

# Institute for the **Physics** of the **Universe**



Institut  
Physique de  
l'Univers

Aix\*Marseille Université

*Strengthen and structure our synergies  
to better teach, do research, and transfer*



**A\*Midex**  
Initiative d'excellence Aix-Marseille



## Collaborative environment positioned at the best international level

- **Leverage** in excellence and synergies of its 3 constituent laboratories based on the success of the OCEVU Labex (2012-2019)
- **Encourage** and **support** ambitious joint actions and projects to:
  - Lift scientific and technological barriers
  - Push the limits in understanding the Physics of the Universe
- **Foster**
  - Training by and for Research
  - Innovation, Creativity, *Coopetition*
  - Open to the world
- **Promote and enforce**
  - Crossed fertilization between its 3 pillars
  - HRS4R Compliant Practices

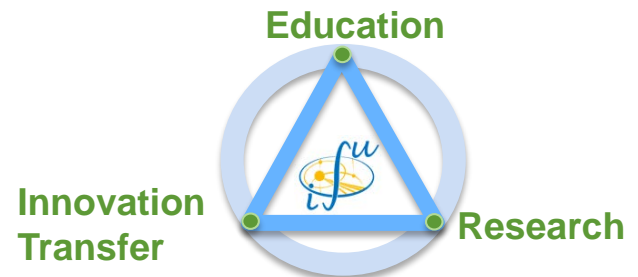
➔ **Research Groups**

➔ **Graduate School**

➔ **Innovation Cell**




➔ **Centre International de Rencontres de Physique**

**Sustainability**



**Ambitious project, with no real equivalent at national and international levels  
created by AMU on 01/01/2020**

## RESEARCH LABORATORIES (in alphabetic order)

- **CPPM** – UMR 7346 : Centre de Physique des Particules de Marseille 
- **CPT** – UMR 7332 : Centre de Physique Théorique 
- **LAM** – UMR 7326 : Laboratoire d'Astrophysique de Marseille 

## COMPONENTS

- **Faculty of Sciences**
  - Physics Department
    - » Master Degree programme in Fundamental Physics (FunPhys)
- **OSU Pythéas** : OHP (Haute Provence Observatory)

## DOCTORAL SCHOOL

- **ED 352** – Physics and Sciences of Matter

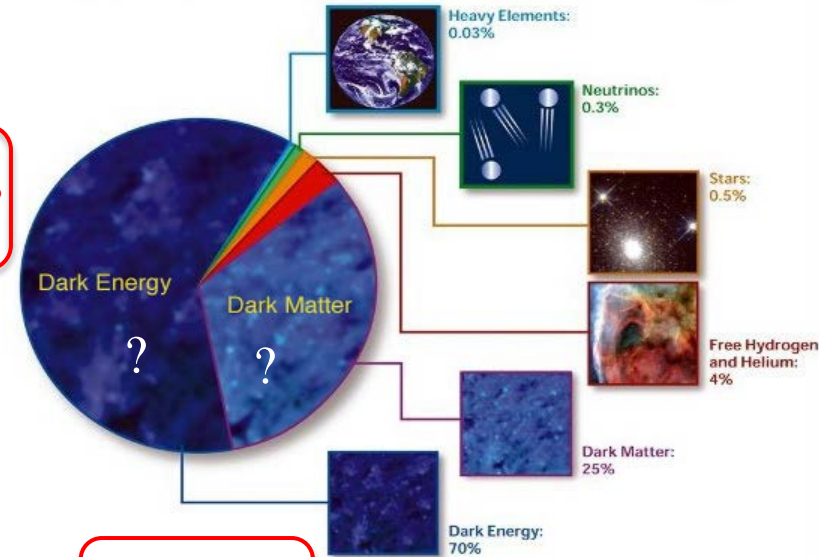
## CNRS

- **3 Institutes** – IN2P3, INP, INSU

## DRIVING FORCES

- **210 staff (110 HDR)**: 100 scientists, 110 engineers, techs and admins  
*note: 50 out of the 110 HDR currently supervise one (or 2) PhD student(s)*
- **35 postdocs, 65 PhD and 70 Master students** *on average*

**What are the fundamental laws governing the Universe?  
What is it made of? How did it form and how does it evolve?  
Do we understand the Universe in its extreme states?**



## Support for international projects

to ensure maximum scientific return

## Support for original, innovative or risky ideas

- **Transversal projects:**  
dark matter & energy, neutrinos, gravitational waves...
- **Big Scientific Data:**  
data management, processing and analysis issues
- **Innovative or risky projects:**  
incubation of potential future large projects

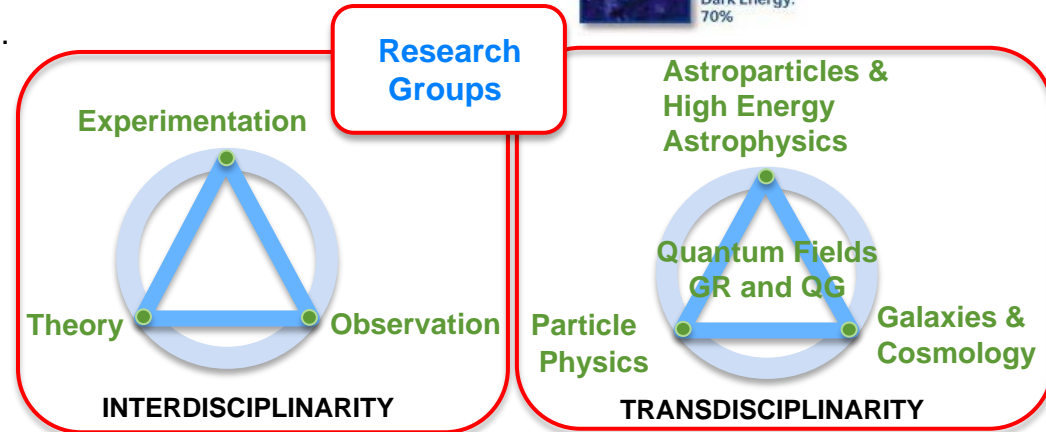
**Priority** to projects developing our synergies on international projects

## International Hiring and Hosting Programs

- PhD students (*and no more Postdocs*)
- High-level guests from science/technology/education

**Development of state-of-the-art equipment and platforms:** KM3NeT/ORCA, GFT-Colibri; SPATIAL & POLARIS platforms and Instrumentation for the extreme; Radon and Infrared sensors technological platforms; CeSAM; Dark Energy Center; IRiS and ePERON platforms; Haute Provence Observatory (OHP) ...

**Which will also be used as training platforms in the Institute Graduate School**



## Graduate School

**Program of internationalized courses**

**4 flavors, including a new "instrument scientist",**

**Direct connection to the Research Groups of the Institute**

### Innovative educational offer

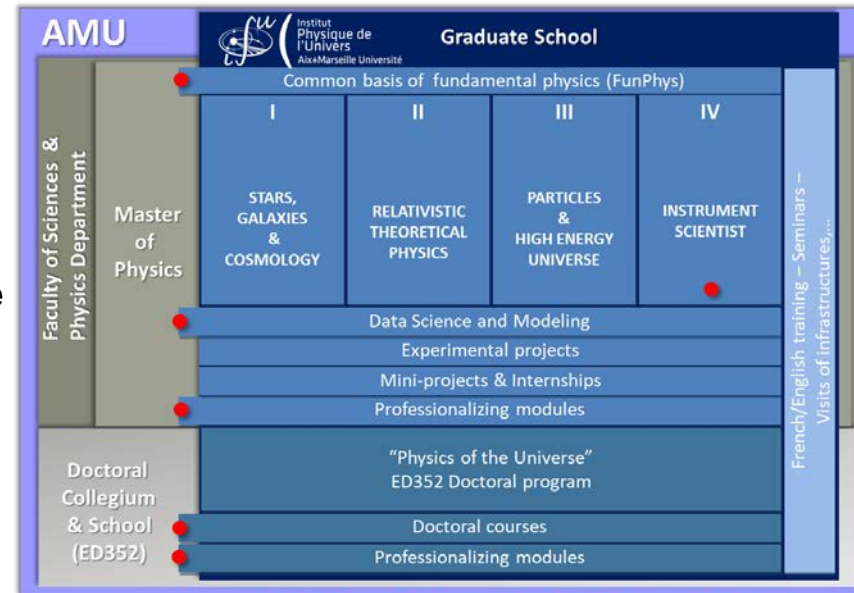
- Develop skills, autonomy and a sense of belonging
- Work in teams and learn by projects; access to research platforms
- Integrate into research teams, including abroad
- Participate in training and scientific dissemination actions

**Link with related trainings** - with strong involvement of the Grad School's students

- Physics Summer Camps/Schools
- IRiS and ePERON training platforms (radio@OHP ?)
- Research and Discovery Internships in IPhU labs and abroad
- Communication/information/support gateways between Bachelor, Master and PhD students

