

## REPORT ON OpenDreamKit DELIVERABLE D2.15

### Community building: Impact of development workshops, dissemination and training activities, year 4

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Lead	Université Paris-Sud (UPSud)
Progress on and finalization of this deliverable has been tracked publicly at: <a href="https://github.com/OpenDreamKit/OpenDreamKit/issues/40">https://github.com/OpenDreamKit/OpenDreamKit/issues/40</a>	

#### DELIVERABLE DESCRIPTION, AS TAKEN FROM GITHUB ISSUE #40 ON 2019-08-29

- **WP2: Community Building, Training, Dissemination, Exploitation, and Outreach**
- **Lead Institution:** Université Paris-Sud
- **Due:** 2019-08-31 (month 48)
- **Nature:** Report
- **Task:** T2.3 (#26)
- **Proposal:** p. 38
- **Upcoming report (sources)**

An important key to the success of the ODK project is linked to its ability to **foster a community** in the spirit of the open source projects it is built on. Part of this relies on the organization and participation to scientific and development events of many different scales and objectives. Following up on D2.2 (#42) for year 1, and D2.11 #36 for year 2 and 3, we report here on more than ??? events we have been part of during year 4. This includes:

- the (co)organization of ?? development workshops;
- the (co)organization of ??? training workshops -- or sessions within larger events -- including ??? in developing countries;
- the (co)organization of ??? community building workshops, 4 of which targeted at women;
- the organization of ??? research workshops or sessions;
- communications at and participation to many external events.

We describe each event with its specific goals and explain the exact implication of ODK in the organization and realization of the event. We give a general overview of the impact of single events, thus drawing a picture of ODK impact as a whole, and describe future directions for the year to come.

#### TODO:

- ✓ Koper Software Tools workshop @katjabercic, @slel , @alex-konovalov
- Free Computational Mathematics, CIRM @nthiery, @IzabelaFaguet
- Nicolas's visit to St Andrews @nthiery
- Sage-GAP Days 101: (June 17-21 2019, Cernay, France) Sage GAP developers days on packaging, portability, interfaces and documentation tools @nthiery

- Sage Days 105 -- Free and Practical Software for Algebraic Combinatorics'19: (July 8--12, 2019, University of Ljubljana, Slovenia) @nthiery
- Sage Days 100 -- Geometry and dynamics of surfaces June or July 2019, MPI Bonn Germany @videlec
- Sage Days 102 - University of Ibadan: (July 15-19, 2019, Ibadan, Nigeria) Sage Days Nigeria @embray
- GAP Singular Meeting and School August 2019 @sebasguts
- Cernay Data base workshop @katjabercic
- Cernay Report writing sprint @nthiery
- Micromagnetics dissemination? @fangohr @marijanbeg
- GAP Tutorial at GAP in Algebraic Research school (Aachen, November 2018) @alex-konovalov

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## 1. DEVELOPMENT WORKSHOPS

**♠TO DO: EDIT♠** We call a development workshop an event with a restricted number of participants who meet to work on a specific task. These workshops are an inherent part of OpenDreamKit development process as described in **T2.3**: they bring together developers from within and outside of OpenDreamKit and allow effective work and discussions on many technical aspects. They also participate in building and maintaining a community of developers inside OpenDreamKit and within the open-source communities we belong to.

Throughout years 2 and 3 of the project, we have had 15 workshops dedicated mostly to development. Some of them also included a training approach.

### Event 1- Atelier PARI/GP 2019

Bordeaux (FR), 2019-01-14 to 2019-01-18

ODK partners involved: UPSud CNRS UVSQ UWarwick

36 participants (including 6 from within ODK)

<http://pari.math.u-bordeaux.fr/Events/PARI2019/>

**OpenDreamKit implication.** OpenDreamKit participants: B. Allombert, K. Belabas, J. Cremona, V. Delecroix, J. Demeyer, L. de Feo.

OpenDreamKit provided the main funding source for the workshop (accommodation, subsistence and some travel expenses), for about 13k€.

