic has been since the 1970s a constant source of concepts and methods for the design and study of high-level programming languages. Among the notions derived from this approach one can cite on the one hand advanced type systems, which allow one to analyze the behavior of programs and guarantee some properties statically, and on the other hand logics for verification, such as Floyd-Hoare logic. These techniques have initially been developed for sequential programs, but a growing interest has then emerged for concurrent programming, where processes that communicate and evolve in a non-deterministic way carry out computation. The concurrent setting has raised new challenges, as the complexity of the new systems makes the task of checking the validity of programs far more difficult. The **"Concurrency, Logic and Types"** week, February 10<sup>th</sup>–14<sup>th</sup> 2014 (organizers P. Baillot, LIP, D. Pous, LIP, D. Hirschhoff, LIP) focused on recent developments and problems at the interface between programming languages and concurrency theory. The 50 participants attended the eleven invited lectures, which brought together different viewpoints on the challenges in these areas, and fostered interactions between researchers.

A final **overview**: the event structured the interactions on formal proof, rewriting and certified mathematics between ICJ (Philippe Malbos) and LIP (Patrick Baillot, Nicolas Brisebarre, Jean-Michel Muller). Combined with the trimester at the Institut Henri Poincaré, it also structured the research in these fields. It gathered two communities for fruitful and enriching changes on hot subjects in both Mathematics and Computer Science.

• **Bimester "Algebraic Groups and Representations"**, June–July 2014 (organizers Michel Brion (Grenoble), Philippe Gille (ICJ), Bertrand Rémy (ICJ), Nicolas Ressayre (ICJ), Amaury Thuillier (ICJ), Milyon founding 75 K€), [AGR2014](#)

Algebraic groups are at the intersection of group theory and algebraic geometry. Their structure was studied by C. Chevalley (algebraically closed case), and by A. Borel and J. Tits (general case). Recent results of B. Conrad, O. Gabber and G. Prasad, based on older ideas of J. Tits, somehow concluded the major part of the structure theory of connected affine algebraic groups. Understanding these results was one of the motivations for organizing the event.

In a different direction, a major part of the classical representations theory is, ultimately, encoded by combinatorial objects describing the structures (e.g. highest weight theory of H. Weyl and E. Cartan). These combinatorial methods are nowadays largely complemented by a geometric approach initiated by A. Borel and A. Weil. On the other hand, one of the most difficult and relevant problems in the field is the understanding of modular representations. This problem has been geometrized by the works of G. Lusztig, which gave a clear conjectural picture of the organization of these representations. Very recently, G. Williamson gave (numerous) counterexamples to Lusztig's conjecture, and understanding these examples was the second motivation of the bimester.

The bimester, mainly organized by members of the Algebra, Geometry and Logic team of the ICJ, was intended to cover both the basics and the recent advances in the above-mentioned directions. It was meant for a large audience, from graduate students to experts in the field, and was structured as follows: two weeks of summer school, two workshops, and two conferences.

More than 50 young participants attended the summer school. The **first week of the summer school**, June 2<sup>nd</sup>–6<sup>th</sup> 2014, proposed four introductory six-hours courses on Affine groups in positive characteristic (P. Gille, ICJ), Geometric representation theory (E. Letellier, Caen), Representation of quivers (N. Ressayre, ICJ), and Kazhdan-Lusztig theory (P. Shan, CNRS, Caen). The **second week of the summer school**, June 9<sup>th</sup>–13<sup>th</sup> 2014, offered four advanced six-hours courses on Possibly non-affine algebraic groups (M. Brion, CNRS, Grenoble), Pseudo-reductive groups (B. Conrad, Stanford), Path models (S. Gaussent, ICJ) and Bruhat-Tits theory (B. Rémy, ICJ).

More than 30 participants attended each of the workshops and conferences.

The **workshop "Structure of algebraic groups"**, June 16<sup>th</sup>–20<sup>th</sup>, discussed the theme of rational points on equivariant compactifications of algebraic groups, in particular Gabber's recent construction of compactifications of algebraic groups over arbitrary fields with positive characteristic. The workshop was opened by B. Conrad, who introduced the setting and problems, and presented the conclusions at the end of the week. The other lecturers were N. Bhaskhar (Emory University), O. Gabber (IHÉS), J. Gandini (SNS, Pisa), Z. Gao (Orsay), P. Gille (ICJ), Y. Hu (Caen), T.-Y. Lee (Duisburg), L. Moret-Bailly (Rennes), A. Tchoudjem (ICJ).

The **conference "Structure of algebraic groups"**, June 23<sup>rd</sup>–27<sup>th</sup> 2014, reported on recent research on the structure of algebraic group. It proposed more than twenty lectures; among the participants, we mention B. Conrad (Stanford), G. Prasad (Ann Arbor).

The **workshop "Representation of algebraic groups"**, June 30<sup>th</sup>–July 4<sup>th</sup> 2014, was focused on Soergel bimodules and their applications to representations, in particular to representations of algebraic groups in positive characteristic. Courses on Soergel bimodules (G. Williamson) and the Lusztig conjecture (W. Soergel) have been followed by eight invited lectures (H.H. Andersen –Aarhus, S. Arkhipov –Aarhus, D. Juteau –Caen, M. Kaneda –Osaka, M. Lanini –Nürnberg, G. Lusztig –MIT, C. Mautner –Max Planck Bonn).

The **conference "Representation of algebraic groups"**, July 7<sup>th</sup>–11<sup>th</sup> 2014, reported on recent research on representations of algebraic groups and related structures. It proposed more than twenty lectures; among the participants, we mention A. Knutson (Cornell), G. Lusztig (MIT), O. Schiffman (Orsay).

A final **overview**: the bimester attracted a considerable audience, including brilliant young Russian mathematicians (HSE Moscow) and students from prestigious American universities (Berkeley, Cornell). It allowed the dissemination of two recent groundbreaking results in the field (Conrad-Gabber-Prasad and Williamson). The event contributed to the visibility of the excellent team in groups and representation theory at ICJ. The flexibility of the Milyon support allowed a long-term invitation of B. Conrad (Stanford), whose support was crucial to the scientific organization of the bimester.

• **Month "Resource Optimization for Exascale Systems: Models and Algorithms"**, July 2014 (organizers Yves Robert (LIP), Bora Uçar (LIP), Frédéric Vivien (LIP), Milyon founding 51 K€)

The organizers took advantage of the opportunities offered by Milyon in order to host at Lyon two prestigious periodical events and to combine them with short-term invitations.

The **9<sup>th</sup> "Scheduling for Large Scale Systems" workshop**, July 1<sup>st</sup>–4<sup>th</sup> 2014 (organizers Loris Marchal (LIP), Yves Robert (LIP), Frédéric Vivien (LIP)), [9SLSS2014](#), was the ninth edition of this workshop series organized alternatively in France and USA. This selective workshop is on-invitation only, and is focused on problems of scheduling for large-scale systems. The current edition dealt more specifically with optimization problems for energy consumption, with system temperature, with data movement and with memory usage. In addition, the more traditional themes of the workshop, e.g. the load balancing or the platforms debit, were addressed. The platforms under consideration were most of the time heterogeneous and could include GPUs or multi-cores, and also could be subject to silent errors. Many talks addressed modeling of the application problems (e.g. the lectures on the runtime systems). A total of 55 participants, twenty of them from abroad (Austria, Germany, GB, Ireland, The Netherlands, The New Zealand, Portugal, Sweden, USA), attended the workshop. Among the participants, we mention E. Bampis (Paris 6), Ü. Çatalyürek (Ohio State University), K. Jansen (Kiel), J. Langou (University of Colorado at Denver), A. Munier (Paris 6), P. Raghavan (Penn State), Y. Robert (LIP), and J. Weissman (Colorado State University).

