

OCEVU Report - v1.6 - still a draft!



Report to the OCEVU Steering Committee
OCEVU 2015 Status and 2016 Objectives

CONTENTS

OCEVU LEXICON	4
INTRODUCTION	5
OCEVU LABEX PROJECT DESCRIPTION	5
OCEVU AND ITS ENVIRONMENT	5
OCEVU GOALS	6
OCEVU SNAPSHOT	6
RESEARCH	6
EDUCATION	6
SOCIO-ECONOMIC IMPACT	7
OCEVU STRATEGY	7
OCEVU SCIENTIFIC PROJECTS	7
OCEVU GOVERNANCE	8
OCEVU EXECUTIVE COMMITTEE	9
OCEVU STEERING COMMITTEE	9
OCEVU SCIENTIFIC COMMITTEE	10
OCEVU WORKING GROUPS	10
OCEVU SELECTION COMMITTEES	10
OCEVU GLOBAL BUDGET AND MANAGEMENT	11
ADMINISTRATIVE AND FINANCIAL MANAGEMENT	11
ANSWERS TO THE QUESTIONS OF THE 2014 OSTC REVIEW	11
ANR MID-TERM EVALUATION	11
Scientific activities and GROUND FOLLOW-UP FAST TELESCOPE	11
computing resources	11
Impact of the education and outreach actions	12
Acknowledgements in publications in large collaborations	12
technological transfer	12
OCEVU ACTIVITIES IN 2015	12

ORGANIZATION.....	12
EQUIPEMENTS FOR RESEARCH and education/outreach PLATFORMS.....	12
Collaborative projects.....	13
On-going projects in 2015	15
BUDGET SPENDING in 2015.....	16
Calls for proposals in 2015	17
OCEVU general workshop.....	18
Organization of conferences	19
Publications	19
Opening to other labex.....	21
ASTROPARTICLES	21
Working group.....	21
Ongoing projects	22
COSMOLOGY.....	27
Working group.....	27
ongoing projects.....	28
New projects funded in 2016	32
PARTICLE PHYSICS.....	33
Working group.....	33
Ongoing projects	34
NEW projects FUNDED IN 2016.....	40
EDUCATION.....	41
Working group.....	41
Ongoing projects	41
Actions foreseen in 2016.....	42
COMMUNICATION AND OUTREACH.....	43
Working group.....	43
Ongoing actions.....	43
Actions foreseen in 2016.....	46
TECHNOLOGICAL TRANSFER.....	47

Working group.....	47
2015 project – Powermate - hybrid submarine connectors	48
OBJECTIVES FOR 2016.....	49
Labex-wide.....	49
BUDGET AND PROVISIONAL SPENDING PROFILES	49
CALLS FOR PROPOSALS.....	51
5 th OCEVU GENERAL WORKSHOP	53
COLLABORATION WITH other labex	54
QUESTIONS	54
Technological transfer	54
Future of OCEVU	54

OCEVU LEXICON

ANR:	Agence Nationale de la Recherche
IA:	“Investissements d’Avenir” (Investment for the Future) Program managed by the ANR
DNC interests:	Interests on the non-consumable endowment (“Dotation Non Consommable”)
IdEx:	Initiative of Excellence in the framework of IA
Labex:	Laboratory of Excellence, in the framework of IA
AMU:	Aix-Marseille University
A*Midex:	IdEx of AMU
OCEVU:	Labex “Origins, Constituents, and Evolution of the Universe”, selected in the IA 2011 Call for proposals. It is part of A*Midex, the IdEx of AMU
UPS:	University Paul Sabatier, Toulouse III
UM:	University of Montpellier
CNRS:	Centre National de Recherche Scientifique
IN2P3:	Institut National de Physique Nucléaire et de Physique des Particules
INP:	Institut de Physique
INSU:	Institut National des Sciences de l’Univers
APPEC:	AstroParticle Physics European Consortium
CERN:	European Organization for Nuclear Research
CNES:	National Center for Space Studies (Centre National d’Etudes Spatiales)
OHP:	Observatoire de Haute Provence (Haute Provence Observatory)
OPM:	Observatoire du Pic du Midi (Pic du Midi Observatory)
OSTC:	OCEVU Steering Committee
OSC:	OCEVU Scientific Committee
ComEx:	OCEVU Executive Committee
WG:	Working Group

AP:	Astroparticles
CO:	Cosmology
PP:	Particle Physics
INTD:	Interdisciplinary
TT:	Technological Transfer
COMO:	Communication and Outreach
OCEVU “document-b”:	document describing the OCEVU project which was submitted and selected for funding.
CFP:	Call for Proposals (Appel à Projets – AAP in French)
VS:	Visiting Scientist

INTRODUCTION

This report aims at giving to the Steering Committee, first, a description of the OCEVU Labex project, its context and environment, its management, and its budget. It then presents a summary of its activities in 2015, and a summary of its objectives for 2016. It concludes with some questions on which the OCEVU coordination would like to have the Committee guidance to try and answer them in the best possible way. The OCEVU Labex was officially started in March of 2012. For a report on the activities of the OCEVU Labex in 2012, 2013, and 2014, please refer to the documents presented to the previous Steering Committee meetings. They are available, together with the presentations, on the Indico agenda of the meetings at <https://indico.in2p3.fr/category/419/>.

OCEVU LABEX PROJECT DESCRIPTION

OCEVU AND ITS ENVIRONMENT

OCEVU is a Laboratory of Excellence on the Origins, Constituents, and Evolution of the Universe. It has been selected by an international jury as part of the French government “Investissements d’Avenir” program. OCEVU is a cluster of scientific excellence in the fields of cosmology, particle and astroparticle physics, located in the Southern part of France. Combining theory, observations, and experiments, it has a multidisciplinary approach to the exploration of the Universe, from the extremely large cosmological scales to the extremely small particle physics scales.

OCEVU is a partnership between:

- 6 laboratories: CPPM (Center for Particle Physics of Marseille), CPT (Centre for Theoretical Physics), LAM (Laboratory of Astrophysics of Marseille), LUPM (Laboratory Universe and Particles of Montpellier), L2C/IFAC (“Fundamental Interactions, Astroparticles and Cosmology” group of the Laboratory Charles Coulomb), IRAP/GAHEC (“GALaxy, High-Energy and Cosmology” group of the Institute for Research in Astrophysics and Planetary Science of Toulouse).
- 3 Universities: Aix-Marseille University, University of Montpellier, and University Toulouse III (Paul Sabatier)
- CNRS: through 3 of its Institutes, namely IN2P3, INP, and INSU

- A*Midex. The Aix-Marseille University Initiative of Excellence (IdEx) has been selected as part of the French government "Investissements d'Avenir" program. If A*Midex manages OCEVU and 9 other LabEx, it also has projects of its own to foster excellence in research and education on the Aix-Marseille site.

The OCEVU Labex (ANR-11-LABX-0060) and the A*Midex IdEx (ANR-11-IDEX-0001-02) are funded by the "Investissements d'Avenir" French government program managed by the ANR. The budget allocated to OCEVU amounts to 10 M€ over 8 years.

OCEVU covers three French Regions (Midi-Pyrénées, Languedoc-Roussillon, Provence-Alpes-Côte d'Azur) and three cities (Marseille, Montpellier, and Toulouse). The Labex comprises 40 faculty members, 25 astronomers, 70 CNRS researchers, 40 postdocs, 80 PhD students, 170 engineers and high-level technicians.

OCEVU GOALS

One of the goals of the LabEx initiative program is to reinforce the scientific excellence and the international positioning of the French research labs above mentioned.

Building on the strengths and synergies of its partner labs in theoretical, observational, and experimental fundamental physics, OCEVU has the ambition to create a structuring, collaborative, interdisciplinary, and internationally attractive environment of excellence for research, education, and societal applications through technological transfers and scientific communication and outreach, so that the Aix-Marseille-Montpellier-Toulouse geographical arc becomes fully recognized as a major international player in the current and future projects meant to address seminal questions pertaining to our understanding of the Universe.

OCEVU SNAPSHOT

RESEARCH

OCEVU covers three main research areas: Cosmology, Particle Physics, and Astroparticle Physics. It will focus on a limited number of projects, on which we are particularly well positioned to make significant progress: Dark Energy and Dark Gravity, particularly using cosmological probes developed in the context of the Euclid mission; Dark Matter, with the direct search for dark matter candidates, including super-symmetric particles, indirect detection, and astrophysical constraints; Dark ages and structure assembly in the Universe, with the goal to identify objects emitting "first light"; Study of the recently discovered new Higgs-boson-like particle and search for supersymmetric particles at the LHC, exploration of Electroweak symmetry breaking scenarios, Flavor and precision physics; Study of Gamma-ray Bursts (GRBs), of the astrophysics of new messengers, and of Cosmic Rays;

To support this ambitious scientific program and to increase its attractiveness, OCEVU offers LabEx-wide and on a competitive basis: incentive funds for new ideas; an International Program for PhD and postdoctoral grants; funding for visits of high-profile senior scientists.

EDUCATION

Faculties in our laboratories are conducting all the under-graduate and graduate courses in Astrophysics, Astroparticle Physics, Cosmology, Fundamental Physics, Particle Physics, in the Marseille-Montpellier-

Toulouse area. OCEVU will offer a comprehensive set of courses combining experimental, observational, and theory training. It will offer the best students world-wide, a complete access to all these courses for them to tailor their curriculum depending on their motivation. It will foster innovative pedagogic approaches complementary to the more traditional academic way. It will reinforce and develop international exchange collaborations for research and education with high-level foreign universities, and invite the best students to engage into the competitive selection process to obtain OCEVU-financed thesis grants. It will also reinforce its ties with the secondary and high school system through innovative pedagogic approaches in order to interest more pupils to science and research.

SOCIO-ECONOMIC IMPACT

The research and R&D conducted within OCEVU will lead to scientific advances and discoveries as well as to new technological breakthroughs linked to instrumentation development. These results will be presented to the scientific community through peer-reviewed publications and communications at international conferences. Its communication and outreach group will work on presenting these results to the younger generations and the public at large through a variety of actions and events. Following our experience with existing patents and startup companies issued from our technical activities, we will follow-up technological developments in our technical facilities to identify patentable innovations, partnerships with private companies, as well as encourage the creation of new startup companies, in coordination with the SATT (Accelerator of Technology Transfers).

OCEVU STRATEGY

The strategy of OCEVU is to create a competitive but collaborative environment fostering:

- Further progress in the understanding of the main constituents of the Universe
- New advances in understanding Dark Energy and Dark Matter, and exploring new Physics like modified Gravity and physics beyond the standard model,
- New experiments on the ground, underground, undersea, and in space; new data analysis facilities and methods; new theoretical advances to interpret the large data samples collected.

Compete at the best international level by:

- Promoting closer ties between experts in astrophysical observations, particle physics experiments, fundamental physics and cosmology theories
- Offering students and researchers outstanding work conditions and resources

Provide a creative environment for:

- Undergraduate education
- Researcher training at PhD and post-doctoral levels
- Technological development for new instrumentation in partnership with industry.

So as to attract the best students, young researchers, and experienced visitors from all over the world, OCEVU intends to strengthen the international standing of our laboratories and our Universities in this interdisciplinary field of research, positioning the greater south of France as a research cluster of excellence in the study of the physics of the Universe.

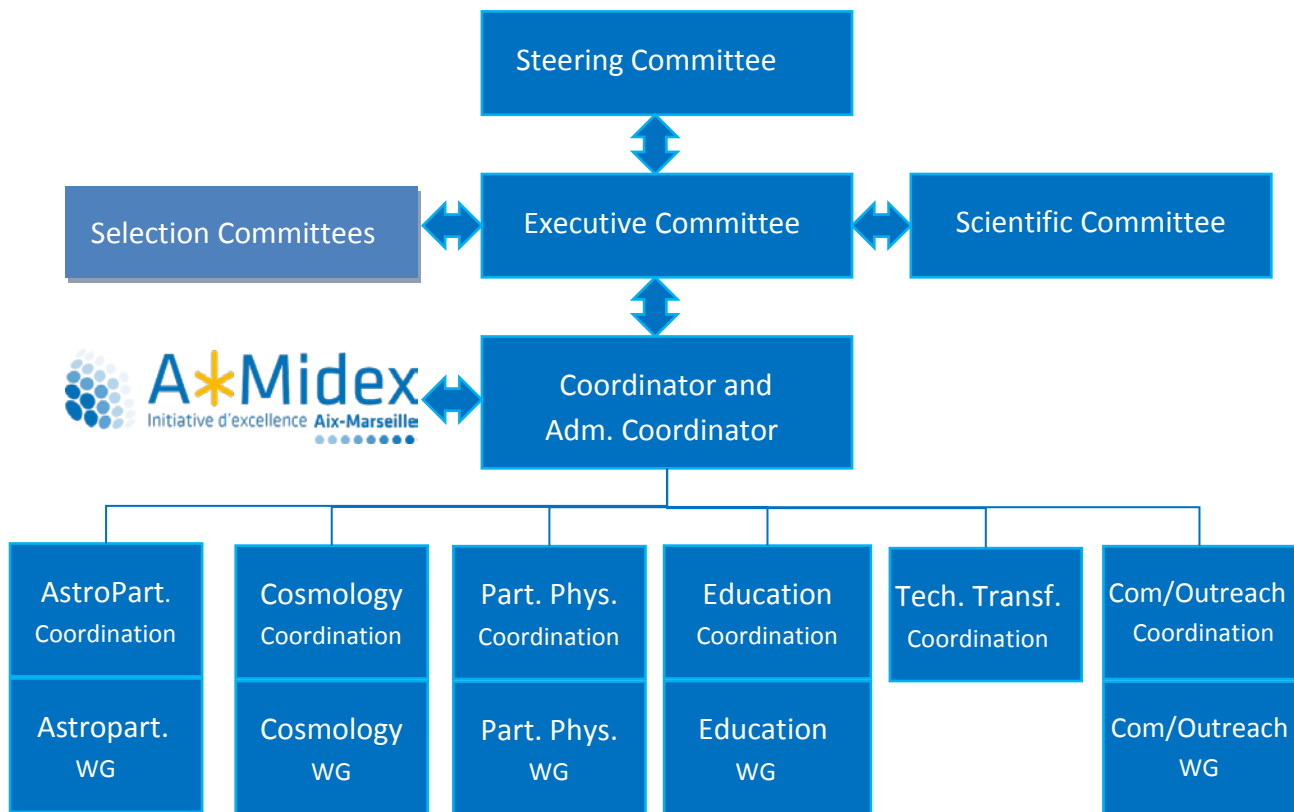
OCEVU SCIENTIFIC PROJECTS

- Significant but limited number of projects, on which we are particularly well positioned to make significant progress:
 - Dark Energy and Dark Gravity, using cosmological probes
 - Dark Matter: direct and indirect search, astrophysical constraints
 - Dark ages and structure assembly in the Universe: identify objects emitting “first light”
 - Violent Phenomena astrophysics
 - Astrophysics with new cosmic messengers, Gamma-ray Bursts (GRBs)
 - Cosmic Rays (origin, acceleration and propagation)
 - Search and study the Higgs boson and supersymmetric particles at the LHC
 - Study Flavor and precision physics

- Approach based on:
 - Development of new experiments: science payload of the space missions Euclid, SVOM, and ATHENA+, LSST, the Cerenkov Telescope Array (CTA) and its neutrino counterpart MEUST/KM3, upgrades of the ATLAS and LHCb experiments at CERN
 - Participation to major observations and data collection (VIPERS, BOSS, LHC ATLAS/LHCb, ANTARES, CTA, VLT, VISTA, MUSE...).
 - Development of statistical combinations of cosmological probes for high precision cosmology

OCEVU GOVERNANCE

The OCEVU Labex management is based on committees modeled on the ones used in our research labs and which has proven to be efficient: an Executive Committee (ComEx) advised by a Scientific Committee (OSC) and reporting to a Steering Committee (OSTC). The operational level comprises a Coordinator and an Administrative Coordinator with six Working Groups Coordination Boards for: Astroparticle Physics, Cosmology, Particle Physics, Education, Technological Transfers, and Communication and Outreach. Ad hoc Selection Committees are put into place whenever a PhD student or a postdoc position is open for recruiting. The OCEVU labex has strong links with the governance of the A*Midex Idex - Aix-Marseille University, University of Montpellier, University Paul Sabatier Toulouse - and CNRS through three of its Institutes (IN2P3, INSU, and INP).



OCEVU EXECUTIVE COMMITTEE

It is in charge of implementing the scientific program and the operation of the Labex through its Coordinator and Administrative Coordinator. It is advised by the Scientific Committee and reports to the Steering Committee. The Executive Committee comprises the directors of the partner laboratories, the Working Group Coordinators, and the Labex Coordination (Coordinator and Administrative Coordinator). It convened on a weekly basis until July 2013, while the Labex was being set up. Now that the organization and the operation rules are well defined, the frequency of the regular meetings has been reduced to about once a month. Discussion by email is also used to address specific occasional issues.