### Development of teaching and research links with other Universities

- Innovative pedagogy - contacts with UCL (University College London)
- Contacts with **Barcelona** AU, **Bologna** Univ. and **Bucharest** Univ. (**CIVIS**) to structure a common Erasmus adventure (ERASMUS+, ERASMUS MUNDUS)
- But also with: Penn State (USA), **UNAM** (Mexico), **UCAS**(IHEP, NAOC), USTC, **THU**, **PKU**, SDU, **SJTU**, SYSU (China)  
[IRL ERIDANUS] [IRL FCPPL]
- **Strengthen present collaborations, but open to develop new ones in accordance with AMU priorities**



● (partly) shared with other curricula in Faculty of Sciences and/or ED352

## World of knowledge

### Amplify the dynamics of scientific dissemination and mediation

- **Weave** multiple links between the places where science is produced and the various actors in society
- **Produce** multimedia resources and organize events and actions for these audiences
- **Foster *OHP, and IRiS, ePERON, and radio@OHP*** (new!)... educational platforms as training infrastructure
- **Create** a space for exhibition and exchange with secondary school teachers and the general public

## World of technology

### Amplify links with industry and the regional economic actors

**The Innovation Cell** - in connection with CISAM, SATT, Competitiveness Clusters, etc. - will offer to innovative project leaders: individualized coaching, advice by groups of industrial and academic experts, adapted training, seed and pre-maturation funding, etc.

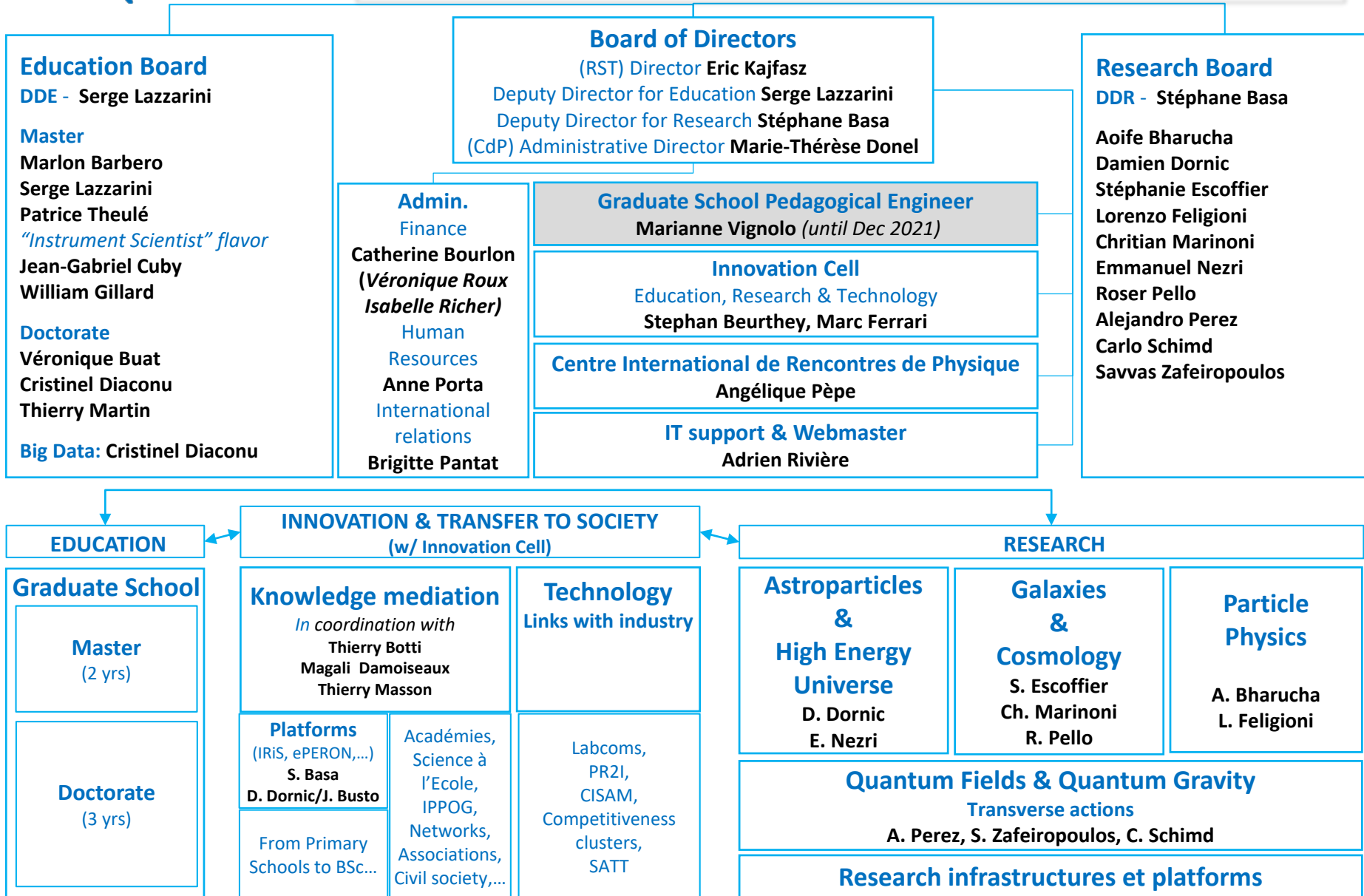
#### First concrete paths already being explored

- **LabCom and Partnerships with identified companies** to develop Design of spectrographs for large cosmological survey projects, Characterization of infrared sensors, Data acquisition and AI developments on FPGAs,... (Lynred, Thalès, Winlight, Intel/FPGA, Nexvision,...)
- **Seminars, Internships and PhD grants linked to the « Instrument scientist » flavor**

# Organizational chart

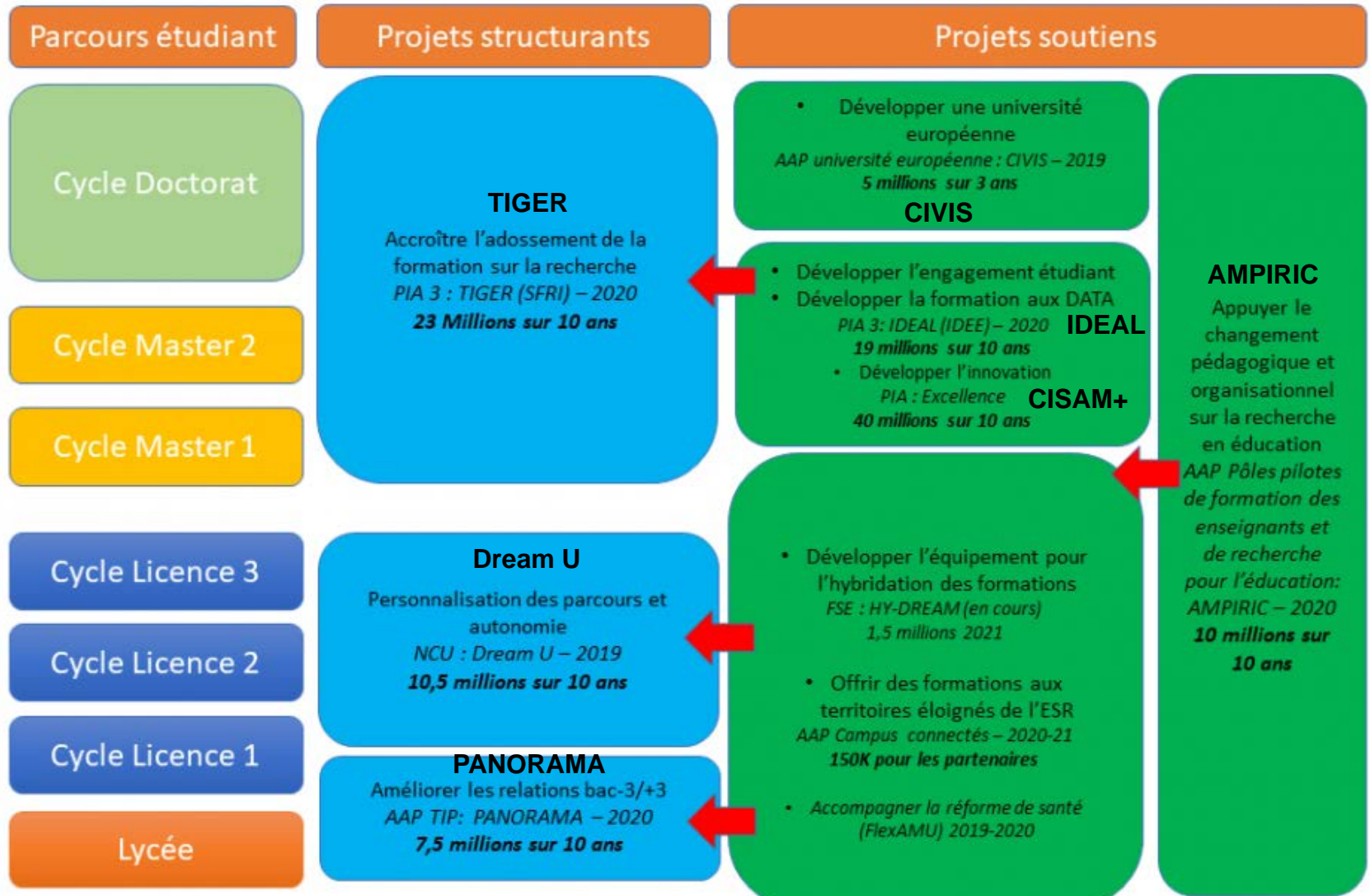
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**Great thanks to our colleagues taking care of the administrative aspects !**