The **6<sup>th</sup> SIAM workshop on "Combinatorial Scientific Computing" CSC14**, July 21<sup>st</sup>–23<sup>rd</sup> 2014 (main organizers P. Hovland (Argonne National Laboratory), B. Uçar (LIP)), [6 SIAM CSC2014](#), followed five previous workshops organized alternatively in USA and Europe. It provided a forum for researchers from academia and industry interested in current research developments concerning the interactions between combinatorial mathematics and algorithms and scientific computing. 55 participants from Belgium, Brazil, The Czech Republic, France, Germany, GB, Israel, Norway, Switzerland, Turkey, and USA, attended the workshop, which focused on combinatorics and combinatorial algorithms for HPC. The three invited speakers were P. Dineas (Rensselaer Polytechnic Institute), T.G. Kolda (Sandia National Laboratories), and S. Toledo (Tel-Aviv). Their lectures focused on two main aspects: random algorithms for numerical linear algebra, and networks analysis. The workshop also hosted 27 contributed talks and 8 posters. The topics addressed included the modeling, analysis, bisection, clustering and partitioning of graphs, with applications to networks, as well as factorization of sparse matrices, iterative solvers, fast multi-pole methods, automatic differentiation, and also general issues concerning HPC and linear programming.

The organizers edited the book of abstracts <https://hal.inria.fr/hal-01054876>. A SIAM News (vol. 47, no 10, 2014) article described the event.

In order to enhance the international participation at the workshops, as well as for collaboration purposes, the organizers invited six researchers from GB, Israel, and USA for short-term visits at the LIP.

A final **overview**: by organizing two well-established and respected international events, Milyon increased the visibility of the Lyon site.

- **Month "Analysis in Action"**, August–October 2014 (organizers Alberto Farina (Amiens), Ivan Gentil (ICJ), Dragos Iftimie (ICJ), Petru Mironescu (ICJ), Milyon founding 51 K€)

The month was at the image of the research in analysis (in the wide sense) at ICJ. On the one hand, in the recent years the PDEs and Analysis team added to its harmonic and functional analysis research directions new domains in interest at the crossroads between analysis and other fields of mathematics (fluid mechanics, geometry, probabilities, quantum mechanics, relativity theory). On the other hand, ICJ and more generally mathematicians and mechanical engineers in the Lyon–Saint-Étienne area cover virtually all the fields of applied mathematics relying heavily on analysis (mechanics, probabilities, statistics, numerical computing, numerical analysis, modeling, mathematical biology, image processing, material sciences, etc.). It was thus natural to propose a month **devoted to the interactions of the analysis with other fields of pure and applied mathematics**. The month combined an existent event (the French-Romanian Conference on Applied Mathematics) with three workshops devoted to the interactions of the analysis with fluid mechanics, PDEs and geometry, and probabilities.

The **12<sup>th</sup> French-Romanian Conference on Applied Mathematics**, August 25<sup>th</sup>–30<sup>th</sup> 2014 (main organizers D. Iftimie, ICJ, P. Mironescu, ICJ) [CFR2014](#), was the Lyon edition of a biennial conference organized alternatively in France and Romania. Traditionally, this conference, which is, together with the European Laboratory Math-Mode, the flagship of the French-Romanian collaboration in mathematics, covers the whole spectrum of applied mathematics. Since 2008, it started opening to pure mathematics. The Lyon edition was the most successful of all in terms of participation (180 participants from 10 countries). The scientific committee (president: Bernard Helffer, Orsay) invited 20 plenary lecturers, most of them from France or Romania (in the tradition of the conference). These lecturers covered the full spectrum of applied mathematics, and the conference continued its policy of opening towards pure mathematics via invited lectures in mathematical physics, random matrices and harmonic analysis. Among the lecturers we mention P. Auscher (Orsay), V. Bonnaillie-Noël (Rennes), D. Bresch (Chambéry), F. Delarue (Nice), O. Druet (ICJ), A. Guionnet (MIT), S. Petermichl (Toulouse), D. Talay (Nice). The opening towards pure mathematics turned out to be so successful that it is planned to transform the event into the "French-Romanian Conference in Mathematics".

There were eight parallel sessions (and twenty session organizers): Analysis, Numerical Analysis, Mathematical Biology, Image Processing, Materials and Structures, Fluid Mechanics, Solid Mechanics, Stochastic Processes, Statistics. In total, there were more than one hundred contributed talks. In accordance to the tradition of the conference, a significant number of very young participants (around thirty) presented contributed talks.

The scientific level of the conference was very good. Two volumes of proceedings are planned to appear in *Confluentes Mathematici*, the open access journal supported by the mathematical community in Lyon.

The **"Geometrical and variational methods for nonlinear PDEs" workshop**, September 1<sup>st</sup>–5<sup>th</sup> 2014 (organizers A. Farina, Amiens, P. Mironescu, ICJ, E. Valdinoci, Berlin), [GVMNPDE2014](#), focused on the interactions between nonlinear PDEs and geometry, a typical subject being the relation between the geometry of a manifold and the existence of non trivial solutions for some nonlinear elliptic PDE. Fifty participants (including twenty students) attended sixteen lectures delivered by leading experts in the subject. Among them, we mention B. Dacorogna (Lausanne), N. Garofalo (Purdue, Pavia), P. Sternberg (Indiana), S. Terracini (Torino), J.-L. Vazquez (Madrid).

The **"Analysis-Probabilities" days**, September 29<sup>th</sup>–October 1<sup>st</sup> 2014 (organizers I. Gentil, ICJ, A. Guillin, Clermont), were a joint event of Milyon and of the ANR project Stab. The central theme of the meeting was the one of the connections between analysis and probabilities, with applications to PDEs and SDEs. Thirty participants from France, Italy, Japan, and Spain, attended fourteen lectures, among which we mention Rate of convergence of empirical measures in the Wasserstein distance (N. Fournier, Paris 6), Adaptive importance sampling techniques (T. Lelièvre, ÉNPC Paris), On the long time behavior of some piecewise deterministic Markov processes (F. Malrieu, Rennes), and Strong stationary times for one-dimensional diffusions (L. Miclo, Toulouse).

The **"Mathematics of Fluid Dynamics" workshop**, October 20<sup>th</sup>–23<sup>rd</sup> (organizers L. Brandolese, ICJ, V. Busuioc, ICJ, D. Iftimie, ICJ), [MFD2014](#), was devoted to mathematical challenges of fluid dynamics, domain of excellence in France in general and in the Rhône-Alpese region in particular. The workshop attracted more than fifty participants (and more than twenty from abroad), including twenty young participants. A 4 h 30 course on "Interface dynamics for incompressible flows in 2D: SQG, Muskat and Water Waves" by Diego Córdoba (Madrid, Princeton) was followed by 15 invited lectures and 5 contributed talks of young participants. Among the invited lecturers, we mention C. Cheverry (Rennes), G. Crippa (Basel), D. Gérard-Varet (Paris 7), G. Raugel (Orsay), F. Rousset (Orsay).

Two mid-term invitations (E. Pinto de Moura, M. Lopes Filho) allowed enhancing existent collaborations with D. Iftimie.

A final **overview**: the organization of the French-Romanian conference was a test for Milyon's ability to host a relatively large event. In addition to its scientific interest, this event enhanced the binational collaborations and brought more visibility to the applied mathematicians in Lyon. Other positive consequences include more Romanian candidates to the Milyon fellowships, future binational summer schools, and master programs agreements between Lyon and Timisoara.

The three workshops attired more audience than expected, and gave an overview of the present-day research in their respective domains in a very friendly atmosphere.

The participation was important (310 participants) and the month increased the visibility of the PDEs/Analysis team.

## [A1.2 Other conferences, workshops and scientific events](#)

In line with his mission of increasing the visibility and attractiveness of the Lyon–Saint-Étienne site, Milyon accorded full or partial support to smaller events. An additional mission is to give very active young colleagues or teams the

possibility of organizing events in their domain of expertise, and increases in this way their notoriety. To summarize, we favor two axes: organization of present-day research events that could not be funded otherwise and are proposed by the most active teams or young colleagues, and organization in Lyon of well-established international events.

There are four annual calls for such "light" projects, all of them evaluated by the research commission. According to the estimated scientific impact, and also according to the estimated impact on visibility, the board decides which projects are supported. Milyon's founding for such events went as follows: 22 K€ in 2012 (6 events), 50 K€ in 2013 (11 events), 37 K€ in 2014 (7 events), and (for the moment) 96 K€ in 2015 (12 events). The 2015 high figure is in particular due to the support to a prestigious international conference in honor of Étienne Ghys. We present below few of these events.

