EUROPEAN COMMISSION
Research Executive Agency
Director

AMENDMENT Reference No AMD-734303-75

Grant Agreement number: 734303 — NEw WindowS on the universe and technological advancements from trilateral EU-US-Japan collaboration (NEWS)

The parties agree to amend the Grant Agreement as follows ('**Amendment**'):

1. Change of Annex 1 (description of the action)

Annex 1 is changed and replaced by the Annex 1 attached to this Amendment.

2 . Changes of Annex 2 (estimated budget)

Annex 2 is changed and replaced by the Annex 2 attached to this Amendment.

All other provisions of the Grant Agreement and its Annexes remain unchanged.

This Amendment **enters into force** on the day of the last signature.

This Amendment **takes effect** on the date on which the amendment enters into force, except where a different date has been agreed by the parties (for one or more changes).

Please inform the other members of the consortium of the Amendment.

SIGNATURES

For the coordinator | For the Agency

Enclosures:

Annex 2
Annex 1

EUROPEAN COMMISSION
Research Executive Agency
Marie Skłodowska-Curie Research and Innovation Staff Exchange

ANNEX 1 (part A)

RISE

NUMBER — 734303 — NEWS

Table of Contents

1.1. The project summary

Project Number [1]	734303	Project Acronym [2]	NEWS

One form per project

General information	
Project title [3]	NEw WindowS on the universe and technological advancements from trilateral EU-US-Japan collaboration
Starting date [4]	01/07/2017
Duration in months [5]	48
Call (part) identifier [6]	H2020-MSCA-RISE-2016
Topic	MSCA-RISE-2016 Research and Innovation Staff Exchange
Fixed EC Keywords	Fundamental interactions and fields, Particle physics, Relativity
Free keywords	Gravitational wave astronomy, gamma-ray astrophysics, x-ray polarimetry, anomalous muon magnetic moment, charged lepton flavor violation, crystal calorimeter, superconducting magnet

Abstract [7]

NEWS promotes the collaboration between European, US and Japanese research institutions in some key areas of fundamental physics. LIGO and Virgo collaborations have built the largest gravitational wave observatories and exploit the propagation of light and spacetime to detect gravitational waves and probe their sources. The first observation of a signal from a merging black hole system has inaugurated the era of gravitational wave astronomy. The Large Area Telescope collaboration operates a gamma-ray telescope onboard the Fermi Gamma Ray Space Telescope mission and has revolutionized our view of the gamma-ray Universe, by increasing the number of known sources, unveiling new classes of gamma-ray emitters, and probing particle acceleration and electromagnetic emission in space with unprecedented detail. Fermi is the reference all-sky gamma-ray monitor for the follow-up searches for electromagnetic counterparts of gravitational wave sources. The multimessenger astronomical observations will soon be enriched by X-ray polarization detectors. New-generation space telescopes will measure the polarization of X-rays from the cosmic sources and probe the laws of physics under extreme conditions of gravitational and electromagnetic fields. A complementary approach to probe the Universe is provided by particle accelerators built in laboratories. FNAL will provide the cleanest probes for physics beyond the Standard Model of particle physics. The Muon (g-2) experiment will measure the muon anomalous magnetic moment with unprecedented precision. Mu2e will search for the neutrinoless coherent muon conversion to an electron in the Coulomb field of a nucleus, which would be the unambiguous evidence of new, unknown, physics. These endeavors require innovative detectors and cutting-edge technologies that NEWS will develop to open new “windows” in fundamental physics.

1.2. List of Beneficiaries

Project Number [1]	734303	Project Acronym [2]	NEWS

List of Beneficiaries

No	Name	Short name	Country	Project entry date[8]	Project exit date
1	ISTITUTO NAZIONALE DI FISICA NUCLEARE	INFN	Italy		
2	HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF EV	HZDR	Germany		
3	Prisma Electronics ABEE	Prisma	Greece		
4	POLITECNICO DI MILANO	POLIMI	Italy		
5	CLEVER OPERATION	CLEVER	France		
6	UNIVERSITA DEGLI STUDI DI GENOVA	UNIGE	Italy		
7	UNIVERSITA DI PISA	UNIPI	Italy		
8	STOCKHOLMS UNIVERSITET	OCK	Sweden		
9	KUNGLIGA TEKNISKA HOEGSKOLAN	KTH	Sweden		
10	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	CNRS	France		
11	UNIVERSITA DEGLI STUDI DI PERUGIA	UNIPG	Italy		
12	UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA	UNIRO	Italy		
13	IMPEX HIGHTECH GMBH	Impex	Germany		
14	EUROPEAN GRAVITATIONAL OBSERVATORY(EGO) (OSSERVATORIO GRAVITAZIO NALEEUROPEO)	EGO	Italy		
15	UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II	UNINA	Italy		
23	HOGSKOLAN DALARNA	HOG	Sweden	01/12/2017	