# IPhU in the AMU PIA Context

## A strategy based on the articulation of different structuring training projects





# Budget 2022-2027

~ 357 (320 + 37) k€/yr

Institut de Physique de l'Univers (IPhU) budget de 6*320k€=1920k€ pour 2022-2027 + 220 062 € de reliquat 2021-2022 = 2 142 062 €	2022	2023	2024	2025	2026	2027
PhD 1 - 2020	12	9				
PhD 2 - 2020	12	9				
PhD 5 - 2021	12	12	9			
PhD 6 - 2021	12	12	9			
PhD 7 Revers. de 50 688€ de IPhU en FCT au CNRS pour contrat CNRS	0	0	0	0		
PhD 8 1/2 PhD IPhU + Revers. 50 688€ du CNES à IPhU en MS	3	6	6	3		
PhD 9		3	12	12	9	
PhD 10		3	12	12	9	
PhD 11			3	12	12	9
PhD 12			3	12	12	9
PhD 13				3	12	12
PhD 14				2	6	6
PhD 15					3	12
PhD 16					2	6
PhD 17						3
PhD 18						2
# Nombre PhDs	6	8	8	8	8	8
cost	133 506	144 476	154 828	169 504	202 267	189 084
PhD IA-ANR 1 (co-financement à 50%) - PhD 3 - 2020						
PhD IA-ANR 2 (co-financement à 50%) - PhD 4 - 2020						
# mths	0	0	0	0	0	0
cost	0	0	0	0	0	0
cost RH PhDs	133 506	144 476	154 828	169 504	202 267	189 084

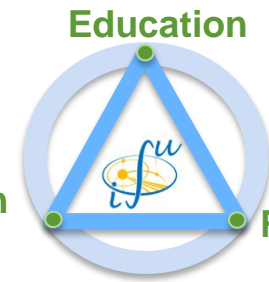
Institut de Physique de l'Univers (IPhU)	2022	2023	2024	2025	2026	2027
IGE (ingénieur pédagogique de la Graduate School) puis gestionnaire	0	0	0	0	0	0
# mths	0	0	0	0	0	0
cost	0	0	0	0	0	0
IGR (innovation IR/Radon)	8	0	0			
# mths	8	0	0	0	0	0
cost	33 160	0	0	0	0	0
Wages for PhDs teaching/outreach (2+2 and 1+1 or 1+2 in descoped)	0	0	0	0	0	0
PCA Directeurs adjoints	3 000	3 000	3 000	3 000		
Provision						
cost	3 000	3 000	3 000	3 000	0	0
cost RH Other	36 160	3 000	3 000	3 000	0	0
<b>COST: Human resources</b>	<b>169 666</b>	<b>147 476</b>	<b>157 828</b>	<b>172 504</b>	<b>202 267</b>	<b>189 084</b>
<b>PhD operation (2k€/person per yr until 2021 and 1.2k€/person after)</b>	<b>7 200</b>	<b>12 800</b>	<b>12 800</b>	<b>12 800</b>	<b>12 800</b>	<b>12 800</b>
Research projects operations engagées						
<b>Research projects operations</b>	<b>80 000</b>	<b>80 000</b>	<b>80 000</b>	<b>80 000</b>	<b>80 000</b>	<b>80 000</b>
Research platforms consolidation (COLIBRI, SPACE, IR, and ELIXIR)						
<b>COST: Research (hors ce qui est déjà inclus dans le REPORTING)</b>	<b>87 200</b>	<b>92 800</b>	<b>92 800</b>	<b>92 800</b>	<b>92 800</b>	<b>92 800</b>
<b>IPhU Operations</b>	<b>1 800</b>	<b>2 000</b>	<b>2 000</b>	<b>2 000</b>	<b>1 700</b>	<b>1 101</b>
Innovation (incentive money)	2 000	2 000	2 000	2 000	2 000	2 000
Frais de gestion CNRS (cofinance thèse IPhU-ANR Fouchez/Arnouts)	4 055					
Versement au CNRS (cofinance thèse IPhU-ANR Fouchez/Arnouts)	50 688					
Outreach						
Education platforms consolidation (IRiS@OHP, ePERON @OHP&OPM)	4 500	4 500	4 500	4 500	4 500	4 500
<b>COST: Innovation, Outreach and operations</b>	<b>63 043</b>	<b>8 500</b>	<b>8 500</b>	<b>8 500</b>	<b>8 200</b>	<b>7 601</b>

Institut de Physique de l'Univers (IPhU)	2022	2023	2024	2025	2026	2027
Incoming grants engagées						
S1-2022 (engagé sur budget 2021)						
S2-2022 (engagé sur budget 2022)	16 000					
S1-2023 (engagé sur budget 2022)	8 000					
Incoming grants à partir rentrée 2022						
<b>M1 Full</b>	0	8 000	16 000	16 000	16 000	8 000
<b>M1 Half</b>	0	8 000	16 000	16 000	16 000	16 000
<b>M2 Full</b>	8 000	8 000	8 000	8 000	8 000	4 000
<b>M2 Half</b>	20 000	8 000	8 000	8 000	8 000	8 000
Outgoing grants engagées						
<b>Outgoing M1</b>	2 500	2 500	2 500	2 500	2 500	2 500
<b>Outgoing M2</b>	4 500	4 500	4 500	4 500	4 500	4 500
Internships engagés						
<b>Internships M1</b>	4 950	4 950	4 950	4 950	4 950	4 950
<b>Internships M2</b>	6 600	6 600	6 600	6 600	6 600	6 600
Training @OHP	7 000	7 000	7 000	7 000	7 000	7 000
<b>Facturation interne par l'UFR (pour cours master)</b>	2 043					
<b>Cours doctoraux (105h à 45€/h)</b>	4 725	4 725	4 725	4 725	4 725	4 725
<b>Intervenants externes pour "Instrument Scientist" (0h à 60€/h)</b>						
<b>COST: Graduate School (hors ce qui est déjà inclus dans le REPORTIN)</b>	84 318	62 275	78 275	78 275	78 275	66 275

- **GS Master: ~ 80 k€/yr**
  - Incoming grants: M1 (1 Full + 2 Half); M2 (1 F + 2 H) /yr
  - Outgoing grants: 1 M1; 1 M2 /yr
  - Including PhD courses: ~ 5 k€ /yr
- **PhD students: ~ 8 over 2022-2027**
- **PhD salaries: 150-200 k€ /yr**
- **Research: ~ 90 k€ /yr**
  - including ~ 10 k€ PhD operations /yr
- **Innovation, Outreach & IPhU Operations: ~8 k€ /yr**

Institut de Physique de l'Univers (IPhU)	2022	2023	2024	2025	2026	2027		
<b>Grand Total</b>	<b>404 227</b>	<b>311 051</b>	<b>337 403</b>	<b>352 079</b>	<b>381 542</b>	<b>355 760</b>	2 142 062	
Total 2020+2021 (doit être < ou = à 2*400k€)								
	-47 217	45 959	19 607	4 931	-24 532	1 250		
							<b>TOTAL PREVISIONNEL 2022-2027</b>	<b>2 142 062</b>
							budget total alloué =>	2 142 062
							difference =>	0
<b>RECETTES</b>								
Institut de Physique de l'Univers (IPhU)	2022	2023	2024	2025	2026	2027	total	
CNES - cofinancement thèse Buat/Dornic		16 896	16 896	16 896			50 688	
ELIXIR - partie Région (déjà @AMU)		120 962					120 962	
ELIXIR - partie CNRS (transfert par facturation interservice LAM->IPhU)		80 000					80 000	
Radio@OHP - partie Région @CNRS (Fact interservice LAM -> IPhU)		34 000					34 000	
Engagement Labex OCEVU - transport Colibri au Mexique	39 200						39 200	
<b>GRAND TOTAL RECETTES</b>	<b>39 200</b>	<b>251 858</b>	<b>16 896</b>	<b>16 896</b>	<b>0</b>	<b>0</b>	<b>324 850</b>	