- **"Random Walks, random Media, Reinforcement"**, June 10<sup>th</sup>–14<sup>h</sup> 2013 (organizers J. Bérard (ICJ), N. Guillotin-Plantard (ICJ), C. Sabot (ICJ), Milyon founding 7 K€)

The probabilities team, one of the most active and visible in ICJ, organized this event in connection with its ANR project MEMEMO2. The workshop brought together 42 participants from several countries, mainly specialists in disordered media, interacting random walks and interacting particle systems. The topics involved in the workshop have been: interacting particles systems (sandpiles, activated random walks); random polymers; random walks in random environment; interacting random walks (reinforced/repulsive random walks); percolation; random partitions; and stochastic flows. It was organized around two mini-courses of V. Sidoravicius (IMPA, Rio de Janeiro) and T. Seppäläinen (University of Wisconsin at Madison), and 15 lectures. Many young researchers (PhD students or post-docs) have participated to the workshop and delivered short lectures. This gave them the opportunity to learn some new topics and to talk to senior researchers and eventually get to collaborate with them.

In his six-hours lectures, V. Sidoravicius focused on two examples of conservative, infinite-volume particle systems: the activated random walk model for reaction-diffusion and the stochastic sandpile model. This is a widely open subject that leads to many challenging open questions. He explained how sophisticated multiscale analysis gives precious information on these models. T. Seppäläinen opened his six-hours course with a brief introduction to the general  $(d+1)$ -dimensional lattice model of directed polymer in a random environment. He subsequently focused on properties of the explicitly solvable  $(1+1)$ -dimensional log-gamma polymer model. This model corresponds to a specific choice for the law of the environment (log-gamma). It enjoys of some remarkable identities and has in particular an explicit stationary version, obtained by an appropriate choice of boundary conditions, which can be used to derive various properties.

- **Conference on "p-adic Arithmetic Geometry"**, June 17<sup>th</sup>–20<sup>th</sup> 2013 (organizers V. Pilloni (UMPA), B. Stroth (CNRS, Paris 13), J. Tilouine (Paris 13), Milyon founding 8 K€)

The conference focused on the p-adic aspects of the Langlands program, either in its global versions (p-adic modular forms, completed cohomology and p-adic Galois representations of fields) or in its local versions (Galois representations of local fields, p-adic Hodge theory, p-adic representations of p-adic algebraic groups). In addition, some of the 19 lectures addressed topics related to neighbor subjects like the analytic aspects of the theory of automorphic forms, or on cohomology theories in algebraic geometry or rigid geometry. Forty participants (from Belgium, Canada, France, GB, and USA) attended the conference.

The most noticeable events of the conference were the participation of leading experts: D. Geraghty (Princeton), F. Herzig (Toronto), H. Hida (UCLA), E. Urban (Columbia); the possibility given to numerous young gifted mathematicians to present their results (among them, G. Dospinescu, which was later recruited as a junior researcher at UMPA); and the course delivered by D. Geraghty. This course allowed D. Geraghty to disseminate his new ideas on the modularity of Galois representations.

- **The 42<sup>nd</sup> annual International Conference on Parallel Processing ICPP2013**, October 1<sup>st</sup>–4<sup>th</sup> 2013 (organizers L. Lefèvre (LIP), Y.-C. Tseng (NCTU, Taiwan), Milyon founding 10 K€), [ICPP2013](#)

This well established conference provides a forum for engineers and scientist in academia, industry and government to present their latest research findings in all aspects of parallel and distributed computing. This "rank A" international event has a very strong impact in the HPC and distributed computing communities. The 2013 edition of this old tradition conference was the first one organized in France. In addition to the main session, the participants could attend one of the eight workshops (Parallel Programming Models and Systems Software for High-End Computing, Scheduling and Resource Management for Parallel and Distributed Systems, Power-Aware Algorithms, Systems, and Architectures, Heterogeneous and Unconventional Cluster Architectures and Applications, Applications of Wireless Ad-hoc and Sensor Networks, Parallel Software Tools and Tool Infrastructures, Embedded Multi-core Systems, Advanced Technologies of Cloud Computing) and to a posters session.

Accordingly to the tradition of the conference, the participation was very selective. The program committee supervised the panel of international experts in charge of the selection of the accepted communications. Three referees evaluated each submission. 59 articles (30 % of the total) were finally accepted.

The three keynotes of the event were "The Coming Era of Adaptive Control Systems in HPC" (L. Kale, University of Illinois at Urbana-Champaign), "Distributed Routing Algorithms in Networks: A Game Theory Approach" (B. Gaujal, INRIA Grenoble), and "Many-core GPUs: Achievements and future perspectives" (M. Ujaldon, University of Malaga).

- **The "REvISitiNg DEcadES of conservation laws" conference**, November 5<sup>st</sup>–7<sup>th</sup> 2014 (organizers S. Benzoni (ICJ), A. Heibig (ICJ), P. Lafitte (École Centrale Paris), B. Sévenec (UMPA), Milyon founding 7 K€), [REDESSINER](#), was a fest for the 60th anniversary of Denis Serre, Professor at UMPA and leading expert in conservation laws, who trained in and oriented to PDEs numerous students from ÉNS de Lyon that are now well established mathematicians. Almost 70 participants attended eighteen conferences on PDEs. Among the prestigious lecturers, we mention J.-F. Coulombel (CNRS, Nantes), B. Dacorogna (Lausanne), C. Dafermos (Brown), A.-L. Dalibard (Paris 6), T. Gallay (Grenoble), S. Méléard (École Polytechnique), A. Vasseur (Austin), R. Temam (Indiana), K. Zumbrun (Indiana).

The lecturers were invited to contribute with original research articles to a Festschrift of *Confluentes Mathematici*.

- **The Labex Day**, January 13<sup>th</sup> 2015, (Milyon founding 10 K€), [Milyonday](#), gave the almost hundred participants (members of the scientific committee of Milyon, colleagues from the three UMRs or from other units, representatives of R&HEIs, representatives of partners of the MMI) the opportunity to get acquainted to the organization and some of the achievements of Milyon.

The day started with a conference of E. Giroux (UMPA) on a joint work on holomorphy and convexity with J. Pardon (Stanford), issued from a Milyon invitation. Four thematic quarters were presented next. V. Calvez (UMPA) and F. Crauste (ICJ) presented the scientific challenges that motivated the trimester on mathematical biology, as well as its organization and several scientific developments possible thanks to the trimester. Similar approaches were undertaken by A. Darte (LIP), T. Dumont (ICJ), and V. Louvet (ICJ) for the thematic quarter on compilation and for the forthcoming semester on HPC; by N. Brisebarre (LIP) and P. Malbos (ICJ) for the weeks on mathematical structures of computation; and by N. Ressayre (ICJ) for the trimester on algebraic groups. The eight Milyon postdoctoral researchers presented their research via a poster session.

In the dissemination part of the day, the director of MMI, J. Germoni, gave a general description of the MMI and of its role. This was followed by the presentation of some specific activities, like the “Surfaces” exhibition, or Math $\alpha$ Lyon.

The day was the opportunity to give a lively description of Milyon and stimulated the emergence of new projects.

### **[A1.3 Invitations](#)**

The invitations are “light” projects and are thus evaluated as explained in Section 2A1.2. In Section 2A1.1, we saw that the invitations programs enhanced some of the thematic quarters. We mention here only the invitations that were not related to the quarters. At the **senior level**, Milyon invited 9 researchers, for a cumulated period of 9 months. We present below some of the interactions our guests had during their visit(s) in Lyon.

- **J. Maurice Rojas**, Professor of Mathematics and Computer Science and Engineering, Texas A&M University, [www.math.tamu.edu/~rojas](http://www.math.tamu.edu/~rojas), is an expert in Algorithmic Algebraic Geometry (including tropical and arithmetic methods), Fewnomial Theory, and Complexity Theory. He visited P. Koiran (LIP) and the MC2 team of LIP in 2012 and 2013 for joint research on number-theoretic approaches to circuit complexity. Their collaborations gave 4 preprints (3 accepted); see [92–95] on Milyon’s publications list.