**Event summary.** The 12th Atelier PARI/GP took place in Bordeaux (France) from january 14h to 18th.

There were 57 registered participants from 31 different institutions (no registration fees).

A typical day of the workshop had introductory talks and tutorials in the morning; afternoons allowed ample time for hacking sessions, discussions and training.

The Atelier featured 10 morning talks on mathematical topics and implementation projects including 4 talks by OpenDreamKit members

- Bill Allombert “New GP features” and “Parallel GP programming”.
- John Cremona “Computing classical modular forms for the LMFDB”.
- Jeroen Demeyer “cypari2: Python bindings for PARI/GP”.

Slides for all talks are available at <http://pari.math.u-bordeaux.fr/Events/PARI2019/>

**Results and impact.** The workshop was productive and a successful teaching and dissemination event; 12 participants came from developing countries (Algeria, Djibouti, Lebanon, Morocco, Senegal, Tunisia, Turkey).

It provided final feedback on recent PARI/GP developments that paved the way for the release of pari-2.12-alpha (2019/06).

### Event 2- Workshop on Data in Mathematics

Cernay, France, August 17th to 24th

ODK partners involved: UPSud FAU

14 participants (including 11 from within ODK)

<https://opendreamkit.org/2019/08/17/WorkshopOnDataInMathematics/>

#### Main goals.

**ODK implication.** This event was organized and funded by OpenDreamKit (Paris Sud, FAU). OpenDreamKit funded accommodation for all participants, as well as travel expenses for all but two.



PARI/GP Atelier 2019 in Bordeaux

**Event summary.** This workshop brought together interested users and authors of mathematical datasets, data framework developers, and experts interested in integrating mathematical databases with computer algebra systems. Participants discussed general issues related to data in mathematics, as well as working on concrete steps towards improving the status.

**Demographic.** The workshop was attended by two PhD students, a postdoc, four research software engineers, and seven researchers from various areas of mathematics and computer science.

**Results and impact.** The workshop allowed for a lot of time for free discussion. Several pain points experienced by mathematicians that work with data came up this way, were noted, and several cases already acted upon. In particular, there appears to be a real need for a journal dedicated to mathematical datasets and mathematical software.

Discussions on provenance of data in mathematics, initiated by Michael Kohlhase, resulted in a draft of a standard and formalisation of math data provenance.

Similarly, participants collaborated on how the web interface for datasets in mathematics should look like. This effort was led by Andrea Kohlhase and resulted in a clickable prototype in addition to a long list of requirements, sorted into must–have, should–have, and can’t–have.

Participants from FAU are working on an infrastructure for math data and significant effort went into improving this prototype system. As planned, we were able to import several real-life datasets. This included writing up descriptions, metadata (including provenance), formalising the mathematics. In addition to the datasets that were planned for import, several participants identified the need for new datasets for their research communities, and have started to work on them. The diverse backgrounds of the participants made for a helpful environment for this.