**Keep looking for external fundings, even though implementing co-fundings can be administratively difficult**

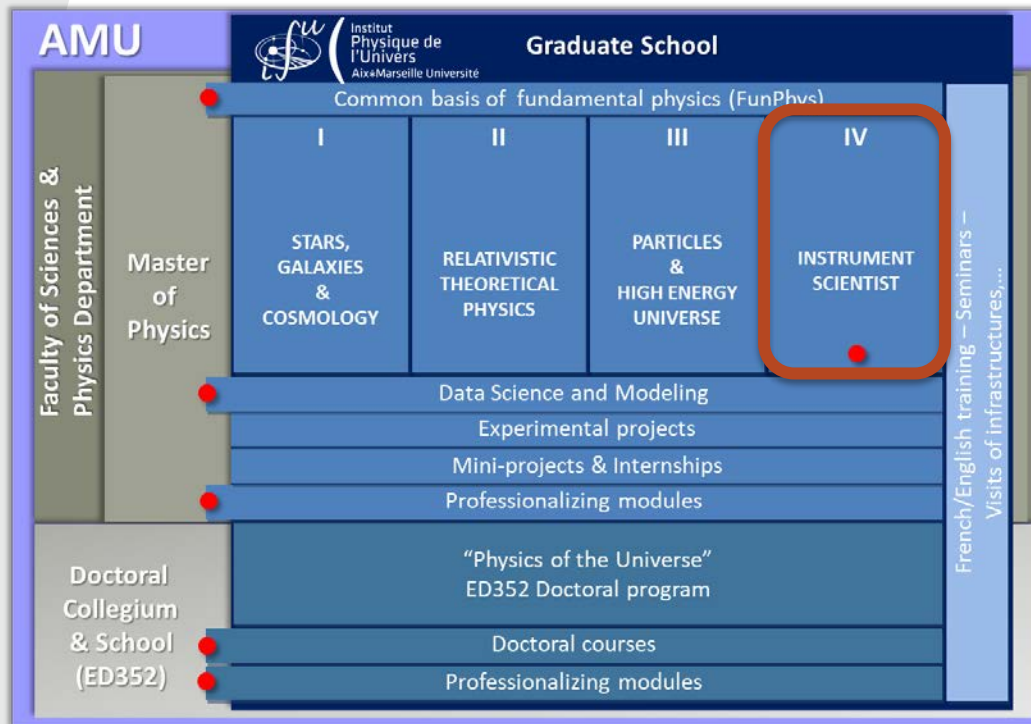


Innovation  
Transfer

Research

## Transformation of the Master Programme

**involves:** UFR – Physics Department  
Master « Mention Physique » and « Parcours FunPhys »  
IPhU and ISFIN (essentially)



● (partly) shared with other curricula in Faculty of Sciences and/or ED352



**Creation of an “Instrument Scientist” flavor**  
**Integration of the TRIPS platform MULTIVERSE**

# TIGER Experimentation phase impact on IPhU 2022-2025 Budget

- Allocated budget to FunPhys selected in the EoI TIGER **2021-2022** experimentation Call  
Shared between IPhU and ISFIN institutes => for IPhU: **2400€ (~ 1 internship M2) et 4000€ (outgoing grant)**

Mention de master	Parcours	Composante(s)	Budget total	Dispositif "stages"	Dispositif "mobilités"	Dispositif "colloques"	Dispositif "événements"	Dispositif "extérieurs"	Institut(s) associé(s)...
Physique	Physique (acronyme FunPhys)	Faculté Des Sciences (FDS)	12 800 €	4 800 €	8 000 €	0 €	0 €	0 €	<b>IPhU+ISFIN</b>
Somme totale à répartir			12 800 €	4 800 €	8 000 €	0 €	0 €	0 €	

- 17/11/2021: FunPhys is eligible for a few incoming grants for M1 and/or M2 students**
  - Un montant de 80 000 euros vous sera donc octroyé pour 8 bourses de mobilité entrante (de 10 000 euros chacune), à répartir sur les trois prochaines années universitaires, et entre IPhU et ISFIN.*
  - Exemple d'allocation des ressources :*
    - Rentrée 2022 : 2 bourses de M1*
    - Rentrée 2023 : 2 bourses de M1 + 2 bourses de M2 (M1 2022 terminant leur master)*
    - Rentrée 2024 : 2 bourses de M2 (M1 2023 terminant leur master)*
  - => for IPhU 1 M1 full-grant in 2022 and 1 M1 full-grant in 2023 (40k€ over 3 years)**
- Allocated budget to FunPhys 01/09/22 - 31/08/24 (2 yrs): 14 400 € to share btw IPhU/ISFIN**
  - Outgoing grants: 4000 + 4000
  - Internship: 2400 (4\*600)
  - Event MSE: 4000

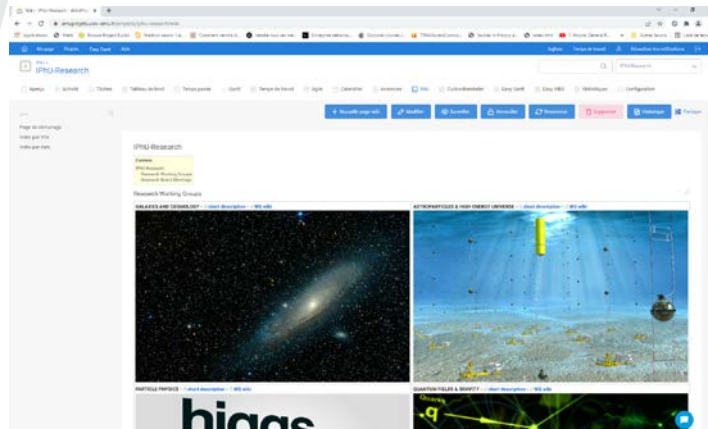
# Some IPhU Actions

We have developed web pages: <https://www.univ-amu.fr/iphu>

- Some pages are still under construction, though

Collaborative tools:

- AMUbox + AMUprojets (Redmine based)

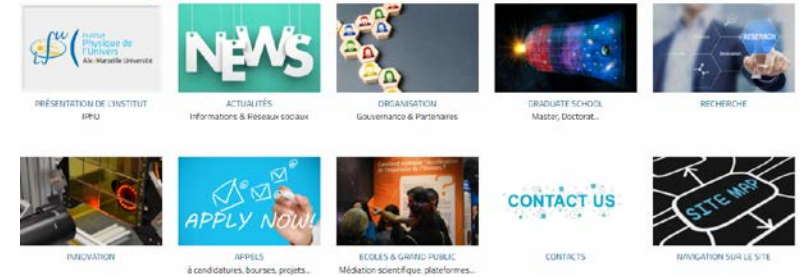


- Indico to manage all our meetings: <https://indico.in2p3.fr/category/873/>

- A newsletter



INSTITUT PHYSIQUE DE L'UNIVERS - IPhU (SITE EN CONSTRUCTION)