- **Ivan Smith**, Professor of Geometry at the Department of Pure Mathematics and Mathematical Statistics, Cambridge, is an expert in symplectic topology, Floer theory, and mirror symmetry. In 2012, he visited E. Giroux (UMPA) and the symplectic geometry group at UMPA in 2012 for a series of lectures on Fukaya categories.

- **Christian Genest** and **Johanna G. Nešlehová** visited in 2013 A.-L. Fougères (ICJ) and the statistics group of the ICJ. Christian Genest is Professor of Statistics and Holder of the Canada Research Chair in Stochastic Dependence Modeling, McGill, [www.math.mcgill.ca/cgenest/](http://www.math.mcgill.ca/cgenest/). His research interests are in multivariate analysis, nonparametric statistics, and applications in finance and insurance. Johanna G. Nešlehová is Associate Professor of Statistics, McGill. Her research interests are in multivariate analysis, nonparametric statistics, and applications in risk management. Their collaboration gave publication [11] on Milyon’s publications list.

- **Jin Feng**, <http://www.math.ku.edu/~jifeng>, Associate Professor at the Department of Mathematics, University of Kansas, is a specialist in Probability and Analysis. In 2013, he spent two months visiting A. Fathi (UMPA) and the dynamical systems group in UMPA. An outcome of this visit is publication [7] on Milyon’s publications list.

- **Alexandra Silva**, Assistant Professor at Radboud University Nijmegen, [www.alexandrasilva.org](http://www.alexandrasilva.org), has as research interests coalgebra, semantics of programming languages, and logic. In 2012, 2013 and 2014, she visited F. Bonchi (LIP), D. Pous (LIP) and the Plume team of LIP for joint research on coinductive techniques for concurrent systems. These collaborations led to publication [21] and to preprints [112–113] on Milyon’s publications list.

At the **junior level**, the invitation program allowed short or mid-term (1 week-5 month) visits at a pre-doctoral, doctoral (or even postdoctoral) level, in view of a PhD, possibly in co-tutelle. This can be viewed as the research side of the training missions of Milyon. In total, Milyon offered partial support to 14 master or PhD students, or postdoctoral fellows (total founding 41 K€) for a cumulated period of almost 60 months. We consider this support possibility as one of the most “productive” ones. A striking example is the visit of

- **John Pardon**, PhD student, Stanford, <http://math.stanford.edu/~pardon/>, whose research interests are symplectic and contact geometry. In 2014, he visited E. Giroux (UMPA) and the symplectic geometry group at UMPA. The visit led to a very successful collaboration; see prepublication [99] on Milyon’s publications list.

### **[A1.4 Postdoctoral program](#)**

The “**regular**” **postdoctoral program** consists in two-years postdoctoral positions, with the possibility of a third year, in one of the three of Milyon’s UMRs. Total Milyon founding for 2011–2014: 450 K€.

As explained in Section 1.2, the call for applications opens in November and ends in January. Results are communicated in February, and contracts start in September or October. The research commission, after consulting the interested colleagues, proposes the ranking of the candidates. In order to guarantee the insertion of the candidates, they must be endorsed of one of the members of the UMRs, who proposes a joint research project. To summarize, an application is evaluated in terms of achievements of the candidate, of possibilities of interaction within a team, of the research project and of its adequacy with UMRs research priorities. The number of candidates was around 80 the first year, and now stabilized to 115, with an increasing quality of the candidates year after year. We briefly present here our “veteran” postdoctoral researchers.

- **Jonathan Rouzaud-Cornabas**, PhD 2010 Orléans (adv. C. Toinard), post-doc Milyon 2011–2013, tutors E. Caron and F. Desprez (Avalon team, LIP). Research interests: security, distributed systems, cloud, information flow. Milyon publications: [2], [10], [26]. Currently Maître de Conférences at INSA de Lyon, in the Beagle LIRIS-INRIA team.

- **Riccardo Brasca**, PhD 2012 Milano (adv. F. Andreatta), post-doc Milyon 2012–2013, tutor V. Pilloni (UMPA). Research interests: p-adic modular forms, eigenvarieties. Currently Maître de Conférences at Paris 7.

- **Federico Aschieri**, PhD 2011 Torino/Queen Mary, University of London (adv. S. Berardi, P. Oliva), post-doc Milyon 2012–2014, tutor A. Miquel (Plume team, LIP). Research interest: mathematical logic. Milyon (pre)publications: [17–20], [23], [107–108]. Currently postdoctoral researcher, Institute of Discrete Mathematics and Geometry, Vienna University of Technology.

- **Irena Penev**, PhD 2012 Columbia (adv. M. Chudnovsky), post-doc Milyon 2013–2015, tutor N. Trotignan (MC2 team, LIP). Research interest: graph theory. Milyon prepublications: [101–102], and two other accepted papers.

- **Ennio Fedrizzi**, PhD 2012 Paris 7 (adv. J. Garnier), post-doc Milyon 2013–2015, tutor J. Vovelle (MMCS team, ICJ). Research interests: Stochastic Differential and Partial Differential Equations, Regularization by Noise. Milyon prepublication: [100].

Milyon opened six positions in 2014, and three in 2015. The new and future postdoctoral researchers are

- **Hongyang Sun**, PhD 2011, Nanyang Technological University (adv. W.-J. Hsu), post-doc Milyon 2014–2016, Roma team (LIP).

- **Ruihan Guo**, PhD 2014, University of Science and Technology of China, (adv. Y. Xu), post-doc Milyon 2014–2016, tutor F. Filbet (mathematical modeling and numerical computing team, ICJ).

- **Tal Ohrenstein**, PhD 2014, Weizmann Institute, (adv. G. Kozma, N. Berger), post-doc Milyon 2014–2016, tutor C. Sabot (probabilities group, ICJ)

- **Clélia Pech**, PhD 2011, Grenoble (adv. L. Manivel), post-doc Milyon 2014–2016, tutor N. Ressayre (ICJ).

- **Svetlana Puzynina**, PhD 2008, Moscow, post-doc Milyon 2014–2016, adv. tutor M. Rao (MC2 team, LIP).

- **Rizos Sklinos**, PhD 2011, Leeds (adv. A. Pillay), post-doc Milyon 2014–2016, tutor T. Altinel (ICJ).

- **Erich Baur**, PhD 2013, Zürich, post-doc Milyon 2015–2017, tutor G. Miermont (UMPA).

- **Christopher Henderson**, PhD 2015, Stanford (adv. L. Ryzhik), post-doc 2015–2017, tutor V. Calvez (UMPA)

- **Jurriaan Rot**, PhD 2015, Leiden (adv. M. Bonsangue, J. Rutten), post-doc 2015–2017, tutor F. Bonchi (LIP).

As one may see, the Milyon postdoctoral positions are very competitive.

In addition to the “regular” program, Milyon offers the opportunity of **partial postdoctoral support**. Such support is considered as a “light” project and is evaluated as explained in Section 2A1.2. Two researchers benefited of this program, for a cumulated period of 20 months (Milyon founding: 28 K€):

- **Juan-Juan Cai**, PhD 2012 Tillburg (adv. J. Einmahl, L. de Haan), post-doc Milyon-ÉDF 2012–2013 (ÉDF industrial research contract), tutors A.-L. Fougères and C. mercadier (statistics group, ICJ). Research interest: *Statistics of extremes*. Milyon publication: [3]. Currently Assistant professor, Department of applied statistics, Delft University of Technology.

- **Cristóbal Rivas**, PhD 2011 Universidad de Chile (adv. A. Navas), post-doc Milyon 2011–2013, tutor É. Ghys (UMPA). Research interests: Geometry of groups and group actions on manifolds. Milyon prepublication: [91]. Currently Assistant Professor, Departamento de Matemáticas y Ciencias de la Computación, Universidad de Santiago de Chile.

A final **overview**: the postdoctoral programs attracts **good level candidates** from prestigious universities. Their integration is smooth and **productive**, and **their trajectories benefit from the Milyon fellowships**.