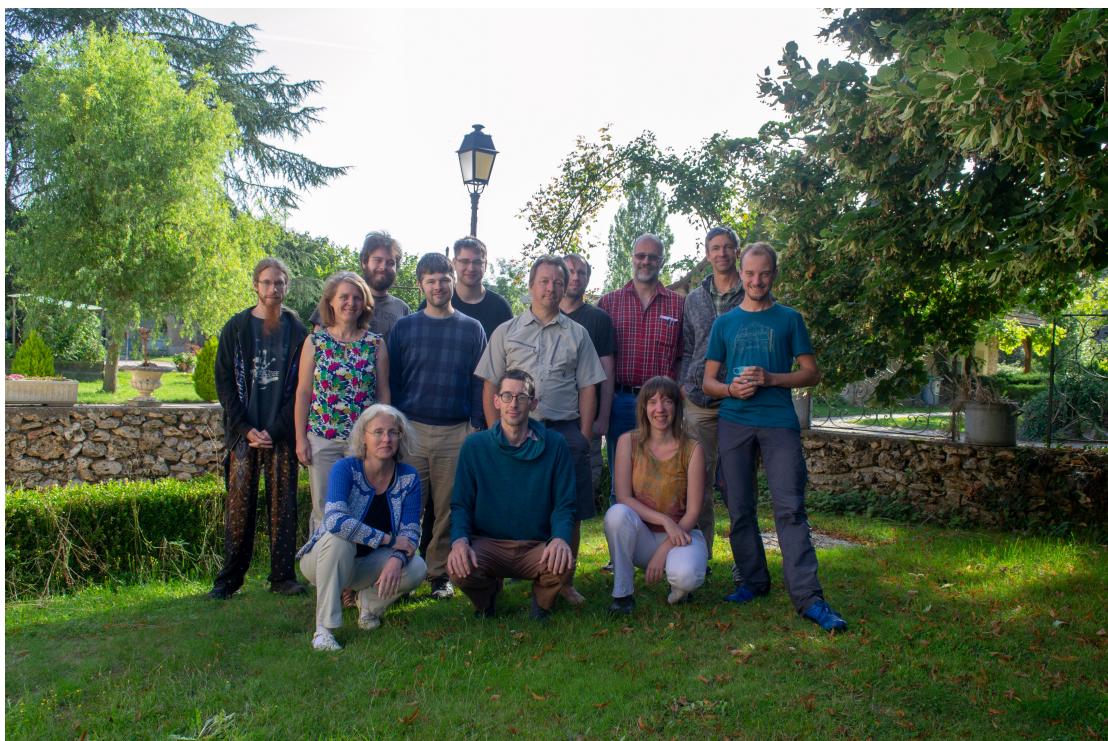
Participants also worked on side projects related to data in mathematics. Odile Bénassy was able to quickly produce a basic Jupyter interface to the system, opening up new interface possibilities. Several user stories were collected by Gabe Cunningham, and will serve as use cases for the system. Participants also added content to a multilingual math glossary.

The following testimonials indicate the degree of progress made in a single week.

“We had a super intense workshop with people with very different, complementing competencies all strongly willing to work together towards the same goal of pushing the data on MathHub idea: a real team evolved and with that a push beyond my expectations.”

“For me this was a great way of getting to know people working towards open math data. It was also an opportunity to see the general idea from different perspectives, including concrete databases, user interfaces, and formal and informal logic interconnecting the data. All this and good concrete steps taken within a superbly leisurely setting – I was absolutely enjoying my time!”

“By bringing together the developers of the MathHub with the mathematicians who are producing and analyzing math data, the workshop accomplished in a week what would have otherwise taken months. It was immensely gratifying to see how quickly the system evolved into something that is already better than the state of the art for most mathematicians.”



Workshop on Data in Mathematics, Cernay, France

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## 2. DISSEMINATION AND OUTREACHING ACTIVITIES

### ♠ TO DO: EDIT ♠

We describe here all activities related to **T2.5**: these are all events oriented towards dissemination, training, and outreach. This includes events organized or co-organized by OpenDreamKit and also participating in external events and many communication activities.

#### 2.1. Training workshops and events

##### Event 3- Software Tools for Mathematics

Koper, Slovenia, 2018-09-24–2018-09-28

ODK partners involved: UPSud

43 participants (including 3 from within ODK)

<http://stm.famnit.upr.si/>

**Main goals.** The goal of the event was for mathematicians to improve their coding skills and knowledge of mathematical software.

**ODK implication.** Samuel Lelièvre (OpenDreamKit member from UPSud) was one of the organisers. The OpenDreamKit funds at Paris-Sud were used to fund travel and stays of speakers. The Faculty of Mathematics, Natural Sciences and Information Technologies at the University of Primorska and Andrej Marušič Institute at the University of Primorska provided coffee and snacks at coffee breaks as well as equipped lecture rooms. The Slovenian Discrete and Applied Mathematics Society provided gifts for all participants.