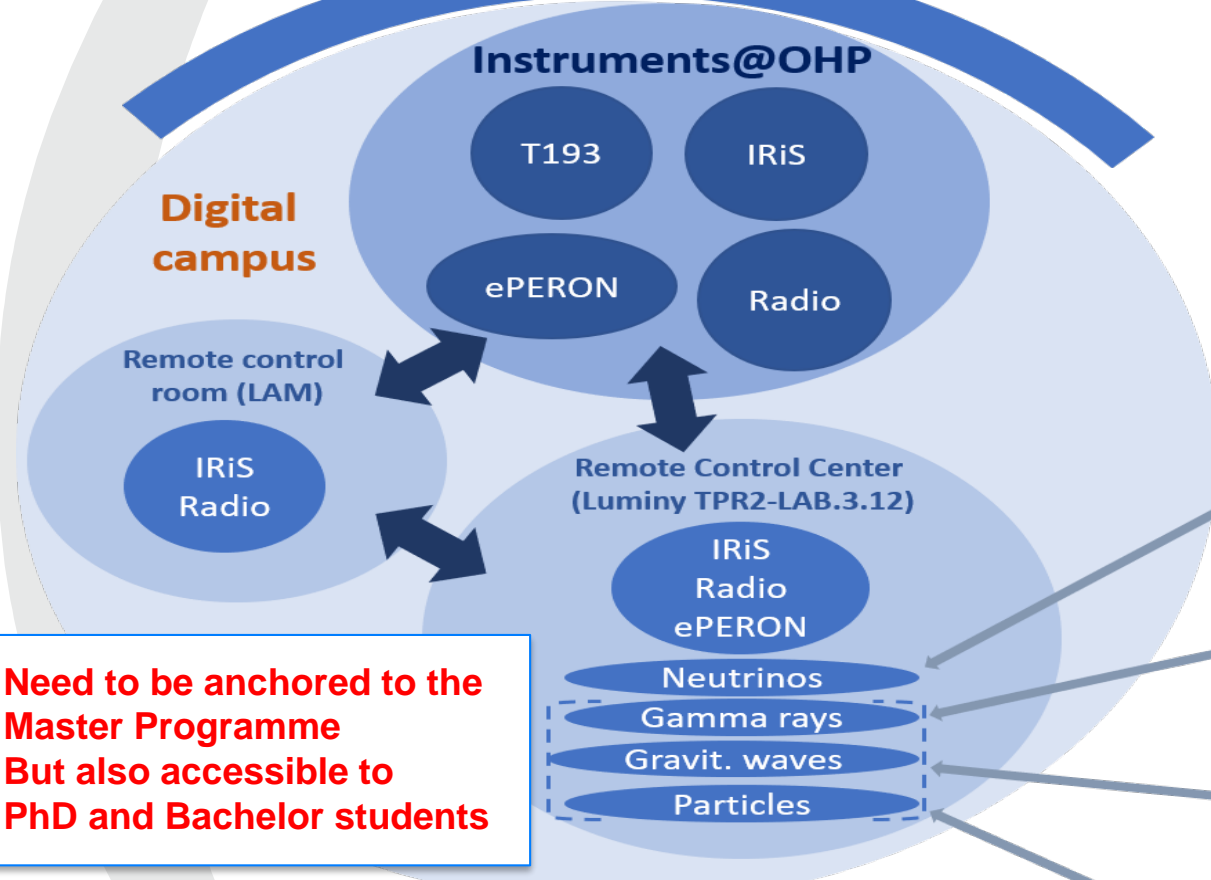
- In 2022 IPhU Days: 10-11 Feb, on Zoom  
in 2023 IPhU Day: 20 Jan, hybrid mode (CPPM & Zoom)

- **Creation of an annual summer school on Gravitational Waves**  
with OCA/Nice & L2IT+IRAP/Toulouse - Master-PhD Level  
**In 2022** : amphis Hexagone et CPPM @Luminy ; 4-8 July 2022 (5 days)  
<https://indico.in2p3.fr/event/25990/>  
  
**In 2023** : @Nice ; 3-8 July 2023 (6 days)
- **In 2023 rebirth of Summer Camps @OHP** (a week of immersion in the scientific process; 4-9 June 2023)  
for end of 10th grade students, en partnership with Aix-Marseille Rectorate.
- **En 2023, « R&D Week » ou « R&D Day »** :  
industrialists in our fields - students and PhD students of the GS IPhU + FunPhys - faculties, researchers, engineers, including: presentation of industrialists with internship/thesis opportunities, speed-dating, hackathon, ...  
**Funded by TIGER**
- **Teaching/training Platforms**
  - **Astronomy** - <http://iris.lam.fr/>
    - IRiS (@ OHP) – has worked really well for some years already; involvement of a school teacher
    - Region co-funded project of an antenna @ OHP for radio-astronomy
  - **Cosmic Rays** - <https://eperon.omp.eu/>
    - ePERON – @ OPM in collaboration with OMP; new complementary deployment @ OHP
  - **Meant to be integrated in a more general “TRIPS” platform MULTIVERSE**



**Possible connections with other institutes**  
**Origins** (for what concerns astrophysics, exo-planets,...),  
**OCEANS** (on Deep sea environment) and **AMI** (on signal processing, and Machine and Deep learning,...)

AMU/AMIDEX  
 Fac. of Sciences    OSU Pytheas    Doctoral Schools  
 Phys. Dept.    IPhU





**Other instruments**

- LSPM – KM3NeT  
Neutrinos & Deep sea environment  
Open data
- SVOM/Colibri  
CTA/HESS  
Open data
- LISA & LIGO/Virgo  
Open data
- CERN - LHCC  
Open data

In a 2<sup>nd</sup> step

**Need to be anchored to the Master Programme  
 But also accessible to PhD and Bachelor students**

**The evaluation date of the applications has been shifted and the selected projects will be announced in late March 2023**

- **International – existing structures we can rely on**
  - LIA/IRL ERIDANUS with Mexico 
  - LIA/IRL FCPPL with China 
  - *Ongoing discussions with AMU and DERCI to have a specific action on immunology (CIML and its IRL) and Physics of the Universe with SJTU – SII + TDLI*
- **International Partnerships in Research and Training**
  - Shanghai Jiao Tong (上海交通大学) & T.D. Lee Institute – cooperation agreement AMU-SJTU signed in 2019, but put on hold because of Covid...
  - CIVIS partnerships to develop – the IPhU internal call AAP#4 is open to CIVIS teams
- In 2022, **hiring of 2 PhD Students on projects selected in the IPhU internal AAP#3 call** (co-funded CNES and ANR)  
In 2023, **2 PhD Students are expected to be hired in the AAP#4**
- **IPhU Doctoral Programme with ED352**
  - ✓ 12 courses of 12-16 hours offered; 5 are funded by ED352 in 2021-2022
  - ✓ Finalization of the 2022-2023 offer (similar to the previous one)

## 2022 Doctoral Courses of the Physics of the Universe Programme

	Titre	Financement	Intervenant(s)	Durée (h)	Répartition (h)
<b>ASTROPHYS. HAUTE ENERGIE</b>					
	Advanced neutrino physics	ED352	José Busto, Juergen Brunner, Damien Dornic, Mathieu Perrin-Terrin	15	4, 4, 4, 3
	Dark matter from phenomenological perspectives	IPhU	Julien Lvalle (LUPM - Montpellier)	15	
<b>GALAXIES ET COSMOLOGIE</b>					
	Observational cosmology	ED352	Denis Burgarella, Veronique Buat, Olivier Ilbert, Eric Jullo	15	
	Bridging cosmology and galaxy formation	ED352	Carlo Schimd, Katarina Kraljic, Simona Gallerani (Scuola Normale Superiore, Pisa)	16	
<b>PHYSIQUE DES PARTICULES</b>					
	Standard Model	IPhU	Aoife Bharucha	15	
	Introduction to theories beyond the Standard Model of particle physics	IPhU	Michele Frigerio (L2C - Montpellier)	15	
	Introduction to Quantum Chromodynamics	IPhU	Antoine Gérardin	12	
<b>TRANSVERSE - THEORIE</b>					
	Field theoretical aspects of general relativity	ED352	Simone Speziale	15	
	Renormalisation and Effective Theories	IPhU	Thomas Krajewski	12	
<b>TRANSVERSE - EXPERIMENTAL</b>					
	The Large Research Astrophysics and Particle Physics Instruments of the coming decades	IPhU	Jean-Gabriel Cuby, William Gillard	15	
	Advanced statistical methods for HEP	ED352	Yann Coadou, Lorenzo Feligioni	15	
	Introduction to Large Surveys, Big Data, and Generous Statistics	IPhU	Matthew Pieri	15	

In 2022, support for IPhU community projects (AAP#3 IPhU internal Call):

- 6 scientific collaborative projects
- 3 summer schools, including a school on Gravitational Waves in Luminy
- 2 international conferences

PI name	Title	Leading Labs	Funding	PhD	Visitors	Already Granted	Extra Grant if IPhU additional budget	Total budget finally granted
coadou@cppm.in2p3.fr	School of Statistics, SOS2022	CPPM, CPT, LAM	3 000			1 000	2 000	3 000
stephane.basa@lam.fr	Operation of the COLIBRI robotic telescope	LAM, CPPM	10 500	1 PhD (CNES co-fund)		9 500		9 500
pralavor@cppm.in2p3.fr	Direct search for WIMP dark matter	CPPM, CPT, LAM; LUPM/IFAC	8 000		3-week visitor (~2,100Eu)	9 100	1 000	10 100
stephane.arnouts@lam.fr, olivier.ilbert@lam.fr	Pix2LSST: from Pixel to Large Scale Structure with Vera Rubin Telescope	LAM, CPPM	10 500			7 000		7 000
sylvain.delatorre@lam.fr	Cosmology with Large Scale Surveys (CLASS)	LAM, CPPM, CPT	19 800	1 PhD (ANR co-fund)		16 300	1 000	17 300
denis.burgarella@lam.fr	International Research Network on Extragalactic Astrophysics and Cosmology (NECO)	LAM, CPPM	10 000			0	3 000	3 000
carlo.schimd@lam.fr	Radio@OHP, Radioastronomy at the Observatoire de Haute-Provence: a new window on the Universe	LAM, CPPM, OHP	18 390					
lorenzo@in2p3.fr	BSM Physics at the Terascale	CPPM, CPT; L2C, LUPM; IFIN-HH (Bucharest Univ. & CIVIS)	6 500		Visitor (A. Dumitriu) several 1-month stays for a total of 10,000Eu	13 000	2 000	15 000
escoffier@cppm.in2p3.fr	International School - The science of the next generation of large cosmological surveys	CPPM, LAM	5 000			0	3 000	3 000
eric.kajfasz@univ-amu.fr	Summer School on Gravitational Waves	CPPM, CPT, LAM; OCA/ARTEMIS, L2IT, IRAP	5 000			4 000	1 000	5 000
vincent.lebrun@lam.fr	From galaxies to cosmology with deep spectroscopic surveys - A tribute to Olivier Le Fevre	LAM, CPPM, CPT, LAM	5 000			4 000	1 000	5 000
perez@cpt.univ-mrs.fr	John Bell Institute workshop "Black Hole Information Puzzle"	QFT & AG	5 000			0	2 000	2 000
<b>TOTAL</b>		<b>118 790</b>	<b>106 690</b>	<b>3 PhD</b>	<b>12 100</b>	<b>63 900</b>	<b>16 000</b>	<b>79 900</b>
						<b>AVAILABLE</b>	<b>62 000</b>	<b>79 900</b>
						<b>Previously</b>		<b>Now</b>