## A2. Training

In higher education, Milyon acted according to its letter of mission:

- 1) Support to the implementation of the applied mathematics oriented research program “Mathématiques en action”, in order to favor industry oriented research and PhD contracts;

- 2) Master and PhD fellowships, mainly intended to attract selected foreign students to the Lyon–Saint-Étienne programs;

- 3) Support to “seasonal” schools, as a tool for enhancing to quality and the attractiveness of the doctoral schools.

It is to be noted that all these actions are research oriented, and thus their success enhances in fine the scientific contribution of Milyon. In particular, attracting selected foreign students to research programs has, in addition to obvious long-term benefits (e.g. for doctorates’ level), a short-term one: in such programs, the number of students is traditionally rather low. More students mean more curricula, and thus curricula better adapted to students’ future research specialization.

### A2.1 Master level

**Mathématiques en action.** [Mathsenaction](#) Milyon supported from the beginning the program Mathématiques en action by: founding a PAST professorship; supporting the teaching hours of the researchers involved in the program; including Mathématiques en Action into its master fellowships program; supporting the advertisement of the program. Of course, the success of the program is first due to the substantial involvement of its pedagogic team (especially the head of the program, Anne-Laure Fougères (ICJ), and the Math biology teams at ICJ and UMPA), but **Milyon substantially contributed to this successful program** (founding: 60 K€).

Among the realizations of this research oriented program, we mention here:

- 15 students in its first year (2013–2014), 28 students in the present year. One curriculum in 2013–2014 (“Mathematics for Biology and Medicine: Theory and Applications”), two additional ones in 2014–2015 (“Environment and Geoscience: From Models to Predictions” and “Fluids and Materials: From Physical Laws to Mathematical Analysis”). Many of the students come from excellent schools (mostly École Centrale de Lyon, and also some from ÉNS de Lyon).

- In the 2013–2014 class, 14 students chose an applied mathematics or biology oriented research internship (contributing thus to Milyon’s scientific production). 11 of them are now PhD students in applied mathematics (mostly mathematical biology), some of them outside the academic community. Two other students are looking for PhD founding.

• In addition to his contractual teaching and supervision duties, the PAST professor François Wahl has now active research collaborations with the statistics team involved in the Mathématiques en action program (Milyon prepublications [103–104]) and will soon defend his Habilitation à Diriger les Recherches.

**Master fellowships.** Milyon offers up to ten master (1000 €/month/10 months) or L3 (650 €/month/10 months) fellowships in the research oriented programs. The call for proposals opens in November and ends in February. Results are announced end of February. The selection process involves the training commission and the directors of teaching units and of training programs. Milyon cooperates with the preexistent excellence grants (Ampère for ÉNS, INRIA for LIP) in order to have complementary rankings and attract a maximal number of selected (most of them foreign) students. The number and the quality of the candidates increased each year, and after a slow start with less than ten candidates, the 2015 campaign saw 56 applications (more than 70 with the Ampère applicants). For the 2012–2015 classes, Milyon offered **18 grants** (founding: 177 K€) to students from China, Ethiopia, Germany, India, Italy, Romania, Senegal, Togo, Ukraine, Vietnam, and also France. Most of them went to the ÉNS programs (Advanced Mathematics, Fundamental Computer Science) and completed successfully their programs and their research internships.

**Chile and Ottawa operations.** In a joint operation of Milyon with the Chilean Mathematical Society and with the French Embassy at Santiago de Chile, the ÉNS programs in Advanced Mathematics and Fundamental Computer Science host every year two or three Chileans students, among the very best of their generation. In 2012–2015, Milyon co-funded **9 fellowships** (Milyon founding 45 K€) for 6 students in Advanced Mathematics and 3 students in Fundamental Computer Science.

In cooperation with the International Affairs Office of the Université de Lyon, Milyon promotes 3 months research internships for selected undergraduate students from the University of Ottawa (SIRI program). Milyon advertises the project and encourages submission of subjects by colleagues in Lyon. In 2013–2015, 4 students arrived via this program and completed excellent research internships. Milyon's RST visited Ottawa in order to initiate MITACS (Canadian graduate program) level exchanges between Ottawa and Lyon–Saint-Étienne.

## A2.2 PhD level

**"Regular" PhD program.** As explained in Section 1.3, we have not initiated the PhD fellowships system from the beginning. The campaign 2014 was the first one (2014–2017 founding: 325 K€). In cooperation with the doctoral school, the training commission selected four subjects out of the ten proposed ones: on efficient compilers (adv. A. Darte, LIP, L. Gonnord, LIP), on optimal transport and functional inequalities (adv. I. Gentil, ICJ, C. Léonard, Paris Ouest), in analytic number theory (adv. X. Roblot, ICJ, J.-R. Belliard, Besançon), and in scientific mediation and geometry (adv. É. Ghys, UMPA, C. Mercat, ICJ).

It is too soon to evaluate the scientific outcome, but the level of the candidates is good. Only two of them were from abroad, but we may estimate that the attractiveness of the 2015 campaign will be higher.

**Partial support.** In addition to the junior short or mid-term visits (described in Section 2A1.3), Milyon offered partial research contracts to PhD students. These contracts are evaluated as the other "light" activities. Three students received support for a cumulated total of 18 months (Milyon founding: 31 K€). Two of them did not defend yet. The third one is

• Jingwei Chen, PhD student at the University of the Chinese Academy of Sciences in 2012, visited D. Stehlé (LIP) and G. Villard (LIP) for joint research on integer relation and lattice reduction. Research interests: integer relation finding, lattice reduction, polynomial factorization and their applications. Milyon publication: [22]. Currently Assistant Professor, Chongqing Institute of Green and Intelligent Technology (CIGIT), Chinese Academy of Sciences.

## A2.3 Schools

Milyon offered light support to five schools (founding: 10 K€) and significant support (founding: 42 K€) to three high quality schools organized by some of the most active groups in Lyon:

• **Winter school "New mathematical aspects of quantum field theories"**, [NMAOFT](#), January 29<sup>th</sup>–February 3<sup>rd</sup> 2012 (co-organizers D. Calaque (ICJ), T. Strobl (ICJ)), Milyon founding 12 K€).

The course notes and some original contributions were gathered in a Springer "yellow series" volume supported by Milyon (Milyon publication [25]).

• **Spring School "Kinetic Theory and Fluid Mechanics"**, [KTFM](#), March 26<sup>th</sup>–30<sup>th</sup> 2012 (main organizer F. Filbet (ICJ)), Milyon founding 15 K€).

• **Workshop "Jeunes Chercheurs en Théorie des Nombres"**, [JCTN](#), June 13<sup>th</sup>–15<sup>th</sup> 2012 (main organizer S. Rozensztajn, UMPA, Milyon founding 15 K€).

The schools were benefic for both the participating PhD students and the international visibility of the involved teams.

## A3. Concluding remarks

Most of the activities we have presented in Section 2A would not have been possible in absence of Milyon in the Lyon–Saint-Étienne area. The same applies to the major dissemination activities described in Section 3.4.

The organization of thematic quarters (and of more modest events) made of Lyon a place with an increased visibility, where more things happen, where researchers have present-day research events to participate at, and where it is possible for a young active colleague to propose and organize an important event in its field of expertise. We mention in particular the mathematical biology teams in ICJ and UMPA. This is excellent for both research and for boosting careers, and we may credit in part Milyon in the recent successes of colleagues who have been promoted or obtained prestigious grants (ERC starting grant of Vincent Calvez (UMPA)), or habilitated.

Symmetrically, this visible activity made positions opened in the Lyon—Saint-Étienne become more and more attractive; this concerns both permanent positions (Maître de Conférences, Professeur) and Milyon fellowships.

All in all, this made of the Lyon—Saint-Étienne area “l’endroit où les jeunes mathématiciens aimeraient se fixer” (quote from the 2015 HCERES evaluation of ICJ).

The postdoctoral positions contribute significantly to the research in the UMRs, and would have been impossible to fund with most of the “usual” research funding.