**Event summary.** The event consisted in a two-day Software Carpentry workshop (teaching participants the Unix shell, version control with Git, and programming with Python) followed by three days on mathematical software with mini-courses on CoCalc, GAP, SageMath and Jupyter, LaTeX and TikZ, as well as talks on other mathematical software and databases, and on mathematical research using software. A problem session allowed participants to submit mathematical problems they cared about and thought software might help with, a few of which were solved in the following days by other participants.

**Demographics.** The participants included a small number of bachelor students, several PhD students and postdocs, professors and researchers.

**Results and impact.** At the Software Carpentry workshop, the Unix shell was taught by Peter Palfrader and Jan Berčič, Git was taught by Alexander Konovalov and Peter Palfrader, and Python was taught by Julian Rüth and Nino Bašić.

During the mathematical software part, Alexander Konovalov taught GAP, Nino Bašić taught LaTeX and TikZ, Samuel Lelièvre taught SageMath and CoCalc, and Julian Rüth taught SageMath.

Many participants told the organisers, orally or by email, that this workshop was transformative for them; often they felt they had passed some confidence threshold: whereas before the conference they were interested in mathematical software but unsure how to install and use them, they were now confident how to do that, and felt they had the necessary resources to learn more. One of the participants even commented that they were able to use what they learned immediately in their research. Some of the participants are involved in the organisation of the upcoming European Congress of Mathematics (ECM 2020 Portorož, Slovenia), and expressed interest in highlighting open software for mathematics at the ECM.

Furthermore, a CoCalc instance was installed on University of Primorska servers due largely to this event.

This event was conceived due to the success of the Software Tools for Mathematics in Morelia earlier in 2018. Based on the success of both workshops, Samuel Lelièvre and Katja Berčič (who participated in the organisation of both) hope that the series will continue and are considering options for future installments.

#### Event 4- SageMath classes in Crete

Heraklion, March. 4-6, 2019

ODK partners involved: UPSud

10 participants (including 1 from within ODK)

**Main goals.** We organized a series of SageMath classes in the mathematical department of the University of Crete.

**ODK implication.** OpenDreamKit funded the trip of Viviane Pons to give the classes.

**Event summary.** A series of three classes was organized throughout the week. This was open both to students (from undergrad to PhD) and researchers of the math department of the University of Crete. The classes consisted of SageMath tutorials to allow the attendees to



Software Tools for Mathematics in Koper, Slovenia

discover the software at their own pace. We used Jupyter notebooks with a focus on math related problems.

**Results and impact.** The students enjoyed the tutorials a lot. It was actually used as a starting point for more regular sessions tutored by their local teacher Eleni Tzanaki. We are now confident that SageMath will be taught at University of Crete as part of the math program. The meeting was also an occasion to prepare the up-coming Women in Sage event also organized in Crete.

### Event 5- Atelier PARI/GP 2019b

Roma (IT), 2018-04-09 to 2018-04-10

ODK partners involved: CNRS

36 participants (including 6 from within ODK)

<http://pari.math.u-bordeaux.fr/Events/PARI2019b/>

**Main goals.** This was a teaching and dissemination meeting, by invitation from the Roman Number Theory Association as a satellite event for their 5th mini-symposium.

**OpenDreamKit implication.** OpenDreamKit participants: B. Allombert and A. Page from Bordeaux.

OpenDreamKit funded travel and accommodation costs for B. Allombert for about 1.5k€. The ALGANT consortium, LIA LYSM (CNRS) and University Roma Tre co-funded the event.

**Event summary.** This Atelier PARI/GP took place in Roma (Italy) on April 9th and 10th. It was followed by a 3-day international research conference on Number Theory. There were 40 participants for the Atelier.

The 2-day Atelier followed the same pattern as the previous Roma Atelier in 2018, featuring a general introduction to PARI/GP and two specialized courses (graduate level) in the mornings:

- Bill Allombert “Finite fields”,
- Aurel Page “Algebraic number theory”.