- **Guidelines for the Call**

- Scientific relevance, well defined and realistic work plan, and expected impact (national and international), together with matching the institute scientific perimeter and goals, are the primary selection criteria.
- Implementation of a genuine collaboration between teams of at least two labs of IPhU will be favored; **New this year, genuine collaborations between a team involving at least one IPhU lab and a team involving at least one other CIVIS university** (<https://civis.eu/>) will also be taken into consideration.
- The project proposal can span several years. In that case, an evaluation of the project is performed each year to validate the continuation of its funding by IPhU.

- **Budget framework**

- IPhU's overall budget for 2023 should allow for:
  - the possibility to fully fund **2 PhD students** (although co-funding is favored) ,
  - and expenses on the projects (small equipment, travel and operating money) up to a total of about **80 k€ all included**.

- **Process**

- Project proposals have been submitted
- Event to find a date in Feb 2023 for the Institute Council to meet to perform evaluation and arbitration
- **Early March, selected project announced**

## Some IPhU Actions diversification of funding (cont'd)

- **2<sup>nd</sup> CALL AMIDEX Transfer**  
development of a detection system based on a Ge spectrometer (Mirion Technologies) to measure radioactivity on the Moon (SPARTAN – Space) ... **not possible because SPARTAN impulsed by PACA-Est ☹**
- **Co-funding CNES and CNRS** of 2 PhD Students hired by IPhU in 2022
- **CPJ** (« tenure track »): 1 project submitted by AMU but not selected by the Ministry of Higher Education
- **Chaires AMIDEX :**
  - Spontaneous application on Gravitational Waves – not selected by AMIDEX
  - **Application by CPT on Gravitational Waves – SELECTED by AMIDEX – to be hired in 2023!**
- **Call AMIDEX Interdisciplinarité :** 3 projects submitted (postdocs) – All 3 selected in the end! ☺

PI	Title	Labs	Status	Requested
Aoife Bharucha	Low@LHC - Low mass resonances at the LHC	CPT, CPPM; L2C, LUPM	OK	2-yr Postdoc + TBD
Damien Dornic	NEXCOS - NEutrinos and X-ray follow-up for Cosmic-ray Source studies	CPPM, LAM	OK	2-yr Postdoc + TBD
Eric Jullo	DC2DM - Direct and Cosmological characterization of dark matter	LAM, CPPM	OK	2-yr Postdoc + TBD

## Some IPhU Actions diversification of funding (cont'd)

- **Other Calls** (Région, CNRS, ANR, CIVIS3i)
  - 2 projects co-funded by Région SUD - **selected**
    - ELIXIR - robotic telescope @OHP for follow-up for multi-messenger astronomy and for NEOs (near Earth objects)
    - radio@OHP
  - Submitted to the French National Research Agency (ANR)
    - 1 project in Particle Physics on BSM Theory+Experiment – **not selected**
  - 2 projects MITI (CNRS) 2022 « Rare Events » - **selected**
  - 1 postdoc project CIVIS3i on HE Astrophysics  
in the framework of the « The CIVIS Alliance Programme for International, Interdisciplinary, Intersectoral Research and Training for Experienced Researchers » – **selected**  
**but results came too late ☹ - postdoc found another place to go in the meantime!**
  
- **Call AMIDEX Recherche « Blanc » 2022**  
deadlines Lol: 17/06/2022 – final application: 15/09/2022  
Selected projects should be announced: Feb 2023  
**Several projects submitted**
  
- **Call A\*MIDEX "International - Recherche & Formation" 2023**  
deadlines Lol: 09/01/23 – final application: 28/02/23  
**Some colleagues were interested...** Please let us know if you submit end of Feb.

- Convention de mise en œuvre de l'IPHU (03/12/20) et avenant (20/09/22)
- Convention attributive 2022-2024 TIGER – TRF pour le parcours FunPhys (11/10/22)  
NB: pas de signature de la Faculté des Sciences
- Convention de versement AMU/AMIDEX → CNRS pour co-financement doctorant AAP#3 IPhU (OK)
- Convention de délégation de gestion CNRS-→ AMU du cofinancement CNES d'un doctorant recruté sur l'AAP#3 de l'IPhU (en cours)
- Convention de versement CNRS -> AMU/AMIDEX pour co-financement du projet Région ELIXIR @OHP (en cours)
- Convention AMU/AMIDEX-CNRS pour Summer Camp à l'OHP (en cours)
- Convention à discuter entre AMU/AMIDEX/TIGER, le CNRS et la Région pour cofinancement d'un radiotélescope @OHP dans le cadre du TRIPS MULTIVERSE (en cours)



# Scientific Production: 59 papers

(published or presented at conferences)  
are associated to IPhU in WoS

Chan, SM et al.	Designer fiat bands: Topology and enhancement +B2:B50f of superconductivity	PHYSICAL REVIEW B	2022
Tay, D et al.	Momentum signatures of site percolation in disordered two-dimensional ferromagnets	PHYSICAL REVIEW B	2022
Bertin-Johannet, B et al.	Microscopic theory of photoassisted electronic transport in normal-metal/BCS-superconductor junctions	PHYSICAL REVIEW B	2022
Popoff, A et al.	Scattering theory of non-equilibrium noise and delta T current fluctuations through a quantum dot	JOURNAL OF PHYSICS-CONDENSED MATTER	2022
Gurkan, ZN et al.	Toward a measurement of the effective gauge field and the Born-Huang potential with atoms in chip traps	EUROPEAN PHYSICAL JOURNAL D	2022
Poulin, V et al.	Dark energy at early times and ACT data: A larger Hubble constant without late-time priors	PHYSICAL REVIEW D	2021
Breton, MA et al.	Impact of lensing magnification on the analysis of galaxy clustering in redshift space	ASTRONOMY & ASTROPHYSICS	2022
Marsot, L	Planar Carrollian dynamics, and the Carroll quantum equation	JOURNAL OF GEOMETRY AND PHYSICS	2022
Pace, F; Schmid, C	Tidal virialization of dark matter haloes with clustering dark energy	JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS	2022
Sarpa, E et al.	Tracing the environmental history of observed galaxies via extended fast action minimization method	MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY	2022
Rosalia, LA et al.	Design of the DDRAGO wide-field imager for the COLIBRI telescope	GROUND-BASED AND AIRBORNE INSTRUMENTATION FOR ASTRONOMY	2022
Elander, D et al.	Holographic models of composite Higgs in the Veneziano limit. Part II. Fermionic sector	JOURNAL OF HIGH ENERGY PHYSICS	2022
Pedrayes-Lopez, MH et al.	Tools and equipment needed for the installation, calibration and maintenance of the instruments and optics for the Colibri Telescope in SPM Observatory	GROUND-BASED AND AIRBORNE TELESCOPES IX	2022
Lugo-Ibarra, EE et al.	Design and structural architectural development of the enclosure of the COLIBRI telescope	GROUND-BASED AND AIRBORNE TELESCOPES IX	2022
Gu, A et al.	GIGA-Lens : Fast Bayesian Inference for Strong Gravitational Lens Modeling	ASTROPHYSICAL JOURNAL	2022
Basa, S et al.	COLIBRI, a wide-field 1.3 m robotic telescope dedicated to the transient sky	GROUND-BASED AND AIRBORNE TELESCOPES IX	2022
Abellan, GF et al.	Improved cosmological constraints on the neutrino mass and lifetime	JOURNAL OF HIGH ENERGY PHYSICS	2022
Borsanyi, S et al.	Leading hadronic contribution to the muon magnetic moment from lattice QCD	NATURE	2021
Bel, J; et al.	Constraining spatial curvature with large-scale structure	JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS	2022
Codur, R; Marinoni, C	Redshift drift in radially inhomogeneous Lemaitre-Tolman-Bondi spacetimes	PHYSICAL REVIEW D	2021
Paviot, R et al.	Angular systematics-free cosmological analysis of galaxy clustering in configuration space	MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY	2022
Gallo, E et al.	Spherically symmetric black holes and affine-null metric formulation of Einstein's equations	PHYSICAL REVIEW D	2021
Andreotti, M et al.	Characterisation of signal-induced noise in Hamamatsu R11265 Multianode Photomultiplier Tubes	JOURNAL OF INSTRUMENTATION	2021