OCEVU STEERING COMMITTEE

Typically, the Steering Committee convenes once a year. At the Steering Committee meeting, the Labex Coordinator reports on the projects and expenses of the current year and the ones envisaged for the following year. The Committee evaluates the scientific program of the Labex, the relevance, the priorities, and the resources associated to it. The meeting is also an opportunity to coordinate the Labex actions with the national and international priorities of our funding agencies. The Steering Committee comprises the management of AMidex, representatives of the governance of our Universities, representatives of the management of our CNRS institutes (IN2P3, INSU, INP), representatives of the organizations with which we have strong links : APPEC, CERN, and CNES, for the scientific aspects and Competitiveness Clusters (Pôle

Mer Méditerranée, OPTITEC, Aerospace Valley) for the technological transfer aspects. It is chaired by Prof. Saul Perlmutter, laureate of the Nobel Prize in Physics 2011.

OCEVU SCIENTIFIC COMMITTEE

The Scientific Committee advises the Executive Committee on the scientific program to be implemented. It is consulted on the state, the program and the coordination of the projects lead within the Labex. In particular, it is in charge of the review and evaluation of the projects submitted to the Labex Calls for Proposals, and to provide the Executive Committee with a ranked list taking into account the scientific quality and collaborative aspects of the projects, the resources available for the Calls and the scientific priorities of the Labex, as described in the OCEVU “document-b”. It convenes once a year, in person, in September to review the proposals for the general Call (submission deadline in mid-July); it also processes remotely a second Call (for proposals of additional conferences and invited scientists) in early spring. The Committee comprises 9 internal elected members and 6 internationally renowned scientists. The Committee is chaired by one of the external members, elected by the Committee.

OCEVU WORKING GROUPS

Each of the six OCEVU Working Groups (Astroparticles, Cosmology, Particle Physics, Education, Technological Transfer, Communication and Outreach) is managed by a Coordinator and Deputy-Coordinator(s) forming the WG Board, in direct connection with the Labex Coordinator. They decide of the appropriateness to enlarge the WG Board to people responsible (or their representative) of the different Labex teams working on the topics covered by the WG to help them manage the WG. The WG Coordinators and Deputy-coordinators are also respectively members and invited members of the Executive Committee. Their main role is to foster exchanges, trigger new ideas, and provide a forum for defining priorities and coordination within their group, in preparation of the LabEx Calls for Proposals.

OCEVU SELECTION COMMITTEES

The Selection Committees are appointed for the recruiting of PhD students and postdocs. To ensure the quality of recruitment, it is divided into three phases: a first phase consists in advertising about the available position on the Labex website and on international platforms (Spire, American Astronomical and Astrophysics Society, CERN Courier, Academic Positions, ...) in order to open these offers to the largest possible international community, hoping in return a large number of applications that meet the criteria of excellence required by OCEVU. At the end of the application period, the Selection Committee reviews the application documents and establishes a short list of candidates to be interviewed. Then, the Selection Committee interviews the short listed candidates, and based on the applicant’s interview and academic and scientific records, it ranks, in decreasing order, the candidates meeting the criteria to deserve to be offered an OCEVU grant. Once the ranked lists are validated by the ComEx and in the order of this ranking, the listed candidates are offered an OCEVU doctoral/postdoctoral grant and are hired if they accept.

Each postdoctoral Selection Committee comprises the directors of the laboratories involved (or his/her representative), the coordinator(s) of the Working Group(s) involved, two persons selected by the OCEVU Scientific Committee, and the coordinators of the project on which the new postdoc will work.

Each PhD student Selection Committee comprises the directors of the laboratories involved (or his/her representative), the coordinator(s) of the science Working Group(s), the directors of the three doctoral schools (in Aix-Marseille, Montpellier, and Toulouse) linked to OCEVU, and the principal co-advisor of the thesis on which the recruited student will work.

OCEVU GLOBAL BUDGET AND MANAGEMENT

The recommendations of the ANR internal note 20121005-IA-IDEX-A-MIDEX specify for OCEVU that a 10M€ allocation (compared to the 15.9 M€ requested) should allow OCEVU to reach its goals and that some reductions should be applied on the different budget lines in order to fit in this budget.

ADMINISTRATIVE AND FINANCIAL MANAGEMENT

The 10 M€ (over 8 years) are managed by the A*Midex University Foundation; management costs (4% in 2012-2013 and 8% from 2014 on) have to be taken out of these 10 M€ to get the available budget for the project.

The administrative and financial management of the Labex is based on the one in effect at AMU. It is operating in a centralized way so as to avoid, as much as possible, an inflation of money transfer agreements between the different Universities partners in the Labex, given that they are a bit tedious and time consuming to put into place. This kind of agreement is mostly used to cope with OCEVU PhD grants for which the principal thesis co-supervisor is not affiliated to AMU.

A*Midex recruited administrative personnel specifically to manage the 10 Labex projects part of the AMU IdEx. On the OCEVU Labex side, the administrative and financial matters are managed by an Administrative Coordinator (also the Administrative Director at CPPM), and by some CPPM administrative staff (covering: orders, missions, human resources, international matters, ...).

ANSWERS TO THE QUESTIONS OF THE 2014 OSTC REVIEW

ANR MID-TERM EVALUATION

A summary document describing the OCEVU Labex activities has been submitted end of March 2015 to the ANR, and a presentation has been given in Paris beginning of June 2015 in front of an international jury; Eric Kajfasz gave the presentation and was accompanied by Olivier Le Fèvre and Jean-Luc Atteia who took part in answering the questions of the jury. The jury gave a very good and supportive evaluation of OCEVU; its report specifies that it did not find any weaknesses to the project.

SCIENTIFIC ACTIVITIES AND GROUND FOLLOW-UP FAST TELESCOPE

We follow again this year the wish of the OSTC to meet yearly with the WG coordinators and some of the OCEVU Postdocs and PhD students, and to have a progress report on the Ground Follow-up Fast Telescope.

COMPUTING RESOURCES

Computing resources are part of the OCEVU “document-b” (Dark Energy Data Center and Grid Computing, for a total of 458 k€) are scheduled to be deployed starting in 2016. The OCEVU Labex setup a Task Force to work on the computing and storage resources needed by the projects within the perimeter of the OCEVU LabEx. This Task Force produced a document that will be presented at the OSTC meeting. Following this

meeting and the questions and comments of the OSTC, a Review Committee will be setup beginning of 2016. Its recommendations will be sent to the OSTC and the ComEx for analysis and approval.

IMPACT OF THE EDUCATION AND OUTREACH ACTIONS

This issue is touched upon in the COMMUNICATION AND OUTREACH SECTION.

ACKNOWLEDGEMENTS IN PUBLICATIONS IN LARGE COLLABORATIONS

This issue concerns large collaborations like the ones working at the LHC (ATLAS and LHCb). It has not been resolved yet, but it is slowly progressing towards a hopefully positive outcome. If LHCb specifically mentions OCEVU in its “acknowledgements”, ATLAS only mentions “Labex and Idex” without specifying any names. Another solution suggested by the OSTC is for OCEVU to provide two lists: one including the publications with an explicit mention of OCEVU in the acknowledgements, and a second one without explicit mention but identified by OCEVU as having benefited from its support. This solution remains to be validated by the ANR.

TECHNOLOGICAL TRANSFER

Each lab has its own R&D programs, and so far, these programs have not been conducted in a collaborative way between the LabEx partner labs. Therefore, on the very short term, it is extremely difficult to find collaborative projects between labs on technological transfers. The OSTC suggested to organize a meeting between the labs and the competitiveness clusters in order to strengthen the actions in this domain, unfortunately, due to lack of time this could not be done in 2015.

OCEVU ACTIVITIES IN 2015

ORGANIZATION

In addition to the funding of platforms for research and education that are part of the OCEVU “document-b”, the scientific activities of the Labex are funded through Calls for Proposals (CFP) for collaborative projects to incite the different teams of the Labex to collaborate on common projects.

EQUIPEMENTS FOR RESEARCH AND EDUCATION/OUTREACH PLATFORMS

In accordance with the OCEVU “document-b”, equipment to complete or upgrade some platforms relevant to the OCEVU perimeter has been ordered upon approval by the Steering Committee. The spending profile for this equipment is given in the following table:

		2012-2014	2015	2016-2019
INSTRUMENTATION "EXTREME"	Measuring arm	45 000		
	3D metrology	115 000		
	Digital microscope	65 000		
	Upgrade scope 25 GHz	75 000		
Subtotal (€)		300 000		
PLATFORMS FOR SPACE	ERIOS tank	264 300	105 088	124 912
	7 m3 tank	145 500		
Subtotal (€)		409 800	105 088	124 912
GFT	Follow-up telescope		21 503	1 003 997
Subtotal (€)			21 503	1 003 997
COMPUTING RESOURCES	DE Data Center			353 000
	Grid computing			105 000
Subtotal (€)				458 000
EDUCATION and OUTREACH	IRiS Telescope @ OHP	90 858		
	Equipment @ OHP	3 580		
	ePERON @ OPM	40 520	11 600	6 000
Subtotal (€)		134 958	11 600	6 000

The "Platform for space" installed at LAM and financed by OCEVU at the level of 675,7 k€, will be used, in particular, for the EUCLID space mission (and may be considered for Athena+ later on). The "Platform Instrumentation Extremes" at CPPM and financed by OCEVU at the level of 300 k€, comprises a scope upgrade to 25 GHz used for the upgrade of the LHCb detector readout system, a portable coordinate measuring arm, a 3D optical & touch probe coordinate measuring machine, and a digital microscope, used in particular for the upgrade of the ATLAS pixel detector and for the EUCLID space mission. The ERIOS tank was officially inaugurated on September 19th, 2014; some instrumentation is still needed to complete the platform. The Ground Follow-up Fast Telescope has an approved budget of 1 025 500 €, of which 21 503 € have been used in 2015. For the cosmic ray measurement platform at OPM, well on track to be launched by mid-2016, an extra 6 000 € will be necessary to finalize the setup (requested in the CFP#4).

COLLABORATIVE PROJECTS

One of the main goals of OCEVU is to build a multidisciplinary (observational, experimental and theoretical) and collaborative environment for our research teams. To achieve this goal, a substantial part of the OCEVU budget is dedicated to yearly "Calls for Proposals" (CFP) in order to foster collaborative projects which are required to involve teams of at least two different labs partners in the Labex. Each year, a certain number of PhD and postdoctoral grants, following the time distribution described in the "OCEVU GLOBAL BUDGET" section, and 100 k€ of incentive/operating money to be spent to finance the selected projects.

The deadline for submitting the projects to the OCEVU coordination is mid-July, each year. The OCEVU Scientific Committee reviews the submitted projects, produces for each project a one-to-two-page report and recommendations on financing it or not and at which level. The Scientific Committee sends its report to the Executive Committee beginning of October. Based on the OSC recommendations, the ComEx performs a final arbitrage so that the final list of selected projects and the level of their financial support is available by the end of October.

The criteria used by the OSC to review the projects are the following:

Qualifying criteria

- Scientific relevance (including realism of roadmap) and expected impact (international as well as national); this is of primary importance to justify proper usage of funding to the ANR
- Matching with the Labex scientific fields and goals (Astroparticles, Cosmology, Particle Physics), in accordance with the OCEVU project IA-ANR document
- Genuine collaborative efforts between the Labex partners (at least two partners involved required)

Additional criteria

- Originality of the proposal and positioning with respect to the international competition; realistic presentation of, and matching between, scientific goals, estimated workload, and proposed agenda; matching between proposal and requested (available) funding potentially leading to long-term synergy between the involved Labex groups (and thereby enhancing visibility)
- Matching between scientific goals and scientific expertise
- Scientific quality of participants, confidence in the ability of the team to achieve the proposed goals in the proposed schedule

Based on the OSC recommendations, the final arbitrage of the ComEx can also take into account considerations linked to the priorities of the partner labs and/or the academic bodies involved and their scheduling.

The next step in order to make available the human resources linked to the selected project is a Call for Applications. This Call is managed in a centralized way by the coordination of the Labex. The profiles for the corresponding doctoral and postdoctoral positions are widely advertised on the OCEVU web site and on multiple national and international job platforms in order to attract as many top level students and young researchers as possible. The recruiting is performed on a competitive basis in two steps by Selection Committees.

For selected projects spanning several years, an annual progress report is requested to validate the continuation of the OCEVU financial support and help the projects alleviate the difficulties some of them could run into. This progress report is meant to be reviewed by the OSC and the ComEx.

ON-GOING PROJECTS IN 2015

The 32 on-going projects in 2015 funded by OCEVU are listed in the following table. Following the OSC recommendations and the ComEx arbitrage concerning CFP #3, 4 new postdocs (K. MIURA [PP], C. TRICHARD [AP], M. G. BERNARDINI [AP,CO], A. PISANI [CO]) and 4 new PhD students (E. VENTOU [CO], D. DONEVSKI [CO], R. EL KHOSSEIFI [PP], M. STREF [AP,PP,CO]) were hired thru the Selection Committees.

0	ID#	SIFAC ID	Title	Link to ID#	PI	Labs	2012	2013	2014	2015	2016	2017	2018	2019	Term position or VS name
0	0	LA0812P000	Rare dileptonic B decays	128	G. Mancinelli	CPPM, CPT	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)					Alessandro MORDA (PhD01 - CPPM) funding in 2015
									CFP#3	2 000					
1	1/2	LA0813P001	Cosmic Rays and Molecular Clouds (CR-MC)/Low Energy Cosmic Rays (LE-CR)	112	A. Marcowith	LUPM, IRAP	CFP#1	Post(3m)	Post(12m)	Post(12m)	Post(9m)				Marco PADOVANI (P01 - LUPM)
								VS(2m)	VS(2m)						Huirong YAN (KIAA Beijing, China)
								4 000	4 000						
									CFP#3	6 000					funding in 2015
1	3	LA0813P003	Performance Optimisation for the Fermi LAT gamma-ray telescope	149	J. Cohen-Tanugi	LUPM, IRAP, others	CFP#1	VS(2w)	VS(2w)	VS(2w)					Andrew STRONG (MPI Garching)
								4 000	4 000						
									CFP#3	1 000					funding in 2015
1	6	LA0813P006	Observation of the hadronic sky at high energy	138	A. Klotz/D. Domic	IRAP, CPPM	CFP#1	PhD(0m)	PhD(12m)	PhD(12m)	PhD(12m)				Damien TURPIN (PhD05 - IRAP)
								2 000	2 500	2 000					funding in 2015
1	7	LA0813P007	Flash Telescope – building the final proposal		J.-L. Atteia	IRAP, LAM, CPPM	CFP#1	1 688,07	2 123,31						Réunions et missions Ended in 2015
										5 000					
1	15	LA0813P015	The Three Dimensional Shape of Galaxy Clusters: Combining Data Sets	110, 114	M. Limousin	LAM, IRAP	CFP#1	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)				Mario BONAMIGO (PhD02 - LAM)
									VS(2,5m)						Andrea MORANDI (Purdue Univ., USA)
								3 000	3 000						
									CFP#1.5	VS(0,5m)					Fabio GASTALDELLO (IASF-INAF, Milan, Italy)
									CFP#2.5		VS(1,5m)				Carlo GIOCOLI, Bologna
											VS(3m)				Giulia DESPALI (LAM)
											VS(1w)				Mauro SERENO, Bologna
											7 000				funding in 2015
1	16	LA0813P016	Spectroscopic Redshift Surveys in OCEVU: Dark Energy, Galaxy Evolution and Reionization	145	L. Tresse	LAM, IRAP, CPPM	CFP#1	Post(2m)	Post(12m)	Post(8m)					Sylvain DE LA TORRE (P02 - LAM)
								PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)				David BINA (PhD03 - IRAP)
								14 000	17 000						
									CFP#3		Post(3m)	Post(10m)			Alice PISANI (P12 - CPPM)
										40 000					funding in 2015
1	17	LA0813P017	Featuring Dark Energy	148	A. Blanchard/Ch. Marinoni	IRAP, CPT	CFP#1	Post(1m)	Post(12m)	Post(12m)	Post(11m)				Stephane ILIC (P03 - IRAP et CPT)
								1 000	1 000						
									CFP#3	2 500					funding in 2015
1	21	LA0813P021	Dark Energy and Dark Gravity		D. Puy	LUPM, IRAP, CPT, L2C, others	CFP#1			5 000					Réunions - Status ?
1	26	LA0813P026	Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS detector	140	L. Felgioni	CPPM, LUPM, L2C	CFP#1	Post(0m)	Post(12m)	Post(4m)	Post(12m)	Post(8m)			Sara DIGLIO (P04 - CPPM) TBD (P04-2 - CPPM)
								6 500	21 900						
									CFP#1.5	VS(2m)					Yanwen LIU (USTC, China)
									CFP#2	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)		Venugopal ELLAJOSYULA (PhD08 - CPPM)
									CFP#2.5	VS(1m)					Yanwen LIU, USTC, China
										VS(1,5m)					Xuai ZHUANG, IHEP, Beijing
									CFP#3	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)		Rima EL KHOSSEIFI (PhD12 - CPPM)
										20 000					funding in 2015
1	27	LA0813P027	New physics from a natural electroweak symmetry breaking	115	J.-L. Kneur	L2C, CPT, CPPM	CFP#1	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)				Nicolas BIZOT (PhD04 - L2C)
								1 500	2 500						
									CFP#3	4 000					funding in 2015
1	28	LA0813P028	Lattice QCD enlightens dark matter	136	L. Lellouch	CPT, LUPM, LAM, others	CFP#1	Post(2m)	Post(12m)	Post(12m)	Post(10m)				Christian TORRERO (P05 - CPT)
								14 500	9 500						
									CFP#3	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)		Martin STREF (PhD09 - LUPM)
										10 000					funding in 2015