Finally, the master fellowships enhance the preexistent research programs, and the Mathématiques en action program had a very promising start. Similar grants did not exist except at ÉNS de Lyon, but even there their effect is significant: in a typical year, the M2 Advanced Mathematics program benefits of one Ampère grant and of two or three Milyon grants. Similarly, a typical year in M2 FCS is 2 Ampère+2 INRIA + 3 Milyon, so that the Labex has significant impact. We consider that Milyon played a positive role in the growth of the number of students enrolled in the M2 FCS program (15 in 2012—2013, 18 in 2013—2014, 33 in 2014—2015).

## B) Human resources

Being an ANR project, Milyon cannot recruit “on its own”. The Université de Lyon hires Milyon’s support staff, the postdoctoral fellows and the PhD students. On the other hand, the PAST professor is hired by the Faculté de Sciences et Technologies of the Université Lyon 1. Of course, Milyon was and is the main actor in these recruitments.

Applications to research positions (PhD, post doc) are evaluated as explained in Section 2A. In particular, postdoctoral positions are advertised on the Université de Lyon website.

Milyon has a rank A (research engineer) Project Manager recruited in 2012, Carine Sevestre. She has a significant previous experience in the management of ANR projects. Bertrand Rémy and the administrative director of the ICJ evaluated the candidates.

Milyon also has a rank A (research engineer) Communication Officer recruited in 2014, Séverine Voisin. She has a significant previous experience in communication. Bertrand Rémy, the administrative director of the ICJ, and Carine Sevestre evaluated the candidates.

We described their activities in Section 1.1. The detailed post descriptions are at the disposal of the ANR upon request. Milyon owes very much its support staff, whose activity is crucial in the success of the Milyon events.

An indirect but significant impact of Milyon’s activities is attractiveness of the three UMRs. This is particularly visible at the ICJ, where a “labeled” (i.e., oriented towards a specific fields, e.g. probabilities or PDEs) Maître de Conférences position attracts more than 100 candidates, with a significant number of them very good. We also note that 10 out of the 40 candidates preselected in CNRS’s Section 06 CR contest chose the LIP as unit of assignment. We mention here the 2012—2014 recruitments, which correspond to the Labex activity years:

- At the ICJ, Morgane Bergot (MCF), Oriane Blondel (CR CNRS), Alexandre Boritchev (MCF), Frédéric Chardard (MCF), Xinxin Chen (MCF), Éric Delaygue (MCF), Olivier Druet (DR), Louis Dupaigne (MCF), Thibault Espinasse (MCF), Lie Fu (MCF), Christophe Garban (PR), Stéphane Gaussent (PR), Philippe Gille (DR CNRS), Céline Helbert (MCF), Kate Juschenko (CR CNRS), Xiangyu Liang (MCF), Jan Manschot (MCF), Olivier Marchal (MCF), Filippo Nuccio (MCF), Khaled Saleh (MCF), Nermin Salepci (MCF), Mathieu Sart (MCF), Pierre Simon (CR CNRS), Leon Tine (MCF), Fabio Toninelli (DR CNRS), Julian Tugaut (MCF), Nicolas Vichery (MCF).
- At the LIP, Nathalie Aubrun (CR CNRS), Pierre Clairambault (CR CNRS), Omar Fawzi (MCF), Russ Harmer (CR CNRS), Marton Karsai (MCF/INRIA chair), Matteo Mio (CR CNRS), Damien Stehlé (PR).
- At the UMPA, Mikaël de la Salle (CR CNRS), Marco Mazzucchelli (CR CNRS), Grégory Miermont (PR), Jean-Christophe Mourrat (CR CNRS), Wiesława Niziol (DR CNRS).

## C) Financial resources, leverage effect

Milyon obtained significant co-funding for the activities it organized or supported. We mentioned online some of the co-funding obtained by Milyon, but the online form had not enough room to mention all of them.

The figures are the following:

- 220 600 € obtained in 2012
- 250 930 € obtained in 2013
- 274 560 € obtained in 2014

This represents a total of more than 746 K€, that is more than 37 % of the expenditure of 2 M€ incurred by Milyon in 2011—2014. The documents are at the disposal of the ANR upon request.

The above figures exclude numerous services and benefits in kind, in particular the substantial support to the MMI of the ÉNS de Lyon and of the Université Lyon 1.

The co-funding comes mostly from public funds (typically R&HEIs), but also from local communities or learned-societies. Other significant contributors:

- The NSF contributed with 22 K€ to the conference in honor of John Mather.
- The Clay Institute contributed with 7,7 K€ to the International Summer School ISSMYS 2012.
- EDF contributed with 11,8 K€ to the postdoctoral contract of Juan-Juan Cai.
- European research funding (ERC, ESF) contributed to different conferences or quarters for 55,5 K€.

- The Consortium Cap'Maths co-funded Milyon's dissemination activities, in particular the ones connected to the MMI, for 50,5 K€.

This is the present-day situation, but Milyon prepares the future campaigns. Milyon participates, together with the other Labex in mathematics, to a study on the socio-economic impact of mathematics in France. This ongoing study shows that the socio-economic impact of mathematics is significant. Over 43.3 million jobs in France, 3.8 million jobs (9% of the total) are directly impacted by mathematics. They generate about 15% of French GDP (285 Md€). They are concentrated in high-growth services (IT services, Financial Services, Aerospace Manufacturing etc.). The study questions the levers of dissemination of mathematics in businesses: while staff trained in mathematics are growing moderately, links between research and industry are still in a structuring phase and professional integration of doctors mainly in the public sector. These conclusions give credit to the activities of Milyon, and once the study completed we intend to use it as a fund leverage tool in the direction of private companies and foundations. In a complementary direction, we study the opportunity of creating a foundation supporting Milyon's dissemination activities.

## D) Labex impact on its ecosystem policy

**Statement of the Université de Lyon.** The twelve Labex held by the Université de Lyon are highly integrated to the dynamics of the Programme Avenir Lyon—Saint-Étienne (PALSE). They constitute structuring elements of PALSE's scientific policy and are associated to actions led at an international level as well as at a training level. Labex labeled applications are valued when responding to PALSE calls such as Package and Emerging Project calls, and the doctoral and mobility grants. On November 5<sup>th</sup>, 2014, the first "Journée scientifique de l'Université de Lyon" was organized on an inter Labex basis. More than 250 participants attended the event, which was the occasion of lively interactions between the Labex communities. Since the fall 2014, the Labex are also key actors in the new IDEX project construction.

We add to this statement that some of the natural local partners of Milyon are the Labex Ecofect (dynamics of infectious diseases) and Primes (medical imaging). In particular, Milyon and Ecofect interacted during the trimester on Mathematical Biology, and Milyon and Primes co-funded several actions.

**Milyon, MMI and the IDEX project.** Inside the IDEX project of the Lyon—Saint-Étienne area, both Milyon and the MMI appear as significant actors in the "Theory, observations and modeling and "Numerical Societies" axes of the project. In particular, the MMI is committed to be part of an ambitious project (Maison des Sciences?) opened to the civil society.

**Milyon and the international priorities of the Université de Lyon.** There is a pulling effect resulting from the cooperation between Milyon and the Université de Lyon (UdL) in direction of the main targets of the Université de Lyon (Ottawa, São Paulo, and Tokyo are such targets). We present here some examples.

In April 2013, Milyon and UdL co-funded a Lyon—São Paulo workshop on algebra, geometry and logic (organizer Olivier Mathieu (ICJ), Milyon founding 7 K€). In November 2014, a São Paulo—Lyon workshop on complexity (organizer Stephan Thomassé (LIP), Milyon founding 5 K€) followed, and Oliver Mathieu co-organized a joint mathematical exhibition Matemateca São Paulo—Math $\times$ Lyon which attracted 3 500 visitors.

In 2011, 2013 and 2015 UdL and Milyon supported or will support the ToDai—ÉNS de Lyon meetings (organizers É. Ghys (UMPA), E. Giroux (UMPA), T. Tsuboi (Tokyo)), ToDai being the doctoral school of the University of Tokyo.

Milyon's support to the Canadian program SIRI is connected to UdL's interest for cooperation with Ottawa.

**Bringing together mathematicians and computer scientists.** This is one of the greatest achievements of Milyon. The organization of thematic quarters and the common house MMI favored interactions between the two communities, which now got to know well and have joint research projects. More generally, Milyon favored joint activities of the three UMRs, beyond the preexistent joint seminars.