Afternoons were devoted to practice and problem sessions.

Slides for all talks are available at <http://pari.math.u-bordeaux.fr/Events/PARI2019b/>

**Results and impact.** This was a successful teaching and dissemination event, with positive feedback from the participants and organizers.



RNTA 5th mini-symposium in Rome

## 2.2. Organization of Sage Days in established mathematical communities

One goal of OpenDreamKit is to support local communities of researchers and developers who contribute to the open-source software related to the project. For SAGE, this means supporting the organization of Sage Days workshops that arise from within all the different mathematical communities. The main goal of these workshops is mostly to improve the Sage coverage of some mathematical area. They also play a major role in training and communication. The impact for OpenDreamKit can be summarized this way:

- **Making OpenDreamKit known to the end users:** by supporting Sage Days, OpenDreamKit makes itself known to the Sage community and can thus share the many developments of the project.
- **Improving the overall quality of Sage:** by fostering researchers in specific areas, Sage Days help bring interesting mathematics into the software, which is beneficial for Sage and so OpenDreamKit.
- **Training, bringing in more users:** Sage Days are the perfect place for newcomers, especially students, to get their first experience with the software.
- **Fostering a community:** Sage Days are helping making Sage a vibrant community, which is vital for the success of OpenDreamKit.

## 2.3. Training activities in developing countries

### Event 6- Sage Days 102, University of Ibadan

Ibadan (Nigeria), July 15 – July 19, 2019

ODK partners involved: UPSud

80 participants (including 1 from within ODK)

<https://opendreamkit.org/2019/07/29/SageDays102/>

**Main goals.** The purpose of this event was to introduce students, lecturers, and researchers local to Nigeria, and some of the neighboring countries, to OpenDreamKit software, particularly SAGE and GAP, as well as to improve their programming skills in general and foster interest in contributing to open source mathematics software.

**OpenDreamKit implication.** Much of the initial animation for the event was animated by Viviane Pons, though the only OpenDreamKit member to attend was Erik Madison Bray, whose travel was funded by the project. OpenDreamKit also funded travel for three other instructors from outside the project, as well as two PhD students who attended from neighboring countries outside Nigeria. All on-site facilities and logistics were funded by the University of Ibadan.

**Event summary.** Significant time was spent helping people install such software on their personal machines: A particular challenge in Nigeria where, as many attendees lacked reliable internet connections, even downloading the software could pose a challenge. The workshop was primarily organized as a series of introductory lectures, including on using the UNIX shell and basic Python programming, then moving on to more application-specific uses of SAGE. This included topic-specific break-out sessions on numerical analysis, graph theory, and algebraic combinatorics. There were also successful break-out sessions on group theory and abstract algebra with GAP, and statistical analysis with R. Participants also gave short talks on some of their personal research and computational problems, and participated in a contest to design interactive widgets for the Jupyter notebook.

This workshop was a result of the Free Computational Mathematics conference at CIRM earlier the same year, which had three visitors from the University of Ibadan Department of Mathematics, and wanted to repeat the success of that workshop at their home institution.

**Demographics.** Out of approximately 80 participants, most came from the University of Ibadan as well as a few other institutions in Nigeria, mostly in the southern and south-eastern regions of the country. Two students came from Ghana, as well as one from Congo. One instructor (originally from the United States) came from France, one (originally from Ghana) came from Austria, and one (originally from Benin) came from South Africa. About one third of the attendees were women, and there was a roughly equal mix of PhD students, postdocs, graduate students, and a smaller number of professors and undergraduate students.