2	33	LA0814P033	NectarE2E – Building an end-to-end demonstrator of a NectarCAM module	151	P. Jean	IRAP, CPPM	CFP#2	20 000							funding in 2015
							CFP#3	20 000							Thomas FITOUSSI (PhD06 - IRAP)
2	36	LA0814P036	Probing the universe with cosmological electromagnetic cascades	117	J. Malzac	IRAP, LUPM	CFP#2	1 000							funding in 2015
							CFP#3	6 000							Toru YAMADA (Tohoku Univ., Japan)
2	39	LA0814P039	WISH: Wide-field Imaging Surveyor for High-redshift		D. Burgarella	LAM, IRAP	CFP#2	VS(1m)							Toru YAMADA (Tohoku Univ., Japan)
							CFP#3	5 000							funding in 2015 - Status ?
							CFP#3	7 000							Daniele PIERINI (P06 - IRAP)
2	41	LA0814P041	Unveiling the baryonic properties of the first massive halos in the Universe	120	E. Pointecouteau	IRAP, LAM	CFP#2	Post(7m)	Post(12m)	Post(12m)	Post(5m)				funding in 2015
							CFP#3	2 000	5 000						Hadi RAHMANI (P07 - LAM)
2	43	LA0814P043	REGAL: what REgulates the growth of GALaxies? The missing piece to understand galaxy evolution	124	Th. Contini	IRAP, LAM	CFP#2	Post(2m)	Post(12m)	Post(12m)	Post(10m)				funding in 2015
							CFP#3	2 000	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)			Emmy VENTOU (PhD10 - IRAP)
							CFP#3	10 000							Ana ACEBRON (PhD07 - LAM)
2	46	LA0814P046	Golden Lenses in the HST Frontier Fields (GLIFF)	144	E. Jullo	LAM, CPPM	CFP#2	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)				funding in 2015
							CFP#3	1 000	5 000						Andrey TAYDUGANOV (P08 - CPPM)
2	50	LA0814P050	B decays into tau lepton pairs and related rare transitions	129	G. Mancinelli	CPPM, CPT	CFP#2	Post(2m)	Post(12m)	Post(12m)	Post(10m)				funding in 2015
							CFP#3	1 000	3 000						Kohtaroh MIURA (P09 - CPT)
2	51	LA0814P051	The muon anomalous magnetic moment and the search for new physics in the LHC era	131	L. Lellouch M. Knecht	CPT, L2C, LUPM	CFP#2	4 000							funding in 2015
							CFP#3		Post(3m)	Post(12m)	Post(12m)	Post(9m)			Cyril TRICHARD (P10 - CPPM)
3	76	LA0815P076	10th Edition of the Marseille Cosmology Conference Cycle - "Drifting through the Cosmic Web: the evolution of galaxies within the Large Scale Structure"		M. Treyer	LAM, CPT, IRAP	CFP#3	6 000							Volker BROMM (LAM et LUPM)
3	77	LA0815P077	Preparing OCEVU's CTA Science (CTASci)	125	J. Knödelseder	IRAP, CPPM, LUPM	CFP#3	Post(3m)	Post(12m)	Post(12m)	Post(9m)				funding in 2015
							CFP#3	5 000							Sacha DAVIDSON, IPN Lyon
3	79	LA0815P079	The First stars in the Universe		F. Martins	LUPM, LAM	CFP#3	VS(1w)							funding in 2015
3	80	LA0815P080	Educational facility for the study of Cosmic Rays at Pic du Midi	143	J. Busto	CPPM, IRAP, LUPM	CFP#3	12 000							funding in 2015
3	85	LA0815P085	GRB science prospects and optimization with SVOM/ECLAIRS	119	F. Piron	LUPM, IRAP	CFP#3	Post(3m)	Post(12m)	Post(9m)					funding in 2015
							CFP#3	5 000	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)			Darko DONEVSKI (PhD 11 - LAM)
3	87	LA0815P087	Identification and Modelisation of very high redshift galaxies in Herschel cosmological surveys	113	V. Buat	LAM, IRAP	CFP#3	5 000							funding in 2015
3	90	LA0815P090	Visit of Sacha Davidson in the accurate photometry for precision cosmology within LSST	153	M. Frigerio	L2C, LUPM,	CFP#3	VS(3m)							funding in 2015
3	94	LA0815P094	History of star formation from sub-millimetre and millimetre observations	141	G. Lagache	LAM, IRAP, [IPAG, ESO/Garching, AIM]	CFP#3	4 000							funding in 2015
3	102	LA0815P102	Dark energy: beyond six parameters	147	A. Blanchard/ A. Ealet	IRAP, CPPM, CPT, LAM, LUPM, [IAS, LAL, LAPP]	CFP#3	7 500							funding in 2015
3.5	109	LA0815P109	QCD 2015 - 30th anniversary - 18th international conference in QCD		S. Narison	LUPM, L2C, CPT	CFP#3.5	4 500							funding in 2015
3.5	111	LA0815P111	Test and validation of software		D. Hoffmann	CPPM, IRAP, LAM	CFP#3.5	4 100							funding in 2015

BUDGET SPENDING IN 2015

As of 28 November 2015, the budget spending of OCEVU in 2015 amounts to (in €):

Type	Mass	Committed	Charged	Available
OCEVUSOC	MASSE_FONC	284 404	269 329	109 172
OCEVUSOC	MASSE_INV	182 516	79 081	90 439
OCEVUSOC	MASSE_PERSO	564 653	564 653	138 137
	Somme :	1 031 573	913 063	337 748

It should be noted that the amount for personnel (MASS_PERSO) does not include the salaries of the PhD students installed at Montpellier and Toulouse, for which a transfer of their total salary has been made to their corresponding University.

The budget spent on the different projects is listed in the following table:

Type	Orders	Missions	Total	Expected
Projects	101 737,13	76 874,27	178 611,40	280 000,00
GFT	21 200,00	303,50	21 503,50	0,00
Generic	68 092,62	20 623,50	88 716,12	
Outreach	7 804,80	2 955,05	10 759,85	45 000,00
Education	27 692,85		27 692,85	35 000,00
Internal	3 907,25	4 455,40	8 362,65	30 000,00
Platforms	105 088,02		105 088,02	230 000,00
Summer Camp	12 364,27	1 505,87	13 870,14	16 000,00
OCEVU Workshop	11 811,42	4 586,47	16 397,89	15 000,00
Others	15 027,75		15 027,75	
TOTAL			486 030,17	651 000,00

The table shows some differences with the expected spending in 2015. To make the budgets easier to manage, the rule of the Labex is that the collaborative projects request their budget on an yearly basis; if the budget allotted year N is not completely used by a project, the remainder is not capitalized by the project but goes back to the global budget to be distributed to the projects in year N+1.

In order to be even more attractive to top level candidates at an international level for the OCEVU PhD and doctoral grants, these grants are intended to be increased by 15% w.r.t. regular grants. However, this increase is not automatic. Once the candidates have been selected for hiring, their records must be submitted to the A*Midex governance and the AMU Scientific Council to be reviewed for validation of the requested grant increase. This procedure has been recently simplified: from now on, the increase in salary requests will just need to be validated by the A*Midex governance.

Given the fair amount of on-going projects (over 30) giving rise to numerous orders (mostly missions but not only), we restructured the analytical financial follow up of each of them so that it is done directly in the financial software (SIFAC) of AMU.

CALLS FOR PROPOSALS IN 2015

In 2015, two CFP were launched. In March, the intermediate CFP #3.5 geared toward supporting visiting scientists and the organization of international conferences and workshops, and in July, the general CFP #4. Both calls were processed first by the OCEVU Scientific Committee, to review and rank the submitted proposals, and then by the ComEx for the final arbitrage. As part of Call #4, the on-going projects had also to file progress reports. Altogether, from CFP #0 to CFP #4, 108 proposals were submitted, showing the strong interest of the Labex community for the collaborative projects the Labex helps funding.

An intermediate CFP (#3.5) was launched in March of 2015 to fund visiting scientists (VS) and the organization of international conferences or workshops. The following table summarizes numbers related to the new proposals which were submitted for this Call:

CFP#3.5	Requests				
	AP	CO	PP	EDU	Total
# VS		1 (1 week)			1 (1 week)
# conferences			1	1	2
budget (k€)		1.75	20	4.1	25.85

A general CFP (#4) was launched in spring of 2015 to finance collaborative projects between Labex teams with a deadline for submission mid July 2015. Associated to the Call was the funding of up to 12 yrs of postdocs, 3 PhD students, and 350 k€ of operating money (all included: incentive, postdoc and PhD operating lump sum, visitor per-diem). This should saturate the possible number of postdocs and PhD students the Labex can hire within its allotted budget. The review of the proposals by the Scientific Committee was finalized beginning of October with the final arbitrage of the ComEx end of October. The following table summarizes numbers related to the 50 proposals (new and on-going projects) which were submitted for this Call:

CFP #4	Requests				
	AP	CO	PP	EDU	Total
# projects	12	21	14	3	50
# postdocs	3	7	2		12
# PhD	1	4	2		7
# VS		3 (4m)	1 (3m)		4 (7m)
# conf		1	3	1	5
budget (k€)	129	144.7	74.22	8	355.92

As can be seen from the tables, the CFP resulted so far in a large number of proposals of collaborative projects quite often also combining observational, experimental, and theoretical aspects. This tends to demonstrate the genuine interest of the OCEVU members for these Calls and the achievement of a strong dynamics of collaboration between different teams of the Labex. It also has to be noted that some of the multi-year projects have gotten much stronger over the years requesting additional support in the successive CFP. They consolidate the impact of OCEVU in the large experiments supported by our financing agencies, namely: preparation for future large surveys (EUCLID from theoretical and observational viewpoints and starting LSST) for cosmology; CTA and starting SVOM for astroparticles; electroweak symmetry breaking and new physics at the LHC (ATLAS and LHCb from theoretical and experimental viewpoints) for particle physics.

OCEVU GENERAL WORKSHOP

The 4th annual General Workshop was held in Marseille at CPPM on 26-28 May 2015. Seventy five OCEVU members took part in the Workshop. Its program included: a reminder of the OCEVU objectives; a presentation of the Scientific Committee and its work on the CFP #3 and #3.5; a presentation of the recommendations and requests of the Steering Committee; a presentation of the on-going collaborative projects by the PhD students and Postdocs involved; presentation of actions and prospects of the Working

Groups. The slides of the talks are available on the workshop indico agenda at <https://indico.in2p3.fr/event/11626/>.

ORGANIZATION OF CONFERENCES




















In 2015, OCEVU organized or co-organized 2 conferences and 1 workshop:

- “10th Edition of the Marseille Cosmology Conference Cycle” – “Drifting through the Cosmic Web: the evolution of galaxies within the Large Scale Structure”, 6-12 July 2015, Aix-en-Provence
- “QCD 2015 - 30th anniversary” - 18th international conference in QCD, 29 June -3 July 2015
- “Test and validation of software”, Sept-Dec 2015, Marseille and Toulouse

PUBLICATIONS

Since the beginning of the Labex 103 publications are referenced in WebOfScience as co-funded by OCEVU. **To this number, needs to be added 131 publications from ATLAS for which OCEVU funded young researchers appear as authors (starting Aug 2014).**

The distribution of the 103 publications w.r.t. the different journals is given in the table below:

Field: Source Titles	Record Count	% of 103	Bar Chart
JOURNAL OF HIGH ENERGY PHYSICS	23	22.330 %	
PHYSICAL REVIEW LETTERS	19	18.447 %	
PHYSICAL REVIEW D	15	14.563 %	
ASTRONOMY ASTROPHYSICS	13	12.621 %	
PHYSICS LETTERS B	9	8.738 %	
EUROPEAN PHYSICAL JOURNAL C	5	4.854 %	
JOURNAL OF INSTRUMENTATION	4	3.883 %	
MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY	3	2.913 %	
JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS	2	1.942 %	
ASTROPARTICLE PHYSICS	1	0.971 %	
ASTROPHYSICAL JOURNAL	1	0.971 %	
CLASSICAL AND QUANTUM GRAVITY	1	0.971 %	
INTERNATIONAL JOURNAL OF MODERN PHYSICS A	1	0.971 %	
JOURNAL OF PHYSICS G NUCLEAR AND PARTICLE PHYSICS	1	0.971 %	
NATURE	1	0.971 %	
NATURE PHYSICS	1	0.971 %	
NEW JOURNAL OF PHYSICS	1	0.971 %	
NUCLEAR PHYSICS B	1	0.971 %	
SCIENCE	1	0.971 %	

It is worth noting that two publications in Particle Physics were published in the very high impact journals NATURE (experimental) and SCIENCE (theory), which is quite uncommon. OCEVU members were main contributors of these publications.

Observation of the rare $B_s(0) \rightarrow \mu^+ \mu^-$ decay from the combined analysis of CMS and LHCb data

By: Khachatryan, V.; Sirunyan, A. M.; Tumasyan, A.; et al.
 Group Author(s): CMS Collaboration; CMS Collaboration; LHCb Collaboration
NATURE Volume: 522 Issue: 7554 Pages: 68-U146 Published: JUN 4 2015

[Full Text from Publisher](#) [View Abstract](#)

Times Cited: 18
 (from Web of Science Core Collection)

 Hot Paper

 Highly Cited Paper

Usage Count 

Ab initio calculation of the neutron-proton mass difference

By: Borsanyi, Sz.; Durr, S.; Fodor, Z.; et al.
SCIENCE Volume: 347 Issue: 6229 Pages: 1452-1455 Published: MAR 27 2015

[Full Text from Publisher](#) [View Abstract](#)

Times Cited: 18
 (from Web of Science Core Collection)

 Hot Paper

 Highly Cited Paper

Usage Count 

The ten top cited publications are listed in the table below:

	2012	2013	2014	2015	2016	Total	Average Citations per Year
	0	1	74	370	0	445	148.33
1. Review of lattice results concerning low-energy particle physics By: Aoki, S.; Aoki, Y.; Bernard, C.; et al. EUROPEAN PHYSICAL JOURNAL C Volume: 74 Issue: 9 Article Number: 2890 Published: SEP 17 2014	0	0	9	67	0	76	38.00
2. Test of Lepton Universality Using $B^+ \rightarrow K^{(*)} \ell^+ \ell^-$ Decays By: Aaij, R.; Adeva, B.; Adinolfi, M.; et al. Group Author(s): LHCb Collaboration PHYSICAL REVIEW LETTERS Volume: 113 Issue: 15 Article Number: 151601 Published: OCT 6 2014	0	0	2	23	0	25	12.50
3. The VIMOS Public Extragalactic Redshift Survey (VIPERS) An unprecedented view of galaxies and large-scale structure at $0.5 < z < 1.2$ By: Guzzo, L.; Scodreggio, M.; Garilli, B.; et al. ASTRONOMY & ASTROPHYSICS Volume: 566 Article Number: A108 Published: JUN 2014	0	0	7	16	0	23	11.50
4. The VIMOS Public Extragalactic Redshift Survey (VIPERS) A precise measurement of the galaxy stellar mass function and the abundance of massive galaxies at redshifts $0.5 < z < 1.3$ By: Davidzon, I.; Bolzonella, M.; Coupon, J.; et al. ASTRONOMY & ASTROPHYSICS Volume: 558 Article Number: UNSP A23 Published: OCT 2013	0	1	10	10	0	21	7.00
5. Dalitz plot analysis of $B_s(0) \rightarrow (D)_{\text{over-bar}}(0) K^+ \pi^+$ decays By: Aaij, R.; Adeva, B.; Adinolfi, M.; et al. Group Author(s): LHCb Collaboration PHYSICAL REVIEW D Volume: 90 Issue: 7 Article Number: 072003 Published: OCT 14 2014	0	0	3	17	0	20	10.00
6. Observation of the rare $B_s(0) \rightarrow \mu^+ \mu^-$ decay from the combined analysis of CMS and LHCb data By: Khachatryan, V.; Sirunyan, A. M.; Tumasyan, A.; et al. Group Author(s): CMS Collaboration; CMS Collaboration; LHCb Collaboration NATURE Volume: 522 Issue: 7554 Pages: 68-U146 Published: JUN 4 2015	0	0	0	18	0	18	18.00
7. Ab initio calculation of the neutron-proton mass difference By: Borsanyi, Sz.; Durr, S.; Fodor, Z.; et al. SCIENCE Volume: 347 Issue: 6229 Pages: 1452-1455 Published: MAR 27 2015	0	0	0	18	0	18	18.00
8. The VIMOS Public Extragalactic Survey (VIPERS) First Data Release of 57 204 spectroscopic measurements By: Garilli, B.; Guzzo, L.; Scodreggio, M.; et al. ASTRONOMY & ASTROPHYSICS Volume: 562 Article Number: A23 Published: FEB 2014	0	0	8	10	0	18	9.00
9. Observation of Overlapping Spin-1 and Spin-3 $(D)_{\text{over-bar}}(0) K^+ \pi^-$ Resonances at Mass 2.86 GeV/c² By: Aaij, R.; Adeva, B.; Adinolfi, M.; et al. Group Author(s): LHCb Collaboration PHYSICAL REVIEW LETTERS Volume: 113 Issue: 16 Article Number: 162001 Published: OCT 14 2014	0	0	3	14	0	17	8.50
10. Isospin Splittings in the Light-Baryon Octet from Lattice QCD and QED By: Borsanyi, Sz.; Duerr, S.; Fodor, Z.; et al. PHYSICAL REVIEW LETTERS Volume: 111 Issue: 25 Article Number: 252001 Published: DEC 17 2013	0	0	6	10	0	16	5.33

OPENING TO OTHER LABEX

In 2013 and 2014, OCEVU took the initiative to contact the other coordinators of three other Labex (EnigMass, LIO, P2IO) working on a scientific perimeter close to OCEVU. The idea was to investigate the possibility to have common actions in terms of education/communication, in particular w.r.t. a potential national network of education platforms, and the organization of summer schools and conferences. The discussions were open and fruitful, and all the other Labex showed a real interest. However we have not had a chance to translate these ideas into concrete actions; this work needs to be continued in 2015.