**Impact on training programs.** We have already mentioned that the support to master programs brings more students, and thus more curricula and in fine better research. Another effect we have observed is the impact of Milyon on the success of Mathématiques en action, as well as the fact that this program attracts students from the École Centrale de Lyon (and other engineering schools) to double diploma programs. On the long run, this program will lead to more real-life applications oriented doctorates, which is one of the purposes of Milyon.

We mention here three other consequences of the new environment created by Milyon. First, in order to feed the Mathématiques en action program, the ICJ favors a double diploma program for students from the École Centrale de Lyon at the undergraduate level (by putting at their disposal a TA for adapted training). A great side effect is that the L3 FCS students from the ÉNS de Lyon start following this training for a double diploma in M & FCS.

A second consequence is that starting from the academic year 2015—2016, the Advanced Mathematics program will try to propose a mixed, M&FCS, curriculum. Finally, the Advanced Mathematics program becoming quite international, the possibility of giving lecture in English is considered. On the long run, this could increase program's attractiveness.

**Math Labex network.** The math Labex work together in directions as the coordination and the advertisement of grants systems, especially at a postdoctoral level. The labex AMIES (whose main purpose is to connect mathematics to the companies) has a local Milyon correspondent, Simon Masnou, who in particular favors the participation of our students at the "math-companies" days. Milyon also co-finances the national study on the impact of mathematics on the society.

**Federating research in mathematics.** Milyon increased the number of joint activities between ICJ and UMPA, and favored the regional events. This facilitated the emergence of a Rhône-Alpes federation in mathematics (FRMRAA [FRMRAA](#)), which was born in 2013 as a joint structure of the UMRs in Lyon, Saint-Étienne, Grenoble, Clermont-Ferrand and Chambéry. Milyon provides partial support to federation's activity.

## 3. SOCIO-ECONOMIC IMPACT

### 3.1 Partnerships with social and economic actors

We first present some of Milyon's **direct** actions towards social and economic actors.

- 1) One of the missions of the PAST professor is to favor the contact between companies and the students involved in the applied mathematics programs, for internships, industrial theses, etc.
- 2) Milyon co-funded the postdoctoral contract of Juan-Juan Cai for research at EDF.
- 3) Milyon supported the first "Job forum" organized by the Université Lyon 1 in order to favor the contacts between master programs and master students on the one hand and socio-economic actors on the other hand.
- 4) The quarters on mathematical biology and on compilation attracted numerous company representatives.
- 5) Milyon is a partner of Cap'Maths, which acts as a dissemination foundation.

Milyon interacts **indirectly** with the social and economic actors through the contracts and industrial research activities of the three UMRs it supports. The contracts are too numerous to be mentioned here (especially for the LIP, but also for the numerical computing and statistics teams at the ICJ), but we note that among the partners we can find Alstom, EDF, Exxon Mobil, Intel, Kalray, Orange, Renault, Siemens, STMicroelectronics, etc. The LIP is also active in the creation of start-ups (most recent example: XtremLogic), and the ICJ is associated with the startup Picviz.

We mention the 2015 invitation by Milyon of Peter Tang, senior researcher at Intel, for cooperation with the LIP.

However, the most important effects of Milyon's actions are **long-term** ones.

- 6) Mathématiques en action trains generations of students that will irrigate, in fine, the socio-economic world.
- 7) The LIP trains a significant number of doctors that integrate the socio-economic world.
- 8) On a longer term, the dissemination activities attract young students to scientific programs (or even scientific culture). As the ongoing study on the impact of mathematics makes it clear, businesses need more and more such competences.
- 9) ICJ's mathematical biology team interactions with medical teams, in particular during the mathematical biology trimester, led to interesting developments in drug administration that will possibly end up with patents, but research time in such directions is typically of 15 years. This may have long-term impact on Section 3.2.

### 3.2 Relationships with the SATT, IRT or ITE

The new "Société d'Accélération et de Transfert de Technologies" Lyon—Saint-Étienne (SATT Pulsalys) was created in 2014 to manage business development and technology transfer for the University of Lyon. The SATT allows Milyon researchers to have access to a "single recognized tech-transfer office", to support research projects with high potential (patent applications, obtaining licenses) and through creating start-up projects.

Up to now, one of the domains where the ICJ and the LIP have been particularly active is the one of the development of open-source freely distributed software, like MUMPS, Sage, Mélina, Getfem++, and PARI/GP.

In 2013, Emmanuel Grenier (UMPA) and collaborators applied for a patent on the deterioration of vaccines.

### 3.3 Commercial relations with European public-private partnership research institutes

Milyon's interactions with the European Union are essentially illustrated by its UMRs contracts: ERC grants (Damien Stehlé (LIP), starting grant, Vincent Calvez (ICJ), starting grant), the numerous European contracts of the LIP's teams (the leading of two European FP7 projects and participation to other projects for the Avalon team, 8 contracts for the Dante team, the Mosar project for Compsys, etc.), and the participation to numerous European networks (in research, initial training, etc.).

### 3.4 Knowledge dissemination

Unlike this may be the case for other Labex and under the charismatic influence of Étienne Ghys, **knowledge dissemination is a full axis of Milyon's activities**, and combines the activities federated by the "**Maison des Mathématiques et de l'Informatique**" (MMI) and the organization of **summer camps**.

Milyon considers that scientific mediation is crucial for attracting students towards M&FCS programs, and the initial project allowed 20% of Milyon's envelope to these activities. Combined with a traditional strong implication of our communities in scientific mediation, this effort justifies the following appreciation: "Lyon est sans doute le lieu en France où les actions de diffusion de la culture mathématique sont au plus haut niveau, par leur diversité et leur ampleur. Ceci est le résultat d'une volonté collective" (2015 HCERES evaluation of the ICJ).

#### 3.4.1 La Maison des Mathématiques et de l'Informatique

Centerpiece of the initial project, the **MMI** <http://math.univ-lyon1.fr/mmi/> opened in 2012 (and **opened to the public in March 2014**) near the ENS de Lyon, thanks to the support of the ENS de Lyon and to the considerable energy spent by Vincent Borrelli (first director of the MMI) to bring the project to life. Its budget for the full functioning years (2014, 2015) is of 125 K€ for 2014 and of 140 K€ in 2015. The MMI can also benefit of co-funding by the Cap'Maths consortium of the activities for the MMI of the associations partners of the MMI.

The MMI has an exhibition room, a 40 places conference room, and three offices. The MMI hosts a permanent exhibition and temporary exhibitions. Currently, the exhibitions can be visited every Tuesday (entrance is free), but in few years the MMI will be open to the public four days a week.

The MMI is gradually becoming an interface between society and M&CS. Her missions are to become a place full of life dedicated to scientific mediation; to federate and amplify the dissemination activities in the Lyon—Saint-Étienne area; to support the actions and associations in favor of dissemination of M&CS; to develop actions intended to promote the place of M&CS in the public and political space.

Directed now by Jérôme Germoni (assisted by Frédéric Déglise, Régis Goiffon and Natacha Portier), the MMI is extremely active. Here is a very partial catalog of its present and past activities, which raised to a total of 23 000 hours\*student in 2014. MMI's website <http://math.univ-lyon1.fr/mmi/> links to the complete 2013 and 2014 activities catalogs, as well to an exhaustive description of its past activities [MMI report](#).

**Exhibitions.** Two exhibitions were conceived specifically for the MMI: one around the personality of Turing, another one on surfaces (math-artist Pierre Gallais). Math-artists (Pierre Gallais, Sophie Pouille) are invited by the MMI as residents or supported for exhibitions in public places (libraries, city halls). The MMI exposes the flat torus [flat torus](#), visualization due to Vincent Borrelli and collaborators of the celebrated representation discovered by Kuiper and Nash in the 50s. The Surfaces exhibition (Pierre Gallais) and Math $\times$ Lyon travelled to Saõ Paulo (November 2014, organizer Olivier Mathieu) for a joint exhibition with Matemateca of Saõ Paulo (3 500 visitors). A PhD student (Marie Lhuissier, adv. É. Ghys, C. Mercat) develops support material and new exhibits as part of her PhD.