(23)

Query used on Web of Science Core Collection:  
(((OG=(IPhU)) OR FO=(IPhU)) OR FG=(AMX-19-IET-008))

LHCb Collab	Observation of the doubly charmed baryon decay $\Xi^{++}(cc) \rightarrow \Xi^+(c)\pi^+$	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Identification of charm jets at LHCb	JOURNAL OF INSTRUMENTATION	2022
LHCb Collab	Study of the doubly charmed tetraquark $T_{cc^+}$	NATURE COMMUNICATIONS	2022
LHCb Collab	Observation of the Decay $\Lambda_{b0}(0)^- \rightarrow \Lambda_{b0}^+(c) \tau^-(\nu_{\tau})/\bar{\tau}$	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Search for massive long-lived particles decaying semileptonically at root $s=13$ TeV	EUROPEAN PHYSICAL JOURNAL C	2022
LHCb Collab	Observation of the Mass Difference Between Neutral Charm-Meson Eigenstates	PHYSICAL REVIEW LETTERS	2021
LHCb Collab	Measurement of the charm mixing parameter $\gamma(CP)\text{-}\gamma(CP)(K \pi)$ using two-body $D^0$ meson decays	PHYSICAL REVIEW D	2022
LHCb Collab	Angular analysis of $B^0 \rightarrow D^-D_s^+$ with $D_s^+ \rightarrow D_s^+\gamma$ decays	JOURNAL OF HIGH ENERGY PHYSICS	2021
LHCb Collab	Measurement of $\chi(c1)$ (3872) production in proton-proton collisions at root $s=8$ and 13 TeV	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Search for the decay $B^0 \rightarrow \phi \mu^+ \mu^-$	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Evidence for a New Structure in the $J/\psi$ p and $J/\psi(p)$ over-bar Systems in $B\text{-}s(0) \rightarrow J/\psi p(p)$ over-bar Decays	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Observation of Two New Excited $\chi(0)(b)$ States Decaying to $\chi K(0)(b) \text{-} \gamma$	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Observation of a $\Lambda_{b0}(0)(b) \text{-} (\Lambda_{b0})$ over-bar(b)(0) production asymmetry in proton-proton collisions at root $s=7$ and 8 TeV	JOURNAL OF HIGH ENERGY PHYSICS	2021
LHCb Collab	Tests of Lepton Universality Using $B^0 \rightarrow K(S)(0)l^+ l^-$ and $B^+ \rightarrow K^*(+)l^+l^-$ Decays	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Search for the doubly charmed baryon $\Xi^{++}(cc)$ in the $\Xi^{++}(c)\pi^+\pi^+$ final state	JOURNAL OF HIGH ENERGY PHYSICS	2021
LHCb Collab	Updated search for $B\text{-}c^+$ decays to two charm mesons	JOURNAL OF HIGH ENERGY PHYSICS	2021
LHCb Collab	Angular Analysis of $D^0 \rightarrow x \text{ plus } x\text{-}\mu \text{ plus } \mu\text{-}$ and $D^0 \rightarrow K \text{ plus } K\text{-}\mu \text{ plus } \mu\text{-}$ Decays and Search for CP Violation	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Study of $B\text{-}c^+$ decays to charmonia and three light hadrons	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Search for the radiative $\Xi^-(b) \rightarrow \Xi^-\gamma$ decay	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Measurement of the photon polarization in $\Lambda_{b0}(0)(b) \rightarrow \Lambda_{b0} \gamma$ decays	PHYSICAL REVIEW D	2022
LHCb Collab	Measurement of the $B\text{-}s(0) \rightarrow \mu^+\mu^-\gamma$ decay properties and search for the $B^0 \rightarrow \mu^+\mu^-\gamma$ and $B\text{-}s(0) \rightarrow \mu^+\mu^-\gamma$ decays	PHYSICAL REVIEW D	2022
LHCb Collab	Angular analysis of the rare decay $B\text{-}s(0) \rightarrow \phi \mu^+\mu^-$	JOURNAL OF HIGH ENERGY PHYSICS	2021
LHCb Collab	Centrality determination in heavy-ion collisions with the LHCb detector	JOURNAL OF INSTRUMENTATION	2022
LHCb Collab	Branching Fraction Measurements of the Rare $B\text{-}s(0) \rightarrow \phi \mu^+\mu^-$ and $B\text{-}s(0) \rightarrow f(2)'\mu^+\mu^-$ Decays	PHYSICAL REVIEW LETTERS	2021
LHCb Collab	Study of Z Bosons Produced in Association with Charm in the Forward Region	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Constraints on the CKM angle $\gamma$ from $B^{\pm} \rightarrow Dh^{\pm} \gamma$ decays using $D \rightarrow h^{\pm} \pi^{\pm} \pi^0$ final states	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Analysis of Neutral B-Meson Decays into Two Muons	PHYSICAL REVIEW LETTERS	2022
LHCb Collab	Measurement of $J/\psi$ production cross-sections in pp collisions at root $s=5$ TeV	JOURNAL OF HIGH ENERGY PHYSICS	2021
LHCb Collab	Observation of an exotic narrow doubly charmed tetraquark	NATURE PHYSICS	2022
LHCb Collab	$J/\psi$ photoproduction in Pb-Pb peripheral collisions at root $S\text{-}NN=5$ TeV	PHYSICAL REVIEW C	2022
LHCb Collab	Measurement of prompt charged-particle production in pp collisions at root $s=13$ TeV	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Observation of $\Lambda_{b0}(0)(b) \rightarrow D^+(p) \pi^-\pi^0$ and $\Lambda_{b0}(0)(b) \rightarrow D^{*+} p \pi^-\pi^0$ decays	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Observation of the $B^0 \rightarrow (D)$ over-bar $K^0(\pi^+) \pi^0$ and $B\text{-}s(0) \rightarrow (D)$ over-bar $K^0(\pi^+)\pi^+$ decays	PHYSICAL REVIEW D	2022
LHCb Collab	Precision measurement of forward Z boson production in proton-proton collisions at root $s=13$ TeV	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Measurement of the W boson mass	JOURNAL OF HIGH ENERGY PHYSICS	2022
LHCb Collab	Observation of the suppressed $\Lambda_{b0}(0)(b) \rightarrow D\rho K^0$ decay with $D \rightarrow K^+ \pi^0$ and measurement of its CP asymmetry	PHYSICAL REVIEW D	2021

Within the framework of projects and internships funded or co-funded by IPhU, to comply with the ANR requests within the framework of A\*MIDEX:

**For any communication support** (oral, displayed or digital), you should display the logo of IPhU, the logos of AMU and A\*MIDEX and the logo “France 2030”



They are provided in a zip file as an attachment in the indico agenda, or directly [here](#)

**Concerning publications** – to make it easier to identify them

***In the Acknowledgement section***, please add the following sentence:

"This work received support from the French government under the France 2030 investment plan, as part of the Excellence Initiative of Aix-Marseille University - A\*MIDEX (AMX-19-IET-008 - IPhU)."

***In your affiliation***, you can add “IPhU” right after the acronym of your lab

e.g. for a CPT author it should read:

"Aix Marseille Univ, Université de Toulon, CNRS, CPT, IPhU, Marseille, France"

In particular, all **IPhU funded PhD students should use this acknowledgement in their publications.**

**University Academic Council**  
(Conseil Académique) - AMU

**Management Council**  
(Conseil de gestion) - A\*MIDEX

**Stakeholders Steering Committee**  
(Comité de pilotage des tutelles)

**Scientific and Training Advisory Board**

<b>AMU</b>	Stefan ENOCH
<b>CNRS</b>	Lydia ROOS -> Laurent VACAVANT

**Institute Council**

**Members with deciding vote**  
Faculty of Sciences (2 votes), OSU Pythéas (1)  
CPPM (1), CPT (1), LAM (1)

**IPhU Management**

**Board of Directors**  
(RST) Director **Eric Kajfasz**  
Deputy Director for Education **Serge Lazzarini**  
Deputy Director for Research **Stéphane Basa**  
(CdP) Administrative Director **Marie-Thérèse Donel**

**Conseil stratégique en formation  
et recherche / Scientific and  
training advisory board**

**Fabienne Casoli**, President of the Paris-PSL Observatory, Former Deputy Director of the Innovation, Applications and Science Division at CNES.