There is already an active collaboration with the Labex FOCUS w.r.t. the IRiS telescope, given the fact they contributed to its funding, paying for the telescope camera.

ASTROPARTICLES

WORKING GROUP

The group covers the fields of astronomy, astrophysics and astroparticules. It gathers experimentalists (involved in HESS, CTA, FERMI, ANTARES, KM3NeT...) and phenomenologists (dark matter, interaction CR/MIS, accretion/jet in AGN or galactic binary systems...) amounting to 86 persons in the mailing list of the group. The group is coordinated by Damien Dornic (CPPM) with 3 co-coordinators: Julien Malzac (IRAP), Emmanuel Nezri (LAM), and Matthieu Renaud (LUPM), forming the Board of the group. From an operational point of view, the board meets regularly. The group has organized an internal workshop 19-20/01/2015 in Marseille with ~50 participants from all the laboratories of the Labex. In 2016, the group has planned to organize two workshops on: "dark matter" together with the PP and cosmo groups and "jets&outflows". The WG has 4 main activities (the current list of projects supported by OCEVU are listed under each thematic).

- Observation of the high-energy sky (coordination: M. Renaud): HESS/Fermi sources detection and characterization, Detection of neutrino sources with ANTARES, preparation for CTA and KM3NeT.
 - Performance optimization for the Fermi LAT gamma-ray telescope (J. Cohen-Tanugi) with A. Strong (VS 2013-14).
 - Observation of the hadronic sky at high energy (D. Dornic/A. Klotz) with D. Turpin (PhD 2013-16).
 - NectarE2E - Building an end-to-end demonstrator of a NectarCAM module (P. Jean) with 80keuros (2012-16).
 - NectarCAM qualification model (P. Jean) with 100keuros (TBD 2016-19)
 - Preparing OCEVU's CTA science (J. Knodelseder) with C. Trichard (postdoc 2015-2018) and a new postdoc (2016-19).

- Physics simulation of the cosmic sources (coordination: J. Malzac): Studies of the acceleration mechanisms, high-energy radiation and particles production in the source, interaction with the MIS.
 - Cosmic rays and molecular clouds / Low energy cosmic rays (A. Markowith) with M. Padovani (postdoc 2014-17).
 - Probing the universe with cosmological electromagnetic cascades (J. Malzac) with T. Fitoussi (phd 2013-16).

- Gamma-Ray Bursts (coordination: D. Dornic): Optical follow-up of GRB, Fermi observations of GRB, studies of the properties of the prompt/afterglow phases, preparation of the SVOM mission.
 - GRB science prospects and optimization with SVOM/ECLAIRs (F. Piron) with M.G. Bernardini (postdoc 2015-17)
 - Development of the SVOM/GFT telescope (S. Basa)
- Dark-matter (coordination: E. Nezri): Direct and indirect (neutrinos, gamma and charged cosmic rays) dark matter detection, Galaxy simulations, halo modeling, Beyond the Standard Model framework.
 - Lattice QCD enlightens dark matter (L. Lellouch) with C. Torero (postdoc 2013-16) and M. Stref (phd 2015-18).
 - Indirect search for dark matter towards the Sun and the Galactic Center with neutrinos (V. Bertin/E. Nezri) with a new phd student (2016-19).

ONGOING PROJECTS

Cosmic-ray interaction with molecular clouds: A. Markowith, K. Ferriere, M. Padovani (postdoc 2014-17).

The star formation cycle in our galaxy relies on a complex series of physical processes. In particular the way molecular clouds collapse and stars form is poorly understood. Low energy cosmic rays (LE-CRs) are an important component of the interstellar medium (ISM). They are in equipartition with the magnetic field and the gas thermal energy, hence may contribute to local and global dynamics of the ISM. In particular, LE-CR are able to penetrate in molecular clouds and ionize the surrounding matter. Ionized matter is coupled with the magnetic field and due to collisions with neutrals can prevent the molecular gas collapse. It is then of particular interest to evaluate the degree of ionization of molecular material induced by CRs. Recent observations of several young stellar solar-type objects point towards a high degree of ionization that cannot result from UV or X-ray photons irradiation. A way to alleviate this issue is to produce an in situ population of energetic particles, which can explain a local ionization enhancement.

We have developed a model of energetic particles (protons, ions and electrons) acceleration by diffusive shock acceleration (DSA) in the environment of young stellar objects of solar mass. It is found that protons and ions can be efficiently accelerated in young stellar jets, termination shock (hot spots) and at stellar surfaces up to a few GeV. Self-consistent calculations of ionization rates have been obtained that reproduce high ionization degrees found in these environments. This is the first time that such a possibility is invoked. A letter (Padovani, Hennebelle, Marcowith & Ferrière) has been submitted to A&A. It demonstrates the possibility of particle acceleration in such environments and a longer paper including detailed calculations is in preparation with complete comparisons with observations (sept 2015). For the future, we will derive estimations of the gamma-ray emission to be expected from young stellar objects (Dec 2015) and adapt our calculations to massive young stellar objects (spring 2016) to predict combine gamma-ray and ionization measurements.

Publications:

- “Cosmic-ray acceleration in young protostars”, M. Padovani, P. Hennebelle, A. Marcowith, K. Ferrière, A&A 582, L13 (2015).
- “Interstellar dust charging in dense molecular clouds: cosmic ray effects”, A. Ivlev, M. Padovani, D. Galli, P. Caselli, ApJ, 797 (2014) 17.
- “The role of cosmic rays on magnetic field diffusion and the formation of protostellar discs”, M. Padovani, D. Galli, P. Hennebelle, B. Commerçon, M. Joos, A&A, 571, A33 (2014)

Preparing OCEVU’s CTA science: J. Knodelseder, H. Constantini, J. Bregeon, C. Trichard (postdoc 2015-18)

With the CTASci project, the CTA groups at CPPM, IRAP and LUPM are teaming up to jointly path the way towards a successful science exploitation of CTA. The ingredients for this science preparation will be threefold: mastering the instrument by means of Monte Carlo simulations and event analysis pipeline developments, mastering the data analysis by developing the tools for science exploitation and mastering CTA science by anticipating the key science and discovery potential of the observatory.

Our project aims at establishing a dynamic scientific environment within OCEVU, including two post-doc offers that will form the recruiting ground for the next generation of scientists in the field of high-energy gamma-ray astronomy. Two postdocs have been attributed to this project working on optimizing CTA performances for Galactic Science (post-doc 2015, C. Trichard CPPM) and preparing the CTA Galactic Plane Survey science exploitation (post-doc 2016, IRAP). The main scientific deliverables of our project will be the preparation of the Galactic Plane Survey Key Science Project (GPS KSP) and the preparation of Guest Observer proposals. The preparation of the GPS KSP includes the development of the science case, the definition of the observing strategy, the anticipation of the expected results, and the preparation of the tools needed to analyze the data. The aim is to take leadership on the Galactic plane survey, and preparing the GPS KSP will put us in a favorable position for being a major actor in the relevant science analysis.

The work has started with Cyril on the array layout optimization focusing on SSTs separation (best PSF and sensitivity at very high energies), the integration of high-level analysis methods (Model ++ in HESS) in CTA analysis pipeline and the preparation for analysis of the first SST-GCT prototype data.

Observation of the hadronic sky at high energy: D. Dornic, A. Klotz, D. Turpin (PhD 2013-16)

Transient objects in the sky are interesting because they correspond to a brief release of large amount of energy. Compared to the speed of light, a transient with duration less than one hour must be associated to objects as neutron stars or black holes. Many astrophysical objects are related to these transients: gamma ray bursts (GRB), active galaxy nucleus (AGN), supernovae (SN), pulsars and a part of cataclysmic variables (CV). Compact objects can emit electromagnetic waves in a large spectrum especially when external matter feeds the accretion processes. Radio, infrared, visible, X and gamma electromagnetic domains are useful to detect and study these objects which can be visible at large cosmological distances (up to $z=9$ for GRBs). In the same time, a burst of neutrinos and/or a gravitational wave signal should be emitted during such cosmic events. Because the physics of these transient sources is complex it is important to combine information

provided by various astrophysical messengers to complete our understanding of the physical processes at work. The PhD thesis is divided in four main parts:

- The development of innovative observational strategies to detect and constrain the nature of such astrophysical sources based on a large network of facilities (robotic telescopes, neutrino detector, radio dish). He has submitted 28 circulaires GCN, ATEL, CBET. Damien T. has participated to the writing of the paper “Optical and X-ray early follow-up of ANTARES neutrino alerts” submitted to JCAP mid-2015.

- The study of statistical properties of gamma-ray burst prompt and afterglow emission and their subsequent correlation based on the collection of a large sample of multi wavelength GRB data from gamma-rays to radio (creation of a database which facilitates the search of GRB multi-wavelength parameters). A paper has been submitted to ApJ mid-2015.

- The calculation of the constraints on the physics of the relativistic jets of GRBs obtained with the non-observation of a GRB neutrino signal with ANTARES. This work has been presented in several ANTARES/KM3NeT collaboration meetings and in the last ICRC 2015. A paper is in preparation in the ANTARES Collaboration.

- The on-line/offline neutrino analysis of fast radio bursts detected by the radio telescope Parkes. The analysis is on-going and we expect results for beginning of 2016.

Publications:

- “Optical and X-ray early follow-up of ANTARES neutrino alerts”, S. Adrian-Martinez et al, accepted to JCAP, arxiv:1508.01180
- “Connecting Prompt and Afterglow GRB emission I. Investigating the impact of optical selection effects in the Epi - Eiso plane”, D. Turpin, V. Heussaff, J.-P. Dezalay, J-L. Atteia, A. Klotz, D. Dornic, Submitted to ApJ, arxiv:1503.02760

Probing the universe with cosmological electromagnetic cascades: J. Malzac, R. Belmont, P. Jean, A. Marcowith, J. Cohen-Tanugi, T. Fitoussi (phd 2013-16)

The goal of the project is to study of HE electromagnetic cascades initiated by distant point (AGN, GRB) or diffuse (UHECR, dark matter decay) gamma-ray sources and their propagation in the intergalactic medium. The work consists to develop a MC model of electromagnetic cascade propagation, compare the results with Fermi and HESS data and make predictions for CTA.

In 2015, the activities are: the implementation of the effects of magnetic field on the propagation of leptons in Robertson-Walker metric, tests/optimization/parallelization of MC code, exploration of parameter space (A&A paper in prep.). The first results have been presented at OCEVU workshops and CTA workshop in Sesto (Italy). Moreover, 3 collaboration meetings have been organized in Montpellier and Toulouse. The next step consists to constrain the contribution of blazar induced cascades to Fermi gamma-ray background.

GRB science prospects and optimization with SVOM/ECLAIRs: F. Piron, J.L. Atteia, L. Bouchet, J. Bregeon, O. Godet, M. Renaud, M.G. Bernardini (postdoc 2015-17)

The work consists on the study in detail the prospects for GRB science with ECLAIRs: impact of ECLAIRs low-level performance on the GRB detection, localization and characterization, synergy of ECLAIRs with instruments operating at higher energies. Three main tasks are defined from the instrument performance assessment to the multi-wavelength science:

- Starting from the expected and/or measured parameters of the ECLAIRs instrument (and proto DPIX), study their impact on the scientific performance via simulations
- Contribute to the development of the scientific s/w needed to combine the ECLAIRs and GRM data (complete characterization of the GRB high-energy prompt emission)
- Investigate the synergy between SVOM and very high-energy telescopes (HAWC, LHAASO, CTA)

The group has meet during several meetings relevant to the project, attended in 2015: LUPM/IRAP face-to-face meeting in Toulouse (02/10/2015), SVOM/ECLAIRs science meetings in Toulouse (09/24/2015) and Paris (12/08/2015), SVOM science meetings in Paris (01/28/2015, 12/07/2015) and Sorèze (04/01-02/2015) and SVOM ground segment meetings in Paris (01/27/2015) and Toulouse (06/04/2015).

Performance optimization for the Fermi LAT gamma-ray telescope: J. Cohen-Tanugi, T. Desgardin with A. Strong (VS 2013-14)

The project was aimed at providing extra-funding for travel of Thibaut Desgardin, in the context of his CNES/CNRS PhD on investigating the low-energy science reach of the Fermi LAT data. It also included funding for visiting scientist Andrew Strong. The project followed the development of the thesis, with a first half of the 3 years developed to technical improvements to the instrument response functions and the second half to investigations of science case, especially in the context of the COMPTEL legacy catalogue. A much improved description of the energy resolution description has been proposed and accepted by the LAT collaboration. A systematic use of a different analysis framework, named Gardian and geared toward large-scale gamma-ray analyses, has been paramount to the improvement of this software that may reach now sufficient maturity to be released publicly. Significant, though preliminary, results on source spectra from the COMPTEL catalogue are currently being finalized. Thibaut presented a poster on the new LAT data at the Integral workshop in 2014, and a talk on science reach at low energy at ICRC2015. He made several contributions to internal reviews on the topic of instrument performance and COMPTEL comparison. The LAT official

Lattice QCD enlightens dark matter: L. Lelouch, J. Lavalley, E. Nezri, C. Torero (postdoc 2013-16) and M. Stref (phd 2015-18)

The objective of the project is to obtain an integrated approach for the prediction and interpretation of possible WIMP signals in direct (and indirect) detection experiments, in which theoretical uncertainties are reduced and correlations are accounted for as fully as possible. For direct detection, the main such uncertainties are those associated with the local astrophysical DM parameters and those associated with the coupling of WIMPs to ordinary matter in the detectors. To address the first point, an in depth study of the correlations between astrophysical DM parameters that follow from the Galactic mass models was performed and its impact on direct detection limits was studied [1]. Zoom-in cosmological simulations, including dark and baryonic matter, were also performed to provide model spiral galaxies similar to the Milky Way, in which the distribution of matter is exactly known [2]. These are allowing us to study systematic uncertainties on the reconstruction of astrophysical DM parameters from galactic mass models. The second main source of uncertainty is being addressed by ab initio lattice QCD calculations, conducted by the postdoctoral fellow hired for the project, C. Torrero. A first calculation of the spin-independent couplings of WIMPs to nucleons with fully controlled uncertainties has been achieved [3]. A second one is underway, whose goal is to reduce the uncertainties, in particular, on the coupling of WIMPs to the strange quarks in the nucleon that are still too large for DM phenomenology. Work has also begun on the spin-dependent couplings. In the coming year, we will combine the various results obtained to determine their impact on constraining benchmark WIMP models with direct detection experiments. Moreover, a Ph.D. student, M. Stref, was hired this fall to study astrophysical uncertainties in indirect searches and the complementarity with direct searches. Note that two Ph.D. students with thesis topics directly pertaining to this project (S. Magni, P. Mollitor) and a third, who contributed to the lattice calculations (T. Métivet), graduated in the past year.