**Math $\times$ Lyon.** This is the flagship activity in dissemination. Two researchers visit for two days a (junior) high school for a continuum of research workshops in which the manipulation of mathematical objects plays a crucial role. This activity can also be hosted by the MMI. In 2014: 17 visits, more than 5 000 schoolchildren involved.

**National events.** The MMI participates at the "Fête de la Science" <http://www.fetedelascience.fr> (October of each year) and at the "Semaine des Mathématiques" [semaine mathematiques](#) (which starts with the Pi Day 3/14). This year, the MMI was the local organizer of the "Forum Mathématiques Vivantes" [FMV](#) that concluded the Semaine des Mathématiques. In Lyon, the forum was a huge success that attracted around 800 participants.

**Conferences, seminars.** The MMI organizes the "Soirées Mathématiques Lyonnaises" <http://sml.ens-lyon.fr>, which help connecting undergraduate students to present-day research via vivid descriptions of actual problems. Prestigious lecturers (N. Anantharaman, F. Clarke, E. Giroux, V. Jones, etc.) are in front of a numerous audience (up to 100 participants), and the conference is followed by hours of lively discussions. The MMI also supports the Open University lectures. For a more advanced introduction to research, the MMI organizes the "Séminaire de la détente mathématique" [détente mathématique](#), where the lecturers propose a more playful, yet challenging, approach to research. This seminar provides an appreciated bridge between students from the university and the ones from the ÉNS de Lyon.

**Partners, workshops.** The MMI participates to or supports numerous other activities:

- The MMI participates to the "Rallye mathématique" and to the "Hippocampe" or "Math C2+" workshops.
- The MMI hosts the "Discrete Mathematics Club" (whose soul is Bodo Lass (ICJ)), which trains high school students for international contests.
- The MMI favored the emergence of an "Art and Mathematics" series of art events.
- The MMI cooperates with numerous partner associations, that are specialized in mediation activities with schoolchildren: Ébullissance, MixTeen, Plaisir Maths, etc.

All this gives a hint of why **the MMI is a "magnifique creation"** (2015 HCERES evaluation of the ICJ). A major **priority of Milyon** is to **secure the future of the MMI**.

### **3.4.2 Summer camps**

Milyon organized three such major events.

- **The "International Summer School in Mathematics for Young Students" ISSMYS 2012**, August 20<sup>th</sup>—30<sup>th</sup> 2012 (main organizer É. Ghys (UMPA), Milyon founding 100 K€), [ISSMYS](#)

This was the second of a series of six summer schools organized alternatively in Bremen and Lyon by D. Schleicher (Bremen) and É. Ghys (UMPA). MOMISSS was the fourth one. The audience consisted of some 110 young students, aged from 16 to 19, coming from 45 countries. A special committee carefully handled the selection of students. Application required in particular a motivation letter and a scientific project. The committee tried to balance quality, geography and gender, which was definitely not an easy task. Many participants were fully funded by ISSMYS. The scientific committee invited a panel of 18 distinguished speakers (J. Conway, Y. Meyer, K. Ono, L. Saint-Raymond, C. Villani, J.-C. Yoccoz, D. Zagier, etc.) [ISSMYS lectures](#), and the program was indeed remarkable by the scientific quality and by the diversity of lecturers. The summer school ran rather smoothly with plenary lectures during the morning and parallel complementary sessions during the afternoon. An impressive number of young PhD students from Lyon agreed to be TA's and to take part to the exercise sessions. The French Minister of Research visited the school and took this opportunity to express France's will to host more foreign students (in particular in mathematics).

The summer school was a great success since more than a hundred young students enjoyed excellent mathematics during ten days. While the mathematical output is clearly positive, the one for Lyon in particular is less clear. One of the best students was immediately accepted at the ÉNS... de Paris. On the other hand, several of the candidates to the Milyon fellowships followed one of these schools. Presumably the right scale in order to measure the success of such initiatives is the national or European one.

- **The "Modern Mathematics International Summer School for Students" MOMISSS 2014**, August 20<sup>th</sup>—29<sup>th</sup> 2014 (main organizer C. Mercat (Lyon 1), Milyon founding 69 K€), [MOMISSS](#)

81 young students from 38 countries, selected among more than 300 following a procedure similar to the ISSMYS one, participated at this school. Eight lecturers (S. Benzoni (ICJ), J. Conway (Princeton), I. Itenberg (Paris 6), M. Levi (Penn State), C. Sabot (ICJ), F. Wagner (ICJ), R. Waldecker (Bremen), D. Zagier (Collège de France)) delivered 4,5 h courses on hot topics. Numerous TA's from the ÉNS de Lyon and the SNS Pisa helped the participants understand the lectures and go further into the subjects.

- **The "MATH.en.JEANS" 2014 national congress**, April 4<sup>th</sup>—6<sup>th</sup> 2014 (main organizer C. Mercat (Lyon 1), Milyon founding 45 K€), [MATH.en.JEANS Lyon2014](#)

This research camp for junior high school and high school was initiated in 1989. Research workshops are proposed to participants all along the school year, up to a national “final” (actually there are several of them, and Lyon participates to the south-east final events). Lyon hosted 250 young participants (including some from Romania). 48 teachers and 17 researchers animated the activities: presentation of the results of the workshops, plenary lectures (e.g. a presentation of the flat torus by V. Borrelli), and a visit of the MMI.

As the other editions, this one was a success and a good way to attract young students to mathematics.

Final **overview**: **dissemination activities** are an **original feature** of Milyon, and one of its **achievements**.

#### 4. FREE COMMENT

**What works well.** We consider that the organization of thematic quarters, the postdoctoral program, the master fellowships program and the support to Mathématiques en action are sound achievements of Milyon in research and training. In dissemination, the Maison des Mathématiques et de l’Informatique is already a beautiful achievement and has a great potential. The summer camps were successful for participants. Their local impact is under study.

The collaboration of the three UMRs in the Labex life is remarkable, and the inter UMR and interdisciplinary activities were stimulated by Milyon. Best examples are the MMI and some thematic quarters.

**The Labex added value.** The “heavy” activities (quarters, post-docs, the MMI, summer camps, fellowships programs) would not have been possible without Milyon. The immediate effects are increased visibility and attractiveness. On the long run, Milyon will benefit to the research and to the social and economic actors.

**In progress.** Many aspects can be improved, but the two major challenges are the opening of a research center and the longevity of the MMI project.

**Difficulties.** Milyon encountered the “usual” difficulties the other Labex faced, especially related to the eligible expenditure. We point out a specific situation. Milyon’s activities (dissemination, organization of quarters) rely heavily on volunteering –resource whose sustainable production is difficult to obtain without the possibility of having –even modest– reductions of the teaching load. I suggest that the Labex should be entitled to “buy” a fixed amount of teaching load in order to support efficiently its non-research activities.

**Publications.** In the publications file, we started by quoting the 2013 and 2014 publications mentioning support by Milyon. The “Autres” publications are Milyon’s prepublications. The “2015” list contains Milyon’s accepted publications. We should have paid more attention to the “Milyon mention”, and the number of publications supported by Milyon is certainly higher.

A sharper way to measure Milyon’s impact on publications would be to compare the pre-Milyon to the post-Milyon situation, but this is not possible for the time being. We propose here a naïve (and definitely questionable) approach. Milyon’s average support for research in 2012–2014 is of 304 K€/year. The three UMRs total endowment is of 4.3 M€/year. Thus we may expect that Milyon impacts 7.2% of the average number of publications of the UMRs, which leads to 33 impacted publications/year, and 66 publications for 2013 and 2014.

**Budget implementation.** Milyon’s endowment is of 900 K€/year. The initial project plans 50% for research, 30 % for training, 20% for dissemination. Like other Labex, Milyon had a slow start (see diagrams; the purple part is for the overhead costs). 2014 is the first “full strength” year. The estimated 2015 budget is of 1.65 M€. Situation will be similar in 2016 and possibly 2017. In particular, Milyon will soon absorb its actual budgetary surplus. This raises the question of the “budget landing”, since the Labex may be in deficit one or two years before its term.