**Results and impact.** A full report on the impact of this workshop can be read on our website:

<https://opendreamkit.org/2019/07/29/SageDays102/>

As there are relatively few opportunities for many students in Nigeria to travel outside the country, as there are few opportunities to meet with outside lecturers, it's difficult to meet the demand for such opportunities. Thus one of the primary goals of this workshop was to disseminate the software itself, and to give a strong-enough introduction to it that attendees could in turn introduce their peers who were not able to attend, and to feel tapped into a broader international community of researchers interested in computational mathematics. To that end I believe we were successful, with 80% of attendees rating their knowledge of SAGE at 1 out of 5 before the workshop, and over 90% rating their knowledge at 3 or more after the workshop. 83% of attendees also felt highly confident that they had been given the resources to continue to learn on their own, and to find help with SAGE in the future, as well as that the workshop was helpful for them to build opportunities for collaboration with their peers.

Also, recognizing that one workshop was not enough to reach the demand for such training, a group of the attendees spent the week incorporating an organization (the strategy of which is still being developed) to build local sustainability for this kind of training in the future, without relying as much on (unfortunately rare) external support like that provided by OpenDreamKit.

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## 2.4. Women in OpenDreamKit



Sage Days 102, University of Ibadan

**♦TO DO: EDIT♦** OpenDreamKit is aware of the gender gap that exists in science in general and more specifically in software development. We have been organizing events to support specifically women developers, engineers and scientists.

#### Event 7- Sage Days 98 : Women in Sage

Archanes (Greece), April 8 – April 12, 2019

ODK partners involved: UPSud

22 participants (including 1 from within ODK)

<https://opendreamkit.org/2019/06/28/WomenInSage/>

**Main goals.** The main goal of the event was to initiate more women to the software SAGE to reduce the gender gap in mathematics software development. Each participant had to propose a mathematic development project to be carried out during the week.

**OpenDreamKit implication.** The event was initiated by Viviane Pons from OpenDreamKit and co-organized with Eleni Tzanaki (University of Crete). It was funded solely by OpenDreamKit which covered: lodging for the participants (rented houses), food, and transportation for many of the participants.

**Event summary.** The event was organized as a workshop where every participant could work on their own project to develop their coding skills. We started the week with an introduction to Sage and some tutorials. Then each participant gave a 5 minute talk about their own research. After that, we worked on different projects, organizing status reports every day. In particular, we ran a group specifically to produce new contributions to Sage.

**Demographics.** All participants were women coming from 8 different countries (France, Belgium, Germany, Greece, UK, US, Romania and Peru), as per institutions, and more if we count nationalities (Australia, Lebanon, Spain). About half of them could be considered Sage beginners. We had 1 master student, 14 PhD students, 2 postdocs, and 5 *Maîtresses de conférences* or assistant professor or lecturer.

We were supposed to also welcome 3 women from Nigeria but they were sadly not able to obtain their visas on time.

**Results and impact.** A full report on the impact of this workshop can be read on our website:

<https://opendreamkit.org/2019/06/28/WomenInSage/>

The main goal was to make the participants more confident into their programming skills and

more prone to become Sage contributors and attend classical Sage Days. It was a big success in that regard. Indeed, before the conference, only 17% of the participants had attended Sage Days more than once and 50% had never heard of it. After, the conference, 94% rated 3 or more out of 5 the chances that they would attend Sage Days event in the future. 100% of the participant rated 3 or more out of 5 the impact of the workshop on their future career and 100% said they met interesting people. Additionally, work was done on 5 Sage issues from of which 3 have been merged into Sage source code already.



Women in Sage in Archanes

## 2.5. Organization of research workshops

### Event 8- Journées Nationales de Calcul Formel

Luminy (FR), 2019-02-04 to 2019-02-08

ODK partners involved: UVSQ UGA

58 participants (including 3 from within ODK)

<http://www.jncf2019.uvsq.fr/>

**Main goals.** This is the yearly meeting of the French community in Computer Algebra, open to an international audience, with lectures and contributed talks given mostly in English.

**OpenDreamKit implication.** Luca De Feo co-organized the JNCF 2019. The organization of the workshop was coordinated with the organization of the “Free Computational Mathematics” conference, taking place the following week in the same venue, to encourage cross-participation.

Luca De Feo and Clément Pernet gave presentations on Monday on the achievements of OpenDreamKit relevant to the Computer Algebra community.