**Françoise Combes**, "Galaxies and Cosmology" Full Professor at Collège de France, Member of the French Academy of Sciences, Honorary Fellow of the Royal Astronomical Society - UK.

**Eckard Elsen**, Director for Research and Computing at CERN - Switzerland. Professor at Hamburg University - Germany.

**Anne-Isabelle Etievre**, Director of the Institute of research into the fundamental laws of the Universe (Irfu) at CEA, and with University Paris-Saclay.

**Guido Martinelli**, Professor of Theoretical Physics at La Sapienza University Roma - Italy. Member of the CERN Scientific Policy Committee - Switzerland and of the Accademia Nazionale dei Lincei - Italy.

**Teresa Montaruli**, Full Professor at University of Geneva - Switzerland. Chair of the European APPEC Consortium.

**Joseph Silk**, Professor of Physics at Sorbonne University, Homewood Professor of Physics and Astronomy at Johns Hopkins University - USA. Fellow of the Royal Society - UK.

**Christian Stegmann**, Director in charge of Astroparticle Physics at DESY - Germany. Deputy-Chair of the European APPEC Consortium.

- **STAB**

- Convened on March 23<sup>rd</sup>, 2022
- Minutes are available – Conclusions :
  - After an extended programme start-up phase (forced by COVID) IPhU is now ready for a living implementation; first and foremost the three laboratories are now in a position to organise joint teaching programmes that are in earnest attended between the two sites. While virtual meetings have become a common tool the actual bonding experience requires meetings in physical presence.
  - The changing prospects for funding have had detrimental effects. While the now anticipated funding allows only for a reduced engagement in education and PhD positions the IPhU idea of fostering interdisciplinary can only be maintained by co-funding through external sources which are uncertain. IPhU has taken the necessary steps to maximise the overall outcome in education and outreach.
  - IPhU has submitted a proposal for a Junior Professor position in Astrophysics. The STAB wholeheartedly supports this application which is vital for the future visibility. Likewise, IPhU is encouraged to apply elsewhere in novel funding calls emphasising its interdisciplinary capabilities.
  - **The STAB recognises the importance of the IPhU initiative which brings benefits not only in training students at the international level but also fosters research and innovation.**

- **Steering Committee**

- Convened on April 13<sup>th</sup>, 2022

- **Institute Council**

- Convened on Dec 8<sup>th</sup>, 2022
- **Request from the Fresnel "CONCEPT" team to be associated to IPhU.**  
IPhU Management, Board of Research and Institute Council agreed to have the CONCEPT team associated with IPhU, with a possible later transition to full member (with Fresnel integrated into the Institute Council) in a second stage, depending upon actual collaborative work put in place

## Institut Fresnel – activités IPHU



- **Plateforme Photonique**
- **DIFFUSIF**



- **3 équipes**
- **12 permanents**
- **20 doctorants**

### ➤ **Optiques pour le spatial**

- *Centre de référence pour les agences spatiales française et européennes :*
  - *Couches minces optiques*
  - *Tenue au flux laser*
  - *Métrologie extrême des composants optiques de pointe*
  - *Diffusion lumineuse et lumière parasite*

### ➤ **Détection des ondes gravitationnelles**

- *Lumière parasite*
  - *Modélisation*
  - *Métrologie*
  - *Poids de la contamination*
  - *Rétrodiffusion*
  - *Bruit thermique des revêtements...*

## Institut Fresnel – activités IPHU

### ➤ Optiques pour le spatial

- *Travail collaboratif avec le CNES et les acteurs de l'optique pour le spatial depuis plus de 20 ans:*
  - *~20 R&T CNES sur les 10 dernières années*
  - *~ 10 thèses CNES / entreprise*

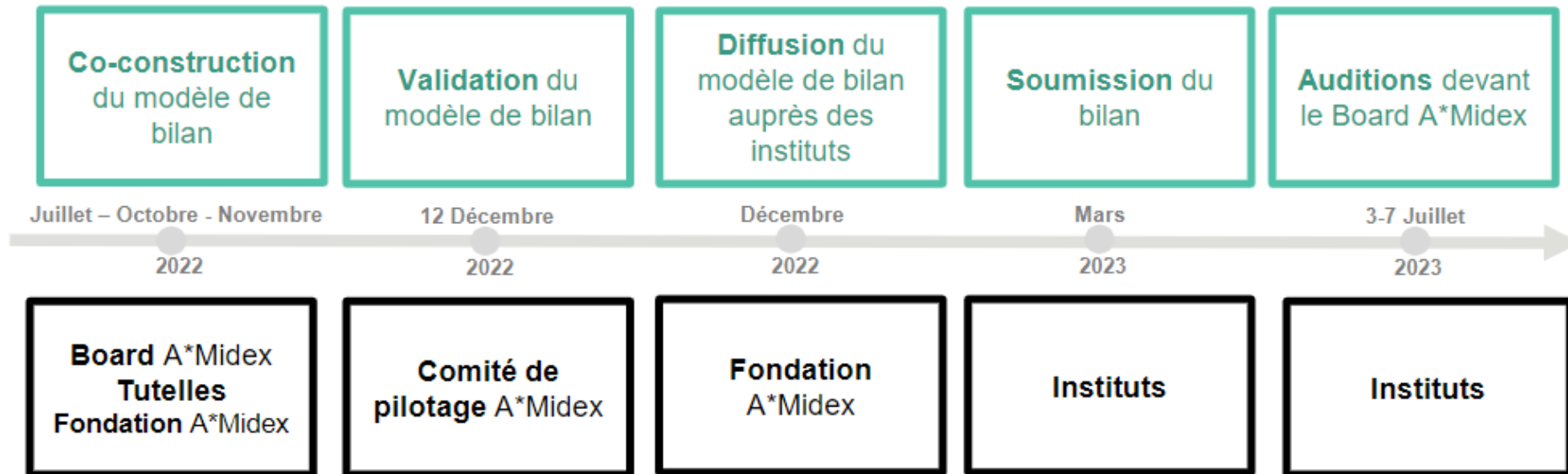


### ➤ Détection des ondes gravitationnelles

- *Membre des consortiums*
  - *LISA (2018)*
  - *Virgo (associé depuis 2020, full member depuis 2022)*
  - *Einstein Telescope (associé depuis 2022)*



- Mid-term review of AMU institutes process will consist of:
  - A written report to be submitted by mid-March 2023 including a qualitative progress report, with indicators common to all institutes and specific indicators for each institute
  - A hearing before the A\*Midex International Strategic Council in early July 2023





# How to improve the operation and impact IPhU?

**Currently, not easy to sustain an efficient scientific animation despite good will of all:**

- IPhU's limited budget does not help, but not the real issue
- The scientific perimeter does not cover the themes of the labs in their totality, which limits the number of persons involved.
- There is already some scientific animation in the labs.

**After several years, it is probably time to take advantage of the Mid-term review to find together a better alchemy:**

- Should we reduce the number of Working Group (4 presently)?
- Should we reduce the number of scientific coordinators, to be more agile? 1 per WG?...
- Should we extend the scientific perimeter by relaxing the « collaborative rule »?...

***Everything is open, so please feel free to make suggestions.***

# How to improve the operation and impact IPhU?

**And more globally, how to evolve our organization to operate more efficiently at the level of:**

- **Scientific animation (in connection with the Working Groups)**
- **Coordinated Response to Call for Proposals (A\*MIdex, Region, ANR, EU,...) and international collaborations (CIVIS,...)**
- **Education (Master and its new « Instrument Scientist » flavor, student projects [including MULTIVERSE], internships, doctoral courses, ...)**
- **Scientific dissemination and outreach**
- **Innovation**
  - **Knowledge: evolution of teaching methods/tools**
  - **Technology: valorization**
- **Management of the IPhU and its Graduate School (Financial, Human Resources, Communication,...)**

**IPhU is a real asset for our community involved in the physics of the Universe. It is an asset for the site as well, and a collaborative adventure in which education, research, innovation and transfer are intertwined. We need to further improve our working together and with our environment to make it a complete success!**



To share information in the Newsletter

Send us an email at: [iphu-contact@univ-amu.fr](mailto:iphu-contact@univ-amu.fr)

**To participate and/or take responsibility in**

- Management
- Communication/Outreach
- Innovation Cell
- On the international front
- Summer/Winter Schools
- ...

**To share ideas about**

- Scientific projects
- Pedagogical projects
- Internships
- Projects for students
- Better tutoring of the GS students
- ...

Send us an email at:

[iphu-board-of-directors@univ-amu.fr](mailto:iphu-board-of-directors@univ-amu.fr)

And let's talk about it 😊

**Thank you very much in advance!**