Publications:

- “Making sense of the local Galactic escape speed estimates in direct dark matter searches,” J. Lavalley and S. Magni, *Phys. Rev. D* 91 (2015) 023510.
- “Baryonic and dark matter distribution in cosmological simulations of spiral galaxies,” P. Mollitor, E. Nezri and R. Teyssier, *Mon.Not.Roy.Astron.Soc.* 447 (2015) 1353.
- “Lattice computation of the nucleon scalar quark contents at the physical point,” S. Durr, Z. Fodor, C. Hoelbling, S.D. Katz, S. Krieg, L. Lelouch, T. Lippert, T. Métivet, A. Portelli, K.K. Szabo, C. Torrero, B.C. Toth and L. Varnhorst, arXiv:1510.08013 [hep-lat].

Conference presentations:

- “Origin of Mass 2014” (Mass 2014), May 19-22, 2014, Odense, invited review by LL on “Mass and lattice quantum chromodynamics”.
- “International Meeting on Cosmology: semianalytic models (SAMs) and hydrodynamic simulations (HSs)” (CosmoSamSim), June 10-13, 2014, LAM, organization by EN, and talks by JL (“Impact of galaxy formation on dark matter particle searches”) & PM (“Baryonic and dark matter distribution in cosmological simulations of spiral galaxies”).
- “32nd International Symposium on Lattice Field Theory” (Lattice 2014), June 23-28, 2014, Columbia University (NYC, USA), talk by CT on “Computing the nucleon sigma terms at the physical point”.
- “Astroparticle Physics 2014: a joint TeVPA/IDM conference,” 23-28 June 2014, Amsterdam, talk by PM on

“Baryonic and dark matter distribution features in cosmological simulations of spiral galaxies”.

- “Dark Side of the universe,” 17-21 November 2014, University of Cape Town, South Africa, talks by PM (“Cosmological N-body and hydrodynamical simulations of spiral galaxies and dark matter detection”) and SM (“Making sense of the Galactic escape speed estimates in direct dark matter searches”).
- “Rencontre de Physique des Particules 2015” (RPP 2015), Jan. 15-16 2015, Institut Henry Poincaré, Paris, France, talks by CT on “Lattice computation of the nucleon sigma terms”, and by SM on “Revisiting the escape speed impact on direct dark matter searches”.
- “33rd International Symposium on Lattice Field Theory” (Lattice 2015), July 14-18, 2015, Kobe, Japan, talk by CT on “A lattice study of the nucleon quark content at the physical point.”
- Invited seminar by SM at the Physics Institute of Zurich University, July 8 2015: “Astrophysical aspects of direct DM detection”.
- “XIV International Conference on Topics in Astroparticle and Underground Physics” (TAUP 2015), Sept. 7-11, 2015, Torino, Italy, talks by CT on “Quark contents of the nucleon for direct dark matter searches from lattice QCD” and by SM on “Astrophysical uncertainties in direct detection from cosmological simulations”.

COSMOLOGY

WORKING GROUP

Main research areas, science perimeter

The working group is focused on three main topics:

- *Dark energy and dark gravity.* This is mainly based on the use of cosmology probes derived from large cosmology surveys (VLT surveys, SDSS-IV, Euclid, LSST, PFS, ...). It is supported by theory work and simulations.
- *Dark ages.* The first galaxies during or right after reionization. Deep galaxy surveys are used on the observational side (VUDS, VANDELS, UltraVista,...) to find the most distant galaxies and study their properties. Multi-scale cosmological simulations tuned to galaxy formation are run using hydrodynamic or semi-analytical prescriptions.
- *Structure assembly.* The study of the assembly of galaxies in the largest structures, and the first large structures in the universe.

General activities

All OCEVU laboratories participate, at different levels, to the projects of this working group.

The WG members meet around one-day annual meetings and topical meetings on particular science questions. Large international conferences are supported.

Workshops and Conferences 2015

Conferences hosted by the Particle Physics Working Group and partially funded by OCEVU in 2015:

- 2015: Drifting through the Cosmic Web: the Evolution of Galaxies within the Large Scale Structure, Aix-en-Provence 6-11 July 2015

ONGOING PROJECTS

Spectroscopic Redshift Surveys in OCEVU

This is a long-term project to exploit on-going redshift surveys for cosmology and galaxy formation and evolution (VIPERS, eBOSS). The expertise developed on these on-going programs is a key asset to prepare future surveys (EUCLID, DESI, PFS,...) and ensure a prominent place to OCEVU teams. The objective is to combine geometrical probes (such as supernova and BAO) and structure growth probes (such as RSD and WL) to result in significant new constraints on the universe's curvature and dark energy, as well as testing modifications of the General Relativity itself.

OCEVU has allocated 2 3-years postdocs and one PhD student to this project. Membership to the SDSS-IV (eBOSS) team is provided for 2 OCEVU members.

Publications 2015:

- The VIMOS Public Extragalactic Redshift Survey. Reconstruction of the redshift-space galaxy density field, Granett et al. 2015, A&A, 583, 61
- The VIMOS Public Extragalactic Redshift Survey (VIPERS). Hierarchical scaling and biasing, Cappi, et al., A&A, 2015, 579, 70
- The VIMOS Public Extragalactic Redshift Survey (VIPERS). Environmental effects shaping the galaxy stellar mass function, Davidzon, et al., arXiv: 15110.1145

Baryonic properties of the first massive halos

This project aims to probe the evolution of matter in large collapsed or collapsing structures to better understand large-scale structure formation: the first systematic characterization of the population of proto-clusters, (using Planck data). How the massive galaxies evolve within the still-forming halos and how they contribute to shape the ICM gas structures through evolution feedback is still to be understood. This investigates the evolution of galaxy properties in these densest environments at high redshift from the characterization of their properties from their emission at optical/NIR to infra-red and (sub-)millimeter wavelengths. The properties of high- z galaxies in dense collapsing environments are compared to those of galaxies in massive clusters at lower redshifts (i.e., $z < 1.0$) in order to better understand the feedback mechanism of galaxy evolution. A systematic statistical study of the overall properties of the population of the progenitors of today's galaxy clusters is conducted.

OCEVU supports this project with a 2 year postdoctoral position, to be followed by the funding of a senior foreign scientist to complete the project.

REGAL: what REGulates the growth of GALaxies?

We still do not understand why the formation of galaxies inside dark matter haloes is so inefficient, especially in the low and high mass regimes. Two simple processes are put forward: baryons must be ejected from galaxies through outflows (feedback effects coming from AGN and/or SNe-driven galactic winds) or do

not cool down to collapse inside galaxy halos. The project focus is on gas inflows and outflows in galaxy evolution from the early mass assembly of building block down to the formation of the Hubble sequence of morphological types. It uses KMOS, MUSE and other data. This project is organized around two main broad science topics: gas flow around galaxies, and the building of galaxy disks in different environments.

OCEVU provides significant funding with a postdoc at LAM hired in 2014, a PhD student at IRAP who started fall 2015, and a 2-years postdoc funded on CFP#4 to be hired at IRAP.

Publications 2015:

- The MUSE 3D view of the Hubble Deep Field South, Bacon et al., A&A, 575, 75

Golden Lenses in the HST Frontier Fields (GLIFF)

Investigate galaxy clusters acting as strong gravitational lenses as a way to probe the geometry of the Universe through the lens equation, sensitive to the Dark Energy and its equation of state, using Hubble ST Frontier Fields observations. The GLIFF project proposes to investigate galaxy clusters acting as strong gravitational lenses as a way to probe the geometry of the Universe through the lens equation. This latter involves distance ratios that are sensitive to the Dark Energy and its equation of state.

Since October 2014, Ana Acebron has started a PhD focused on the analysis of spectroscopic data, and the exploration of possible improvements in the modeling of galaxy cluster lenses. She is applying the gravitational lens modeling code Lenstool developed at LAM to numerical simulations of clusters provided by STSci in the frame of the HST Frontier Field project. This is being extended to the outstanding imaging data of the HST Frontier Fields to get reliable strong lensing models of the inner parts of the massive galaxy cluster MACSJ0416, which she will use to test Dark Energy models. Most of the activity takes place in Marseille (LAM and CPPM) (along with an external collaborator in CRAL, Lyon). During the past year, the modeling of HST Frontier Fields galaxy clusters with exquisite new HST images was performed, and these works have been published.

Publications 2015:

- Hubble Frontier Fields: the geometry and dynamics of the massive galaxy cluster merger MACSJ0416.1-2403, Jauzac et al., MNRAS, 446, 4132
- Hubble Frontier Fields: a high-precision strong-lensing analysis of the massive galaxy cluster Abell 2744 using ~180 multiple images. Jauzac et al., MNRAS, 452, 1437
- Strong-Lensing Analysis of MACSJ0717.5+3745 from Hubble Frontier Fields observations: How well can the mass distribution be constrained?, Limousin et al., arXiv:15100.8077

Featuring dark energy

This aim to contribute to the understanding of dark energy by developing new probes of the linear growth rate of cosmic structures: properties of galaxy clusters and moments of the galaxy distribution. From the

theoretical side, new testing strategies are developed that are minimally (if not at all) affected by astrophysical uncertainties or by not fully motivated phenomenological models. This will make cosmological interpretations easier and safer. From the observational side, the goal is to gauge the performances of the proposed strategies using current, state of the art, redshift data, and to demonstrate their potential for the future large cosmological missions.

Publication 2015

- "X-ray galaxy clusters abundance and mass-temperature scaling" Paper submitted to A&A.

The Three Dimensional Shape of Galaxy Clusters

Galaxy Clusters constitute powerful cosmological probes, forming the high-mass end of the mass function of collapsed haloes. Their standard spherical modeling has proven to be inaccurate and misleading, strongly suggesting that in the road map of precision cosmology with galaxy clusters, triaxial modeling is the next milestone. This project investigates the 3D shapes of clusters both theoretically/numerically and observationally: (a) using simulated clusters to predict the shape of clusters as a function of mass, radius, redshift; (b) develop an algorithm allowing to fit simultaneously lensing, X-ray and SZ data sets within a triaxial framework, using mock data sets (MUSIC clusters); (c) apply the algorithm to a sample of observed clusters in order to investigate their three dimensional properties, and compare them to our theoretical predictions.

OCEVU supports this project with one PhD student started in fall 2013. The project is progressing as planned.

Publications 2015:

- Universality of dark matter haloes shape over six decades in mass: insights from the Millennium XXL and SBARBINE simulations. M. Bonamigo, G. Despali, M. Limousin, R. Angulo, C. Giocoli & G. Soucail, 2015, MNRAS, 449, 3171.

Very high redshift galaxies in Herschel cosmological surveys

The measurement of star formation in galaxies at all distances (and times) and on samples as large as possible remains one of the major challenges in cosmology. The role of the IR emission coming from dust is crucial since it represents on average from 50% to more than 90% of the emission from young stars which is re-processed by dust. The best far-IR observations come from the Herschel space observatory harvest. Several cosmological projects were completed and represent the largest observing time scheduled on this satellite. This OCEVU project is a participation to the European consortium HELP (FP7-SPACE project) with the two main Herschel surveys, HerMES and H-ATLAS (covering about 2000 sq. deg.) from which to perform the ultimate source extraction and produce multi-wavelength catalogues from the UV to the radio for all the sources detected.

OCEVU supports this project with a PhD student.

Publications 2015

- The spectral energy distribution of galaxies at $z > 2.5$: Implications from the Herschel/SPIRE color-color diagram, Yuan, Buat et al. 2015 A&A in press 2015arXiv150607397Y
- Constraining the properties of AGN host galaxies with spectral energy distribution modelling, Ciesla et al. 2015, A&A 576, 10.
- New constraints on dust emission and UV attenuation of $z = 6.5-7.5$ galaxies from millimeter observations, Schaerer, Boone et al, 2015, A&A, 574, 19
- ALMA detection of [C ii] 158 μm emission from a strongly lensed $z = 2.013$ star-forming galaxy, Schaerer, Boone et al., 2015, A&A 576, L2

Accurate photometry for precision cosmology within LSST

This was a collaborative effort to build a partnership between LUPM and CPPM in order to bring a strong and visible contribution within the LSST collaboration. The members of the project envisioned this as a step further in establishing OCEVU as a top-level contributor in future precision cosmology. This ended in 2015 and led to a full proposal which got support from the CFP#4 (below).

History of star formation: sub-mm and mm observations

This uses sub-millimeter and millimeter observations to obtain a complete census on the star formation history of galaxies by probing the dust-obscured star formation at high redshift ($z > 3$) and increase our knowledge about the fuel for star formation in high-redshift galaxies. Deep millimeter continuum detections, combined with ancillary data, measure dust spectral energy distributions providing good estimates of star formation rates, dust temperatures and masses, and (with reasonable assumptions) gas masses and star formation efficiency, a critical ingredient for understanding galaxy growth.

The project is dedicated to the (1) preparation of the observations (2) observational campaigns (3) data reduction (4) source extraction, multi-wavelength catalog merging (5) follow-up observations.

Publications 2015:

- "ALMA detection of [CII] 158 μm emission from a strongly lensed $z = 2.013$ star-forming galaxy", D. Schaerer, F. Boone et al., 2015, A&A 576, 2
- "Galaxy stellar mass assembly: the difficulty matching observations and semi-analytical predictions", M. Cousin, G. Lagache, M. Béthermin et al., 2015, A&A 575, 32

COBESIX: Dark energy beyond six parameters

This is to develop a wide team of close collaborators gathering expertise of various origins to promote progresses in our understanding of the source of cosmic acceleration. Tools are developed for the combination of standard probes following two different statistical approaches (Bayesian and frequentist), including new probes and paying a particular attention to handle the effect of systematics. The high

precision of coming data and the large volume of surveys imply that the key limitation in the interpretation will be the understanding and control of systematics.

NEW PROJECTS FUNDED IN 2016

Support to the PACA-DESI team during the spectrograph construction phase

DESI is a US-led large spectroscopy survey designed to measure galaxy and AGN clustering. This will be one of the few all-sky surveys using the distribution of ~50 million galaxies to measure the BAO and RSD probes, measure the growth rate of the Universe and directly test Gravity all the way back 6-8 billion years ago. This proposal aims to support the team in Marseille + OHP during the construction phase of the spectrograph. The funding is to support travel for technical participation to the DESI project during the spectrograph construction phase, beyond the current prototype phase which is supported by an A*MIDEX grant.

Cosmology with LSST and precursor photometric surveys

This project aims to build up a strong LSST team within OCEVU, to foster collaboration with Euclid members, and prepare a major contribution to the French-LSST effort. The long-term objective is to gather researchers within OCEVU to prepare for a fruitful exploitation of LSST science during the next decade, and be ready well in time for the first data expected by 2019, when the commissioning will start with the partially equipped camera. Computing and software activities will be developed, and an in-depth understanding of the camera performance and of the overall photometric accuracy of the survey will be acquired, key ingredients for investigating and mastering the systematics.

The 3 years project in OCEVU aims: 1/ to prepare an SN Ia probe analysis aimed at the LSST main survey using LSST software applied to CFHTLS data. It will result in a Hubble diagram obtained only with photometric information of the CFHTLS data, 2/ to improve the treatment of dust extinction by photo-z codes (LePhare1, Hyperz2), to export these new methods on the LSST and Euclid pipelines and to test them on a unique dataset (CFHT and HSC data) that mimics LSST depth and filter combination. A postdoctoral researcher for 3 years is funded by OCEVU from this call.

Reionization history and Dark Energy from Cosmic Microwave Background to Cosmic Infrared Background

This proposes to use CIB anisotropies to: i) Measure the Integrated Sachs Wolf effect by cross-correlating CIB and CMB Planck maps. ii) Provide constraints on the reionization signal encoded in the kinematic Sunyaev-Zel'dovich measurement (kSZ). The ultimate goal of this project is to combine kSZ and ISW constraints with other probes of cosmic reionization and dark energy, to refine the constraints on the cosmological parameters and reionization history. A PhD student for 3 years is funded by OCEVU from this call.

PARTICLE PHYSICS

WORKING GROUP

Complementary expertise at different laboratories involved:

- **LUPM/L2C:** supersymmetry phenomenology; composite Higgs phenomenology; dark matter candidates.
- **CPT:** flavor physics; non-perturbative strong-interaction physics; lattice QCD calculations.
- **CPPM:** hadron collider physics at the LHC with contributions to the two experiments ATLAS (SM precision and BSM searches) and LHCb (CP violation and flavour physics).

Lorenzo Feligioni and Michele Frigerio coordinate the WG. One general meeting per year is organized (in addition to the general OCEVU workshop): the last was on the 28/05/2015.

One visiting scientist in 2015: Sacha Davidson, IPN Lyon, for three months. One visiting scientist in 2016: C.J.David Lin, Taiwan, for three months.

Perimeter of the WG (PAST, ONGOING and FUTURE PROJECTS):

Energy Frontier: Higgs properties and new physics direct production at run 2 of LHC.

- Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS detector: CPPM (Diaconu, Feligioni, Muanza), L2C and LUPM (Kneur, Moutaka); 1 OCEVU postdoc: Diglio (Jan 2014-April 2015), Lorenzo Basso (October 2015) 2 OCEVU PhD students: Ellayosula (Oct 2014), Rima El Kosseifi (Oct 2015), 2 OCEVU visiting scientists: Y. Liu (USTC), X. Zhuang (IHEP).
- New Physics from a natural Electroweak symmetry breaking: L2C (Frigerio, Kneur) and CPT (Knecht); 1 OCEVU PhD student: Bizot (Nov 2013).
- New weakly interacting particles: models, constraints and discovery potential: LUPM (Bruemmer), L2C (Frigerio, Kneur) and CPT (Bharucha); 1 OCEVU postdoc (Fall 2016)

Intensity Frontier: CP violation and flavour physics, anomalous muon magnetic moment.

- The muon anomalous magnetic moment and the search for new physics in the LHC era: CPT (Lellouch, Knecht), L2C (Kneur) and LUPM (Narison); 1 OCEVU postdoc: Miura (Oct 2015)
- B decays into tau lepton pairs and related rare processes / Rare dileptonic B decays / Lepton flavour in b to s transitions prospects at the LHC and beyond: CPPM (Mancinelli, Cogan, Serrano) and CPT (Charles, Bharucha); 1 OCEVU postdoc: Tayduganov (Nov 2014) and 2 PhD students: Mordà (Oct 2012) and a future one (Fall 2016).

Cosmic frontier: Dark matter phenomenology.

- Lattice QCD enlightens dark matter: LUPM (Lavalle), CPT (Lellouch), LAM (Nezri); 1 OCEVU postdoc: Torrero (Nov 2013), 1 OCEVU PhD student: Mollitor (Oct 2015)

Workshops and Conferences

Conferences hosted by the Particle Physics Working Group and partially funded by OCEVU:

1. 2015: QCD '15 (Montpellier).
2. 2016: QCD '16 (Montpellier); Beauty '16; SOS '16; 4th Workshop on Muon g-2, EDM and Flavour Violation in the LHC Era (Marseille).

ONGOING PROJECTS

B decays into τ lepton pairs and related rare transitions

In the last ten years, the B factory experiments BaBar and Belle have established the Standard Model (SM) as the dominant source of flavor transitions and CP violation in the quark sector. The underlying mechanism, mediated by the Cabibbo-Kobayashi-Maskawa (CKM) matrix, describes nicely most observables at the level of 10% or better. Nevertheless a few anomalies have been revealed by phenomenological analyses, among which the semileptonic $B \rightarrow D^{(*)}\tau\nu$ and rare $B \rightarrow K^*\mu^+\mu^-$, $B \rightarrow \Phi\mu^+\mu^-$ and $B \rightarrow Ke^+e^-$ modes have received considerable attention.

Due to the presence of at least one neutrino per lepton in the final state, flavor decays with τ leptons have always been a challenge for experiments. However, the τ lepton offers a unique window to new observables and phenomena: first, its sizable mass allows to test both right-handed and left-handed couplings; second, its decay into measurable products leads to a variety of angular observables, that are related to the couplings to the τ spin; and third, the comparison of a transition with τ leptons with its counterpart with muons or electrons allows stringent tests of lepton universality, which is a signature of the SM.

The postdoctoral research project is primarily aimed at the measurement of $B \rightarrow K^*\tau\tau$ at the LHCb experiment. It benefits from the expertise of the CPPM team on rare decays, and develops the tools already used for $B_s \rightarrow \mu\mu$ and $B_s \rightarrow \tau\tau$. One key question, beyond the decay rate, concerns the possibility to measure new observables that vanish with the lepton mass, and angular quantities sensitive to the τ polarizations. This requires a careful theoretical analysis of the fully differential rate, along the line of the existing literature on $B \rightarrow K^{(*)}ll$ decays with massless leptons, and will be worked in collaboration with the CPT team. Another significant part of the project will be devoted to the phenomenological analysis of $B \rightarrow K^*\tau\tau$ and related rare decays within the CKMfitter framework.

Rare dileptonic B decays

B decays are nowadays at the core of indirect searches for New Physics, thanks to the large number of short-distance dominated observables that can be both estimated theoretically and measured experimentally.

Among the most promising ones are the very rare (helicity suppressed) $B_{d,s} \rightarrow l^+l^-$ decays. Measurements of the branching ratios of the mode $B_s \rightarrow \mu^+\mu^-$ have been obtained by the LHCb and CMS experiments with data collected in 2010-2012. On the other hand it is well possible for New Physics to give sizable contributions to $B_{d,s} \rightarrow \tau^+\tau^-$, even in the case where $B_{d,s} \rightarrow \mu^+\mu^-$ appears to be compatible with Standard

Model predictions, because violation of lepton universality could play a role. This is the scenario hinted by recent anomalies seen in B decays to final states with electron and tau leptons, such as $B_s \rightarrow Ke^+e^-$ and $B \rightarrow D(^*) \tau \nu$.

The PhD position we proposed encompasses both experimental and theoretical aspects. On the experimental side the student took advantage of the expertise of the LHCb group at CPPM, to pursue and improve the existing analyses (new isolation variables via an inclusive topological vertexing algorithm, and multivariate analysis refinement), and extend them to the more challenging $B_{d,s} \rightarrow \tau^+ \tau^-$ transition (where he is in charge of the $\tau \rightarrow 3\pi + \text{neutrino}$ final state). On the theoretical side he has collaborated strongly with phenomenology experts at CPT, in order to define new discriminating kinematic variables (paper in production) and, as a preliminary idea, new observables that could be extracted from $B_{d,s} \rightarrow \tau^+ \tau^-$.

Alessandro Mordà defended his thesis (with honors) on September 28th.

New physics from a natural electroweak symmetry breaking

The project aims to study some extensions of the Standard Model (SM) Higgs sector, allowing for a more natural electroweak symmetry breaking (EWSB). A first topic concerned minimal fermion extensions of the SM: in a paper recently accepted by JHEP [1], all possible new fermions which can couple to the Higgs boson are considered, studying various constraints from direct collider searches, electroweak precision tests, focusing on scenarios which could deviate from the decoupling limit for large masses and vanishing mixing. Specific fermionic extension models are identified in which a large mixing with SM fermions is not yet excluded, or regions of parameters where only the Higgs-Z-photon signal strength is significantly modified, while other presently well constrained Higgs couplings are essentially unaffected. A second project concerns the UV completion of the EWSB sector, considering theories that are strongly-coupled at the TeV scale, where the Higgs is a composite object. We study models with new ("techni") fermions that condense at the TeV scale and generate a Nambu-Goldstone boson with the Higgs quantum numbers. We considered four-fermion interactions of Nambu--Jona-Lasinio (NJL) type and extract the mass of composite resonances using the $1/N$ expansion techniques. We found definite predictions for the masses of scalar, vector and fermion resonances. A paper in finalization stage (N. Bizot, M. Frigerio, M. Knecht and J-L. Kneur) is expected before the end of the year 2015. The next step will be to study the coupling of this sector to the SM, in order to induce an effective potential for the Higgs and thus to realize EWSB. We also plan to study more detailed phenomenological consequences of the model for the LHC run 2.

Publications:

[1] N. Bizot and M. Frigerio, "Fermionic extensions of the Standard Model in light of the Higgs couplings," arXiv:1508.01645.

The muon anomalous magnetic moment and the search for new physics in the LHC era

The project aims at coordinating the internationally recognized expertise of the IFAC team at the L2C and LUPM and of the Particle Physics team at the CPT, to address the theoretical challenges surrounding the

study the anomalous magnetic moment α_μ of the muon. In particular, the project focuses at reducing the hadronic uncertainties in the SM computation α_μ , both for hadronic vacuum polarization (HVP) and hadronic light-by-light scattering (HlL), as well as to determine the impact of the new measurements on models of new physics and on the search for such physics at the LHC. To this effect, the project aims to combine the complementary approaches of QCD sum rules, renormalization group optimized perturbation theory (RGOPT), large- N_c QCD and large-scale numerical simulations in lattice QCD. In regards to BSM interpretations of the new measurements, the focus will be initially on SUSY extensions, including the computation of possibly large radiative corrections and the full upgrade of community codes such as SuSpect and NMSSMTools.

They will also consistently account for all other constraints on these extensions, notably those from the LHC Run 2.

The postdoctoral fellow hired for this project, Kohtaroh Miura, arrived at the end of April 2015. He has been working on ab initio calculations of the LO HVP contribution to α_μ . In one approach, we are computing the HVP electromagnetic-current correlation function in lattice QCD with the Budapest-Marseille-Wuppertal collaboration (BMWc). This involves high statistics supercomputer simulations performed directly at the physical values of the u, d, s and c quarks, in large volumes and with 6 different lattice spacing. The calculation should allow a determination of the HVP contribution with a total, fully controlled uncertainty of around 3%, which would be a good first benchmark. A second, new approach is also being tried. It is based on work done, prior to the arrival of the fellow, for the first ab initio computation of the mass differences between members of stable isospin multiplets, including that of the neutron and proton, and published this year in *Science* [1]. Authors are currently investigating the application of some of the methods developed for that work [1-3] to the computation of the HVP and, eventually, the HlL contributions to α_μ . A third approach was further proposed in [4].

- The RGOP method has been applied to the evaluation of the light-quark condensate in QCD [2]. This provides an example (together with the pion decay constant) where the method can be developed and its convergence tested. Preliminary, but encouraging, results at one loop for HVP have also been obtained, giving already a non-trivial solution, roughly consistent with the expected order of magnitude.

- In order to test lattice QCD strategies to compute the HlL contribution to α_μ in a simpler set-up, a fictitious contribution to α_μ involving the QCD $\langle VVA \rangle$ three-point function has been studied, keeping the couplings of the quarks, but also their masses, and the mass of an axial gauge boson, as free parameters. Within certain regions of this parameter space, predictions concerning this contribution to α_μ can be made with a relative error below 15%, thus providing a possibility to test lattice QCD simulations.

Publications

- [1] S. Borsanyi et al., "Ab initio calculation of the neutron-proton mass difference," *Science* 347 (2015) 1452
- [2] J.-L. Kneur and A. Neveu, "The chiral condensate from renormalization group optimized perturbation", *Phys. Rev. D* 92 (2015) 074027
- [3] Z. Fodor, C. Hoelbling, S. D. Katz, L. Lellouch, A. Portelli, K. K. Szabo and B. C. Toth, "Quantum electrodynamics in finite volume and non relativistic effective field theories," arXiv:1502.06921 [hep-lat].

- [4] E. de Rafael, “Moment Analysis of Hadronic Vacuum Polarization - Proposal for a lattice QCD evaluation of $g_{\mu-2}$,” *Phys. Lett. B* 736 (2014) 522
- [5] J. L. Kneur and A. Neveu, “Renormalization Group Optimized Perturbation: α_s from f_{π} ,” *Nucl. Part. Phys. Proc.* 258-259 (2015) 59.
- [6] M. Knecht, “The Muon Anomalous Magnetic Moment,” *Nucl. Part. Phys. Proc.* 258-259 (2015) 235 [arXiv:1412.1228 [hep-ph]].
- [7] M. Knecht, “Status of Standard Model Calculation of Lepton $g_{\mu-2}$,” *Int. J. Mod. Phys. Conf. Ser.* 35 (2014) 1460405.
- [8] R. Malak et al. [Budapest-Marseille-Wuppertal Collaboration], “Finite-volume corrections to the leading-order hadronic contribution to $g_{\mu-2}$,” *PoS LATTICE 2014* (2015) 161

Besides the references above, the participants of this project have also given (invited) talks at several conferences, including “Workshop on hadronic contributions to the muon $g-2$ ” (MK, LL, Mainz, Apr. 2014), “QCD 2014” (MK, JLK, Montpellier, Jul. 2014), “Lattice 2014” (RM, New York, Jul. 2014), Floratos Fest 2014 (EdR, Athens, Oct. 2014), “High-precision QCD at low energy” (MK, LL, EdR, Benasque, Aug. 2015), “Flavour changing and conserving processes” (MK, Capri, Sept. 2015).

Lattice QCD Enlightens Dark Matter

The objective of the project is to obtain an integrated approach for the prediction and interpretation of possible WIMP signals in direct (and indirect) detection experiments, in which theoretical uncertainties are reduced and correlations are accounted for as fully as possible. For direct detection, the main such uncertainties are those associated with the local astrophysical DM parameters and those associated with the coupling of WIMPs to ordinary matter in the detectors. To address the first point, an in depth study of the correlations between astrophysical DM parameters that follow from the Galactic mass models was performed and its impact on direct detection limits was studied [1]. Zoom-in cosmological simulations, including dark and baryonic matter, were also performed to provide model spiral galaxies similar to the Milky Way, in which the distribution of matter is exactly known [2]. These are allowing us to study systematic uncertainties on the reconstruction of astrophysical DM parameters from galactic mass models. The second main source of uncertainty is being addressed by ab initio lattice QCD calculations, conducted by the postdoctoral fellow hired for the project, C. Torrero. A first calculation of the spin-independent couplings of WIMPs to nucleons with fully controlled uncertainties has been achieved [3]. A second one is underway, whose goal is to reduce the uncertainties, in particular, on the coupling of WIMPs to the strange quarks in the nucleon, that are still too large for DM phenomenology. Work has also begun on the spin-dependent couplings. In the coming year, we will combine the various results obtained to determine their impact on constraining benchmark WIMP models with direct detection experiments. Moreover, a Ph.D. student, M. Stref, was hired this fall to study astrophysical uncertainties in indirect searches and the complementarity with direct searches. Note that two Ph.D. students with thesis topics directly pertaining to this project (S. Magni, P. Mollitor) and a third, who contributed to the lattice calculations (T. Métivet), graduated in the past year.

Publications:

1. “Making sense of the local Galactic escape speed estimates in direct dark matter searches,” J. Lavalle and S. Magni, Phys. Rev. D 91 (2015) 023510.
2. “Baryonic and dark matter distribution in cosmological simulations of spiral galaxies,” P. Mollitor, E. Nezri and R. Teyssier, Mon.Not.Roy.Astron.Soc. 447 (2015) 1353.
3. “Lattice computation of the nucleon scalar quark contents at the physical point,” S. Durr, Z. Fodor, C. Hoelbling, S.D. Katz, S. Krieg, L. Lellouch, T. Lippert, T. Métivet, A. Portelli, K.K. Szabo, C. Torrero, B.C. Toth and L. Varnhorst, arXiv:1510.08013 [hep-lat].

Conference presentations:

- “Origin of Mass 2014” (Mass 2014), May 19-22, 2014, Odense, invited review by LL on “Mass and lattice quantum chromodynamics”.
- “International Meeting on Cosmology : semianalytic models (SAMs) and hydrodynamic simulations (HSs)” (CosmoSamSim), June 10-13, 2014, LAM, organization by EN, and talks by JL (“Impact of galaxy formation on dark matter particle searches”) & PM (“Baryonic and dark matter distribution in cosmological simulations of spiral galaxies”).
- “32nd International Symposium on Lattice Field Theory” (Lattice 2014), June 23-28, 2014, Columbia University (NYC, USA), talk by CT on “Computing the nucleon sigma terms at the physical point”.
- “Astroparticle Physics 2014: a joint TeVPA/IDM conference,” 23-28 June 2014, Amsterdam, talk by PM on “Baryonic and dark matter distribution features in cosmological simulations of spiral galaxies”.
- “Dark Side of the universe,” 17-21 November 2014, University of Cape Town, South Africa, talks by PM (“Cosmological N-body and hydrodynamical simulations of spiral galaxies and dark matter detection”) and SM (“Making sense of the Galactic escape speed estimates in direct dark matter searches”).
- “Rencontre de Physique des Particules 2015” (RPP 2015), Jan. 15-16 2015, Institut Henry Poincaré, Paris, France, talks by CT on “Lattice computation of the nucleon sigma terms”, and by SM on “Revisiting the escape speed impact on direct dark matter searches”.
- “33rd International Symposium on Lattice Field Theory” (Lattice 2015), July 14-18, 2015, Kobe, Japan, talk by CT on “A lattice study of the nucleon quark content at the physical point.”
- Invited seminar by SM at the Physics Institute of Zurich University, July 8 2015: “Astrophysical aspects of direct DM detection”.
- “Lattice Gauge Theory for the LHC and Beyond,” Aug. 3 – Sept. 25, 2015, Kavli Institute for Theoretical Physics (KITP), U.C. Santa Barbara, CA, USA, invited keynote lecture by LL on “The Origins of Mass, as Seen from the Lattice.”
- “XIV International Conference on Topics in Astroparticle and Underground Physics” (TAUP 2015), Sept. 7-11, 2015, Torino, Italy, talks by CT on “Quark contents of the nucleon for direct dark matter searches from lattice QCD” and by SM on “Astrophysical uncertainties in direct detection from cosmological simulations”.

Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS Detector.