OpenDreamKit participants: Luca De Feo from University of Versailles, Jean-Guillaume Dumas and Clément Pernet from University Grenobles Alpes.

OpenDreamKit sponsored the event (3000€♠**TO DO: Double-check the figure**♠).

**Event summary.** This conference took place in Luminy (France) from February 4th to 8th. About 58 mathematicians and computer scientists participated to the event. Three of the participants also participated in the “Free Computational Mathematics” conference the following week, while four other noted members of the French community in Computer Algebra, Joris van der Hoeven, Marie Françoise Roy, Fredrik Johansson and Bill Allombert, elected to only participate in the latter due to time constraints.

Slides for Luca De Feo and Clément Pernet’s presentations are available online from the conference web page: <http://www.jncf2019.uvsq.fr/edt.html>.

**Results and impact.** Computer Algebra is the birth place of computer-aided Mathematics, and all of OpenDreamKit software owe something to the field. Over the years, OpenDreamKit

has constantly used the JNCF as an occasion to disseminate its achievements relevant to the community, through contributed talks.

The last edition of JNCF to happen concomitantly with the project was the occasion to double the dissemination efforts, and organize the JNCF in tandem with the main OpenDreamKit conference “Free Computational Mathematics”: two invited talks at the “Free Computational Mathematics” were delivered by noted members of the French Computer Algebra community, while one of the invited lectures at JNCF was delivered by Mohamed Barakat, a GAP developer and founder of the OSCAR consortium, close to the OpenDreamKit community. A full session was devoted to mathematical software on Monday afternoon, with two presentations given by OpenDreamKit members, and one by a MapleSoft executive, which triggered visible interest in the audience.

This was a successful workshop, and a great occasion to deliver successful developments of OpenDreamKit to its user base.

## 2.6. Communication and participation in external events

### Event 9- Keynote at PyconFr

Lille (France), Oct. 6, 2018

ODK partners involved: UPSud

400 participants (including 1 from within ODK)

<https://www.pycon.fr/2018/>

**Main goals.** PyConFr is the annual gathering of the French Python community.

**OpenDreamKit implication.** Viviane Pons was invited to be the opening keynote of the conference.

**Event summary.** Viviane gave a 30 minute talk titled “Science and Open-Source: what do we learn from each other”. This was an occasion to discuss the many interactions between research and open-source development and highlight the role of projects such as OpenDreamKit.

**Results and impact.** The talk was well-received by the Python community and received much positive feedback.

### Event 10- Conference Cohomology of arithmetic groups, lattice and number theory

Luminy (FR), 2019-03-24 to 2019-03-29

ODK partners involved: CNRS

36 participants (including 6 from within ODK)

<https://conferences.cirm-math.fr/1995.html>

**Main goals.** This was a research conference on the cohomology of arithmetic groups, with a focus on computational techniques.

**OpenDreamKit implication.** Bill Allombert was invited to give a 1-hour introduction to PARI/GP for a software session during the conference. He gave a tutorial on the manipulation of lattices,  $L$ -functions, modular forms and curves of small genus in the system.

OpenDreamKit participants: B. Allombert from Bordeaux.

OpenDreamKit funded the participation of B. Allombert to the event (about 600€).

**Event summary.** This conference took in Luminy (France) from March 24th to 29th. About 70 mathematicians participated to the event.

Slides for the PARI/GP presentation are available at <http://pari.math.u-bordeaux.fr/Events/CIRM2019/>

**Results and impact.** This was a successful teaching and dissemination event towards a community (arithmetic geometry, representation theory) for which computer-aided calculations is less natural than in other areas of mathematics: the talk was well-received with interesting feedback.

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Disclaimer: this report, together with its annexes and the reports for the earlier deliverables, is self contained for auditing and reviewing purposes. Hyperlinks to external resources are meant as a convenience for casual readers wishing to follow our progress; such links have been checked for correctness at the time of submission of the deliverable, but there is no guarantee implied that they will remain valid.