PESBLADe is a general collaborative framework between the experimental ATLAS-CPPM and the LUPM-L2C phenomenological group, where one group provide the competence on the LHC data analysis and the other complement with the knowledge on Beyond the Standard Model model building. This is declined currently in

searches for Supersymmetry in both R-parity violating (RpV) and conserving (RpC) scenarios and for an extended Higgs sector.

The RpV work is the more advanced, consists on characterizing various possible direct and cascade decays of the stop-quark, the scalar partner of the SM top quark, involving tri-linear RpV operators. Among the findings of this work there is the understanding of how chains consisting of multi-jet final state, which are able to constrain the stop mass better than the four-jets final state ones usually considered to test such processes. These final states are close to the ones which has been explored at the LHC experiments and the CPPM group has lead this kind of analysis in Run 1 in the framework of the fully hadronic $t\bar{t}(H \rightarrow b\bar{b})$ searches. This work has been carried out together with an OCEVU post-doc, Sara Diglio until April 2015, and it's in the process of restarting with Lorenzo Basso (post-doc OCEVU Oct 2015).

On the RpC front, a PhD thesis funded during AAP3 and attributed to Rima El Kosseifi, has started at CPPM. This PhD is co-tutored by L2C. The workload is sud-divided into 3 parts. The first part is to adapt some of the b-tagging algorithms within the ATLAS collaboration for the LHC Run2. This part has started and should span at least over the first year of this PhD. The second part regards a search for SUSY in the following channel: $C1 + N2 \rightarrow W(\rightarrow l\nu)+N1 + h(\rightarrow b\bar{b})+N1$, using a Higgs boson as a tag for this SUSY EW signal. Preparatory studies aimed at improving the ATLAS sensitivities to such signals, with respect the Run 1 analysis [1], will start in the coming weeks. The third part of the work is focus on improving Suspect v3, which is a SUSY spectrum calculator first developed in Montpellier [2] in Fortran. This program was fully re-written in C++ [3] in a more flexible and modular way, which should enable easier and more efficient future developments. A specific development that R. El Kosseifi will contribute to is to make the precisely measured Higgs boson mass a low energy input rather than a re-calculated quantity. The "state of the art" two-loops radiative corrections to the Higgs boson mass render this inversion of procedure, with respect to the current operating mode of Suspect v3, a quite involved re-writing of an important part of the program. This phenomenology part is expected to start within a few months.

The search for an extended scalar sector is at the core of the LHC program and remains a central question for the complete understanding of the electroweak symmetry breaking. A model which naturally extend the basic scalar doublet by including a triplet with $Y=2$ links the EWSB to the neutrino masses and predicts spectacular topologies at LHC. The PhD funded by the OCEVU AAP (Venugopal Ellajosyula, started in 2014) has the goal to probe the phase space of the Doublet-Triplet Higgs Model where the vacuum expectation value in the sub-GeV region, where the production and decays receive significant contributions from HWW couplings. The final state includes multi-boson signatures, to be measured within this project using events with several leptons. The main activity in the last year concerns the electron identification optimization. Simulation of H^{++} events through ATLAS framework as well as the implementation of the theory model focused on low v_{ev} for H^{++} (decays to WW predominantly) is being tuned. Massive simulations and acceptance studies will be done in the next weeks.

[1]: <https://inspirehep.net/record/1341609/export/hlxe>

[2]: <https://inspirehep.net/record/602629/export/hlxe>

[3]: <https://inspirehep.net/record/1093110/export/hlxe>

Visit of Sacha Davidson in the OCEVU's laboratories.

Sacha Davidson spent about three months in Montpellier in 2015: from March 11 to March 27, from April 21 to May 22, and from October 19 to December 11. She gave a seminar to present her recent research activities, and she discussed with most members of the high energy group (L2C & LUPM), especially on

- conceptual aspects of effective field theories,
- non-standard models with axion-like particles,
- natural models of electroweak symmetry breaking with no colored particles at the TeV scale,
- optimized observables to discover new physics at the LHC, e.g. dark matter candidates.

These studies have a potential impact for the OCEVU particle physics projects Pesblade, Lattice enlightens DM, New physics from a natural EWSB, and New weakly interacting particles.

Sacha Davidson visited Marseille from 1 to 3 June, to give a seminar and discuss with the OCEVU working group on B-physics (CPPM & CPT), especially on the lepton flavor violating channels in B-decays and the reach of the LHC-B experiment. In this context, she came back to Marseille to participate to the workshop 'Novel aspects of b to s transitions' from 5 to 7 October.

NEW PROJECTS FUNDED IN 2016

Lepton flavour in b to s transitions: prospects at the LHC and beyond (LFB2S)

$B_{d/s}$ decays involving b to s quark transitions provide some of the strongest constraints on physics beyond the Standard Model. Indeed, as these transitions are highly suppressed in the Standard Model, the effects of new physics particles could show up clearly. Interestingly, a number of anomalies of varying significance have showed up in the first LHCb data for these mode, for example in the ratio $R_K = BR(B \rightarrow K \mu \mu) / BR(B \rightarrow K e e)$, or the angular observables of the $B \rightarrow K^* \mu \mu$ decay. These measurements suggest the presence of new physics particles, in particular R_K indicates a hierarchy in the coupling to the different lepton generations, such that the coupling to the tau leptons should be strongly affected. It is thus crucial to improve our knowledge about B meson decays into tau leptons, which is currently very limited.

The goal of this PhD is to participate in this effort towards understanding B meson decays into tau leptons, both on the theory side with study of the possible effects of new physics in these modes, and their interplay with other electroweak-scale searches, and on the experimental side, with the search for the very rare $B_s \rightarrow \tau \tau$ decay at LHCb and sensitivity studies for the future circular collider (FCC) for $B_s \rightarrow \tau \tau$ and the lepton flavor violation mode $B_s \rightarrow \tau \mu$.

New weakly interacting particles: Models, constraints, and discovery potential

There is a strong case for new states with electroweak interactions at the TeV scale, motivated especially by the hierarchy problem and the WIMP dark matter paradigm. However, these new particles are usually difficult to constrain or detect at a hadron collider such as the LHC.

The aim of this project is to study scenarios with such new states, by investigating well-motivated models of new physics where new weakly interacting particles are the only states which can be probed at the LHC or via dark matter and flavor physics experiments. Examples include supersymmetry with heavy squarks and gluinos or minimal UV completions of light-mediator dark matter models. The project's objectives are to obtain bounds on these models, to make predictions for the future discovery reach of LHC and of direct dark matter searches, as well as to study possible implications for precision flavor physics. The models will be analyzed (and, where necessary, elaborated upon and extended) analytically, their particle spectra will be studied by a combination of analytical and numerical methods, and experimental events will be simulated numerically using public tools for event generation, detector simulation and analysis recasting.

The goal is to eventually obtain the best possible overview of what parts of parameter space of well-motivated models remains after taking the respective current and estimated future experimental exclusion bounds into account. On the other hand, should indications for new physics be found, these studies will serve as a starting point to interpret them in the context of realistic and promising models.

EDUCATION

WORKING GROUP

The WG is currently coordinated by Véronique Buat (LAM). The Board also comprises: José Busto (CPPM), Cyril Hugonie (LUPM/L2C), Geneviève Soucail (IRAP), Pierre Taxil (CPT). The team meets via teleconferences (a few per year).

ONGOING PROJECTS

- Master research internship: on average, one (3-4 month) per partner laboratory every year funded by OCEVU
- Master observational internships: few days at OHP or Pic du Midi for all the students of the 3 Universities involved in Master 2 related to OCEVU topics
- Lectures (Toulouse→Montpellier) of A. Blanchard

'On the fly' actions:

- invited teachers, speakers
- special visits: e.g. visit of the CERN

New action in 2015:

- 2nd year university students (L2) summer camp

OCEVU organized two summer camps for high school students (1ere), the education team decided to start a new summer school for bachelor student (2nd year). The first school took place on June 22-28 2015 in Marseille with 16 students selected on their academic records (6 from Marseille, 5 from Montpellier and 5 from Toulouse).

5 days were devoted to the different topics of OCEVU (LAM for the first day and then CPPM, with ~4 hours of lecture per day, visits of the labs and practical activities). 2 days and nights were organized at OHP.

Speakers came from Marseille, Toulouse, Montpellier and Grenoble. The return from the students was excellent.

ACTIONS FORESEEN IN 2016

- Second edition of the L2 Summer Camp in Toulouse

- Doctoral course:

The education team decided to start a new action with the organization of a doctoral course with yearly lectures taking place in Toulouse, Montpellier and Marseille. The project consists of 30 hours per year organized in 3 of the OCEVU institutes (3 lecture courses , 10 hours each)

In 2016 (Scheduled in spring 2016):

Toulouse (IRAP, formation of galaxies), Montpellier (LUPM, supersymmetry), Marseille (CPPM, gamma-ray astronomy).

Different lectures will be given every year covering the different topics of OCEVU, and involving all the laboratories of OCEVU

Must now be approved by each Doctoral School (in progress).

OCEVU PhD students attending the school will be funded and should attend it.

Expert speakers could be invited (not only local speakers)

COMMUNICATION AND OUTREACH

WORKING GROUP

The outreach WG is constituted of representatives of each laboratories involved in Labex OCEVU. These people are involved in outreach and communications actions in their own labs, either as communication professionals, or as scientists.

They are: as communicators Thierry Botti (LAM, OSU Pytheas), Magali Damoiseaux (CPPM), Sylvie Etcheverry (IRAP, OMP), Amel Sahli (LUPM) and as scientists Julien Cogan (CPPM), Michel Marcelin (LAM) and Thierry Masson (CPT).

This group is coordinated by Cyrille Baudouin (CPPM) which is entirely dedicated to lead OCEVU outreach actions.

The general objectives of this WG are to conceive and to develop outreach mutual tools/projects/actions on OCEVU thematic (astroparticles, particles physics and cosmology) especially for the young public through education and also to a general public; and to support local actions.

The WG generally meets 2 times a year alternatively in Marseille, Montpellier and Toulouse. In 2015, there has been one of this “physical” meeting in January at LAM, and another one in teleconference in March. The next ones are scheduled in January 2017 and in June 2017 during the OCEVU workshop.

ONGOING ACTIONS

The outreach actions engaged by OCEVU can be divided in 4 categories:

- The education platforms initiated by the OCEVU “community” : IRiS and e-PÉRON
- Public events (organization or participation)
- Financial support to outreach actions
- Other communication actions

Education platforms

→ IRiS (*Initiation à la recherche en astronomie pour les scolaires*)

IRiS is a 50-cm professional and robotized telescope dedicated to education (secondary and universities). It is located at the Observatoire de Haute-Provence and is financially supported by Labex OCEVU, OSY Pytheas, LAM, Labex FOCUS and “Sciences à l’école”. The objective of IRiS is to create a professional environment (the instrument but also the procedure) ;the teachers who want to observe must send a project during the spring each year (from March to May).

In 2014/2015, there has been 24 accepted projects for secondary teaching (65 nights) and in 2015/2016, there has been 21 accepted projects (84 nights).

During these first two years, there has been teacher's formation on IRiS only inside the Aix-Marseille Academy. During 2015, we have initiated a strategy to communicate to a vaster panel of secondary teachers on IRiS and to encourage them to apply to the 2016/2017 call for project:

- We initiated a network of 5 teachers deeply involved in astronomy projects and localized through France; the objective is that they constitute the link between IRiS and the teachers to relay IRiS news, organize formations ; the first "physical" meeting has been hold at OHP in October 2015 ;
- We plan teachers formations in other academies for example in Toulouse (see below) ;
- We plan to initiate online resources to use IRiS ;
- We communicate broadly on IRiS especially through a public event online (see below).

Finally the IRiS telescope should move to a better place on the OHP on December.

Website : <http://iris.lam.fr/>

→ *e-PÉRON (Plate-forme Éducative sur les Rayons cosmiques et les muONS)*

e-PERON is a didactic platform on cosmic ray physics dedicated to education from discovery (high schools) to deep studies (License and Master). The 20 detectors are installed at the Pic du Midi de Bigorre (~2900 m altitude) where the cosmic ray flux is 4 times higher than at the sea level. The objective is to give access to the experiments, the data and didactic resources online via a website.

During this year, we have achieved several key points:

- The experiments :
 - o The 20 detectors have been installed and are working ;
 - o The first data analysis have been done ; 4 experiments have been tested (East/West effect, Rossi experiment, Auger experiment and the muon lifetime) ;
- Activities preparation:
 - o High schools : a working group with 4 secondary teachers has been initiated to work on the future website design, to conceive future didactic resources and to test experiments with their pupils ;
 - o Universities: data from e-PÉRON will be use par L1 of AMU and by DUT in Toulouse.
- Website and database :
 - o The website will be conceived and designed by the Observatoire Midi-Pyrénées (OMP) in 2016 ; the project is currently been written by e-PÉRON and OMP ;
 - o The database will be done by CPPM ;
- Promotion and partnership :
 - o Partnerships with OMP's education service and Régie du Pic du Midi (the institution in charge of the public at Pic du Midi) have been initiated ;
 - o A convention between OCEVU, OMP and Régie du Pic du Midi is in preparation to clarify the role of each one, to guaranty the material maintenance and to officialize e-PÉRON as an important project at the Pic du Midi Observatory ;

- e-PÉRON have been presented inside the OCEVU Labex (during workshops), to institutions (IN2P3 network of communicators) and a few teachers ;

Website : <https://www.labex-ocevu.univ-amu.fr/?q=fr/content/e-p%C3%A9ron>

Public events (organization or participation)

During the International light year in 2015, OCEVU has been directly involved in the organization of two public events, in the context of a regional gathering of research institutes called “Eclats de lumières”:

- ***“La nuit de la lumière”, the 15th october 2015, 18h30 – 22h, CPPM***

This public event has been co-organized by 3 Labex in 3 locations: P2IO in Massy, ENIGMASS in Grenoble and OCEVU in Marseille. The event was divided in 4 parts: one local outreach conference, virtual visits of a scientific installation on each site broadcasted simultaneously on each location, one interactive quizz with the audience on the 3 locations simultaneously, and one show on each site. The thematic for 2015 was “dark and light”.

In Marseille, the first part was a round-table conference on dark matter with 3 scientists from CPPM, CPT and LAM animated by a professional journalist. Virtual visit was a movie on ERIOS tank in LAM. And finally, the show being played at the Massy Opera has been broadcasted in Marseille.

Around 60 people attended this event at CPPM.

- ***“Balade cosmique”, the 7 November 2015, 19h – 22h, streaming online***

This event has been coordinated by Labex OCEVU in partnership with CNRS communication direction, INSU, Observatoire de la Côte d’Azur (Nice). 2 remote-controlled telescopes live-broadcasted astronomical images online on Dailymotion. The objectives was to propose a cosmic journey to a large audience, and to promote our two telescopes to secondary teachers all across the country. Besides astronomical images, scientists answered scientific questions asked by the public. For IRiS, there has been 4588 views during the 3 hours of observations.

See the replay on <http://iris.lam.fr/>

- ***“Voyage vers les 2 infinis”, festival d’astronomie de Fleurance, 7-14 August 2015***

The OCEVU “Voyage vers les 2 infinis” exhibition has been exposed at the Astronomy festival in Fleurance (Gers). It is the greatest european festival on astronomy and space.

Around 10 000 visitors attended the festival.

Website : <http://www.festival-astronomie.com/categorie/22/expositions>

Financial support to outreach actions

OCEVU contributed in 2015 to 3 outreach actions by a financial support :

- The conception of a poster dedicated to the elementary constituents of matter ; this is a national action supported by CNRS/IN2P3 ; Website : <http://www.particuleselementaires.fr/>
- “Eclats de lumière”, the gathering of regional research institutes (region PACA) in which CPPM, CPT and LAM has been deeply involved during the international light year in organizing exhibitions, conferences and public events dedicated to the light.
Website : <http://www.eclatsdelumiere.fr/>
- Outreach material : OCEVU bought one device dedicated to virtual reality (the Oculus Rift) in partnership with the Fleurance Astro-jeunes festival organizers (IRAP PhDs). The objective is to mutualize this device to the OCEVU labs to propose innovative outreach activities.
- OCEVU multimedia resources : the production of short videos on OCEVU thematics has been initiated in partnership with OSU Pytheas (Le saviez-vous TV) ;
Website : <https://www.youtube.com/channel/UC1XDvM2qTZszyOpdsJlhtGw>

Other communication actions

- Logistic support to the organization of the first L2 Summer camp in Marseille (see the Education WG)
- Contribution to the “Science & You” conference held in Nancy (1-6 June 2015) : “The physics summer camp: an innovative action to upper secondary pupils to discover research and to train teachers”. See the proceedings :
<http://www.science-and-you.com/fr/retrouvez-les-actes-des-sessions-dateliers>

ACTIONS FORESEEN IN 2016

Education platforms

- **IRiS** :
 - o Development of the national network of teachers (the « IRiS relays ») to attract new teachers
 - o Organization of the first IRiS formation outside the Aix-Marseille academy in Toulouse in partnership with the Maison pour la science (may 2015)
 - o To initiate a formation for the new users at the beginning of 2016
 - o To conceive new communication tools on IRiS : video clip, flyer
 - o Inauguration event
- **e-PÉRON**
 - o Working of all the experiments on cosmic ray physics
 - o design and conception of the website and the database
 - o 1st use of the data in the classrooms and in the universities
 - o Elaboration of the didactic resources for secondary teachers

- To develop links with the outreach activities of the Pic du Midi (visits for young people, animator's formation, new museum project...)
- Promotion and communication to secondary teachers (E2PHY, Cosmos à l'école) and universities

Outreach events/project

- "Voyage vers les 2 infinis": exhibition planned on the Triolet Campus in Montpellier in partnership with LUPM and L2C ;
- "Le saviez-vous TV ?": Production of multimedia resources on OCEVU thematic (dark matter, dark energy, cosmic rays, antimatter...);

Others

- Support to Formation WG to organize the 2016 Summer camp L2 in Toulouse
- OCEVU Website : to develop the part dedicated to the science projects supported by OCEVU (Astroparticle, Particle physics and cosmology working groups)
- To work on future outreach projects dedicated to instrumental projects in which OCEVU is deeply involved : SVOM/GFT, LSST, CTA, MUSE, etc.

TECHNOLOGICAL TRANSFER

WORKING GROUP

It is coordinated by Rémy Potheau (CPPM) and Laurent Ravera (deputy - IRAP), in collaboration with Stéphan Beurthey (CPPM), Marc Ferrari (LAM), Bruno Milliard (LAM), and Christian Morel (CPPM).

The WG has no scheduled meeting. As mentioned at several occasions, a global action including several labs is difficult: the technical developments are different in the different OCEVU labs. For transfer, there is local structure in each region: CNRS, SATT,...

This difficulty was presented during the OCEVU workshop in June in Montpellier. To alleviate it, it was proposed that a single lab could propose a technological transfer project, and that it would require the approval of both the OCEVU ComEx and Steering Committee to be funded.

Following the ComEx meeting during the Montpellier 2014 General Workshop and as mentioned at the last Steering Committee, the technology transfer action can be submitted independently by the different Labex laboratories. So the concept of technology transfer group is no longer entirely appropriate.

2015 PROJECT – POWERMATE - HYBRID SUBMARINE CONNECTORS

At the end of 2014, the CPPM asked to OCEVU for a mechanical engineer assistant for studying during six months the adaptation of the subsea connector prototype for the MEUST project. This new generation of wetmate connector should enable reduce the cost of connectivity for MEUST/KM3NeT project.

The work of the mechanical assistant engineer during 6 months allowed to:

- make a new design tools for great depth
- define interfaces with the ROV
- improve the connection box purge
- write installation procedures

Thanks to OCEVU, this work has accelerated the technology transfer for industrialization. This work is now done by Powersea Company in the context of FUI program.

No other technology transfer action is foreseen in 2016.

OBJECTIVES FOR 2016

LABEX-WIDE

BUDGET AND PROVISIONAL SPENDING PROFILES

The 10 M€ (over 8 years) allotted to the OCEVU have to be reduced by the management costs (4% in 2012-2013 and 8% from 2014 on). Given this change in constraints, this translates into a reduction in the number of PhD students and postdocs that we can hire.

The provisional spending profile until the current end of the Labex (31 Dec 2019) is the following:

	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
Personnel	8 674,00	148 793,17	560 816,67	853 518,67	1 025 514,02	957 028,53	528 819,92	211 684,62	4 337 798,09
Investment	161 067,69	249 024,50	229 074,65						639 166,84
Operations	55 085,89	277 000,80	261 738,32						593 825,01
SPACE				230 000,00					230 000,00
GFT					1 025 500,00				1 025 500,00
COMPUTING					450 000,00				450 000,00
FORMATION				35 000,00	35 000,00	35 000,00	35 000,00	35 000,00	175 000,00
SUMMER CAMP L2				16 000,00	20 000,00	20 000,00	20 000,00	20 000,00	96 000,00
PROJETS				280 000,00	310 000,00	310 000,00	280 000,00	280 000,00	1 460 000,00
COMMUNICATION				45 000,00	15 000,00	15 000,00	15 000,00	15 000,00	105 000,00
MISSIONS COMITES+GT & Fonctionnement				30 000,00	30 000,00	30 000,00	30 000,00	30 000,00	150 000,00
WORKSHOP				15 000,00	20 000,00	20 000,00	20 000,00	20 000,00	95 000,00
Total	224 827,58	674 818,47	1 051 629,64	1 504 518,67	2 931 014,02	1 387 028,53	928 819,92	611 684,62	9 314 341,45
management costs	8 993,10	26 992,74	84 130,37	120 361,49	234 481,12	110 962,28	74 305,59	48 934,77	709 161,47
Total incl. M.C.	233 820,68	701 811,20	1 135 760,01	1 624 880,16	3 165 495,14	1 497 990,81	1 003 125,51	660 619,39	10 066 451,42

The foreseen recruiting plan for Term technical staff, PhD students and postdocs is the following (the numbers in the cells correspond to a number of months). These distributions could evolve with the project needs and priorities.

Time distribution of the hiring of (4) term technical staff

CDD IT								
2012	2013	2014	2015	2016	2017	2018	2019	2020
	11,00	12,11	12,12	12,12	12,12	1,01		
	11,00	12,11	12,12	1,01				
					12,00	12,12		
				0,00	0,00	0,00		
			6,00					

Cyrille BAUDOIN (IE 6)
Anqing WANG (IE 5)
TBD (IE 6) computing
TBD (IE 5) TT
C. LEROUVILLOIS (ASI) TT

Time distribution of the hiring of (15 instead of 18) PhD students

PhD Students								
2012	2013	2014	2015	2016	2017	2018	2019	2020
3	12	12	9					
	3	12	12	9				
	3	12	12	9				
	3	12	12	9				
	0	12	12	12				
		3	12	12	9			
		3	12	12	9			
		3	12	12	9			
			2	12	12	10		
			3	12	12	9		
			3	12	12	9		
			3	12	12	9		
			0	0	0	0		
				3	12	12	9	
				3	12	12	9	
				3	12	12	9	
				0	0	0	0	
				0	0	0	0	

CFP#0 Alessandro MORDA
CFP#1 Mario BONAMIGO
CFP#1 David BINA
CFP#1 Nicolas BIZOT
CFP#1 Damien TURPIN
CFP#2 Thomas FITOUSSI
CFP#2 Ana ACEBRON
CFP#2 V. ELLAJOSYULA
CFP#3 – Martin STREF
CFP#3 – Emmy VENTOU
CFP#3 – Darko DONEVSKI
CFP#3 – Rima El KOSSEIFI
CPF#4 - TBD
CPF#4 - TBD
CPF#4 - TBD

Time distribution of the hiring of (44.25 instead of 48 yrs) postdocs

Postdocs									
2012	2013	2014	2015	2016	2017	2018	2019	2020	
		10,00	12,10	12,12	2,02			3 years	CFP#1 Marco PADOVANI
	2,00	12,02	8,08					22 months	CFP#1 Sylvain de la TORRE
			4,00	12,04	9,09			25 months	CFP#3+4 Alice PISANI
	1,00	12,01	12,12	11,01				3 years	CFP#1 Stephane ILIC
		12,00	4,04					16 months	CFP#1 Sara DIGLIO
			6,00	12,06	6,06			2 years	CFP#3 Lorenzo BASSO
	2,00	12,02	12,12	10,10				3 years	CFP#1 Christian TORRERO
		7,00	12,07	5,05				2 years	CFP#2 Daniele PIERINI
				7,00	5,00			1 year	CFP#4 Mari POLLETA
		2,00	12,02	12,12	10,10			3 years	CFP#2 Hadi RAHMANI
		2,00	12,02	12,12	10,10			3 years	CFP#2 Andrey TAYDUGANOV
			8,00	12,08	12,12	4,04		3 years	CFP#3 Kohtaroh MIURA
			3,00	12,03	9,09			2 years	CFP#3 Maria Grazia Bernardini
			3,00	12,03	12,12	9,09		3 years	CFP#3 Cyril TRICHARD
				3,00	12,03	9,09		2 years	CFP#4 - TBD
				3,00	12,03	12,12	9,09	3 years	CFP#4 - TBD
				3,00	12,03	12,12	9,09	3 years	CFP#4 - TBD
				3,00	12,03	12,12	9,09	3 years	CFP#4 - TBD

CALLS FOR PROPOSALS

CFP #4 included a review of the progress reports of on-going projects and new projects as well. The deadline for submission was mid-July 2015, the recommendations of the Scientific Committee were given by mid-October 2015 and the arbitrage of the ComEx by the end of October 2015. Given that the budget spending is supposed to stop at the end of 2019, CFP#4 is the last general one for postdoc and PhD student hiring. The campaign for hiring the postdocs and PhD students of the selected projects has already started and will continue until June of 2016.

Out of the 50 projects submitted to the call, 32 have been selected for funding, including 13 new projects, resulting in 12 years of new postdocs (three 3-yr, one 2-yr, and one 1-yr), 3 new PhD students, 3 visiting scientists (one 3-months, two 2-weeks), and 286 k€ of operating money (304 k€ when including the cost of the visitors). Two 3-yr postdocs and the three PhD students were granted to new projects; the others postdocs were granted to reinforce on-going projects (CTA Science, REGAL, and zSurvey [eBOSS]). In the new projects, support was granted for instance to projects related to CTA [NectarCAM qualification model], LSST, DESI, and Theory/LHCb.

The list of on-going and starting project funded by OCEVU in 2016 can be found in the following tables:

CFP	ID#	SIFAC ID	Title	Link to ID#	PI	Labs	2012	2013	2014	2015	2016	2017	2018	2019	Term position or VS name	
1	1/2	LA0813P001	Cosmic Rays and Molecular Clouds (CR-MC)/Low Energy Cosmic Rays (LE-CR)	112	A. Marcowith	LUPM, IRAP	CFP#1	Post(3m)	Post(12m)	Post(12m)	Post(9m)				Marco PADOVANI (P01 - LUPM)	
								VS(2m)	VS(2m)				Huirong YANG (KIAA Beijing, China)			
								4 000	4 000				funding in 2015			
									CFP#3	6 000			Funding 2016			
						CFP#4	6 500									
1	6	LA0813P006	Observation of the hadronic sky at high energy	138	A. Klotz/D. Domic	IRAP, CPPM	CFP#1	PhD(0m)	PhD(12m)	PhD(12m)	PhD(12m)				Damien TURPIN (PhD05 - IRAP)	
								2 000	2 500	2 000			funding in 2015			
										CFP#4	2 000		Funding 2016			
1	15	LA0813P015	The Three Dimensional Shape of Galaxy Clusters: Combining Data Sets	110, 114	M. Limousin	LAM, IRAP	CFP#1	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)				Mario BONAMIGO (PhD02 - LAM)	
									VS(2,5m)				Andrea MORANDI (Purdue Univ., USA)			
								3 000	3 000							
									CFP#1.5	VS(0,5m)			Fabio GASTALDELLO (IASF-INAF, Milan, Italy)			
										CFP#2.5	VS(1,5m)		Carlo GIOCOLI, Bologna			
										CFP#3 et 3.5	VS(3m)		Giulia DESPALI (LAM)			
			VS(1w)		Mauro SERENO, Bologna											
			7 000			funding in 2015										
			CFP#4	6 000		Funding 2016										
1	16	LA0813P016	Spectroscopic Redshift Surveys in OCEVU: Dark Energy, Galaxy Evolution and Reionization	145	L. Tresse	LAM, IRAP, CPPM	CFP#1	Post(2m)	Post(12m)	Post(8m)					Sylvain DE LA TORRE (P02 - LAM)	
								PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)		David BINA (PhD03 - IRAP)			
								14 000	17 000							
										CFP#3	Post(3m)	Post(10m)		Alice PISANI (P12 - CPPM)		
						CFP#4	Post(2m)	Post(10m)						1-yr extension PISANI		
							VS(2w)							Visitor - Aurélie PENIN		
								42 000						Funding 2016		
1	17	LA0813P017	Featuring Dark Energy	148	A. Blanchard/Ch. Marinoni	IRAP, CPT	CFP#1	Post(1m)	Post(12m)	Post(12m)	Post(11m)					Stephane ILIC (P03 - IRAP et CPT)
								1 000	1 000							
										CFP#3	2 500			funding in 2015		
											CFP#4	3 500		Funding 2016		
1	26	LA0813P026	Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS detector	140	L. Feligioni	CPPM, LUPM, LZC	CFP#1	Post(0m)	Post(12m)	Post(4m)					Sara DIGLIO (P04 - CPPM)	
										Post(4m)	Post(12m)	Post(8m)		TBD (P04-2 - CPPM)		
								6 500	21 900							
										CFP#1.5	VS(2m)			Yanwen LIU (USTC, China)		
										CFP#2	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)	Venugopal ELLAJOSYULA (PhD08 - CPPM)	
										CFP#2.5	VS(1m)			Yanwen LIU, USTC, China		
			VS(1,5m)			Xuai ZHUANG, IHEP, Beijing										
						CFP#3	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)				Rima EL KOSSEIFI (PhD12 - CPPM)		
							20 000							funding in 2015		
								CFP#4	14 000					Funding 2016		
1	27	LA0813P027	New physics from a natural electroweak symmetry breaking	115	J.-L. Kneur	LZC, CPT, CPPM	CFP#1	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)					Nicolas BIZOT (PhD04 - LZC)
								1 500	2 500							
										CFP#3	4 000			funding in 2015		
											CFP#4	4 000		Funding 2016		
1	28	LA0813P028	Lattice QCD enlightens dark matter	136	L. Lellouch	CPT, LUPM, LAM, others	CFP#1	Post(2m)	Post(12m)	Post(12m)	Post(10m)					Christian TORRERO (P05 - CPT)
								14 500	9 500							
										CFP#3	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)		Martin STREF (PhD09 - LUPM)
											10 000				funding in 2015	
								CFP#4	11 700				Funding 2016			
2	36	LA0814P036	Probing the universe with cosmological electromagnetic cascades	117	J. Malzac	IRAP, LUPM	CFP#2	PhD(3m)	PhD(12m)	PhD(12m)	PhD(9m)					Thomas FITOUSSI (PhD06 - IRAP)
									1 000							
										CFP#3	6 000			funding in 2015		
											CFP#4	5 000		Funding 2016		
2	41	LA0814P041	Unveiling the baryonic properties of the first massive halos in the Universe	120	E. Pointecouteau	IRAP, LAM	CFP#2	Post(7m)	Post(12m)	Post(12m)	Post(5m)					Daniele PIERINI (P06 - IRAP)
									2 000							
										CFP#3	5 000			funding in 2015		
											CFP#4	7 000		Funding 2016		

COLLABORATION WITH OTHER LABEX

In 2013 and 2014, OCEVU took the initiative to contact the other coordinators of three other Labex (EnigMass, LIO, P2IO) working on a scientific perimeter close to OCEVU. The idea was to investigate the possibility to have common actions in terms of education/communication, in particular w.r.t. a potential national network of education platforms, and the organization of summer schools and conferences. The discussions were open and fruitful, and all the other Labex showed a real interest. Although this work needs to be strengthened in 2016, it is already slowly translating into concrete actions:

- ***“La nuit de la lumière”, the 15th october 2015, 18h30 – 22h, CPPM***

This public event has been co-organized by 3 Labex in 3 locations: P2IO in Massy, ENIGMASS in Grenoble and OCEVU in Marseille.

- ***Multi-Labex support (P2IO, OCEVU, Enigmass)*** to the NectarCAM CTA camera with the following requests:

- o P2IO: 900 k€
- o OCEVU: 100 k€
- o Enigmass: 30 k€

The Scientific Committee gave a good evaluation of the project; the ComEx decided to support this request if the other Labex support it as well. OCEVU would fund the project at the level of 50 k€ in 2016 and if the progress report end of 2016 is satisfactory, would fund it again at the level of 50 k€ in 2017.

- ***COBESIX: Dark energy beyond six parameters*** is also typically a project that could benefit of a multi-Labex support

QUESTIONS

TECHNOLOGICAL TRANSFER

More a comment than a question... technological transfer is probably the domain in which it is the most difficult for OCEVU to contribute full speed. Although there does not seem to be any easy solution, and given the constraints of the remaining budget, we are willing to try to figure out, with the help of the competitiveness clusters, how we could improve.

FUTURE OF OCEVU

Given we are half-way to the end of the Labex project, it is time to start thinking about how it would be possible to sustain the pluridisciplinary collaborative environment that we managed to setup with the Labex beyond 2019. Some very preliminary discussions already occurred within the ComEx on this issue: a possible way could be to transform OCEVU into a Research Federation or an Institute that would allow the OCEVU community to keep collaborating within a stable framework and environment with the financial help of the hopefully sanctuarized Idex of AMU. We would very much like to know the position of A*Midex and the OSTC on this issue.