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number[9]	WP Title	Lead beneficiary[10]	Start month[12]	End month[13]
WP1	Ethics requirements	1 - INFN	1	48
WP2	Gravitational Wave Physics	1 - INFN	1	48
WP3	Gravitational Wave Detectors	11 - UNIPG	1	48
WP4	Fermi-LAT Data Analysis	1 - INFN	1	48
WP5	X-ray Polarimetry	7 - UNIPI	1	48
WP6	FNAL Muon Campus Experiments	1 - INFN	1	48
WP7	Advanced Superconducting Technology for Particle Accelerators	4 - POLIMI	1	48
WP8	Advanced Superconducting Technology for Particle Detectors	6 - UNIGE	1	48
WP9	Dissemination and Outreach	11 - UNIPG	1	48
WP10	Transfer of Knowledge	15 - UNINA	1	48
WP11	Management	1 - INFN	1	48

1.3.2. WT2 list of deliverables

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	NEC - Requirement No. 1	WP1	1 - INFN	Ethics	Confidential, only for members of the consortium (including the Commission Services)	6
D2.1	Roadmap for third generation detectors	WP2	1 - INFN	Report	Public	36
D2.2	Gravitational Wave Event Localization Code	WP2	1 - INFN	Report	Public	24
D3.1	Design of cryogenic seismic filter	WP3	12 - UNIRO	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D3.2	Specification for a Tiltmeter	WP3	15 - UNINA	Report	Confidential, only for members of the consortium (including the Commission Services)	24
D4.1	Analysis Package for LAT 4th Catalog	WP4	21 - STANFORD	Other	Confidential, only for members of the consortium (including the Commission Services)	24
D4.2	Automatic pipeline for gamma-ray follow-up of gravitational wave triggers	WP4	7 - UNIPI	Report	Public	48
D4.3	Fermi Data Legacy Archive	WP4	1 - INFN	Report	Public	48
D5.1	Design Report of a Space Grade GPD and Associated Data Acquisition System	WP5	1 - INFN	Report	Public	36
D5.2	Simulation and Science Analysis Framework for X-Ray Polarimetry	WP5	7 - UNIPI	Report	Public	48
D6.1	Measurement of Muon Anomalous Magnetic Moment at Muon (g-2)	WP6	1 - INFN	Report	Public	36
D6.2	Mu2e Simulation and Reconstruction Code	WP6	7 - UNIPI	Other	Confidential, only for members of the consortium	36

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
					(including the Commission Services)	
D6.3	Construction of the CsI Crystal Calorimeter for Mu2e and Simulation and Design of upgraded BaF2 Crystal Calorimeter for Mu2e-II	WP6	1 - INFN	Report	Public	48
D7.1	16 Tesla Dipole Designed	WP7	1 - INFN	Report	Public	24
D7.2	Nb3Sn Deposition Technique Optimised on Niobium and Copper	WP7	4 - POLIMI	Report	Public	42
D8.1	Single Photon Detector at 100 GHz Study	WP8	6 - UNIGE	Report	Public	42
D8.2	Data from CMB Telescope of the Antenna Coupled TES Bolometer	WP8	6 - UNIGE	Report	Public	48
D9.1	Summer Students at US Laboratories	WP9	7 - UNIPI	Other	Public	12
D9.2	Workshop Day/Open Day	WP9	1 - INFN	Other	Public	9
D10.1	Trainings	WP10	15 - UNINA	Report	Confidential, only for members of the consortium (including the Commission Services)	9
D11.1	Kick-Off Meeting	WP11	1 - INFN	Other	Confidential, only for members of the consortium (including the Commission Services)	1
D11.2	General Meetings	WP11	1 - INFN	Other	Confidential, only for members of the consortium (including the Commission Services)	9
D11.3	NEWS web site	WP11	7 - UNIPI	Websites, patents filling, etc.	Public	5
D11.4	First Progress Report	WP11	1 - INFN	Report	Confidential, only for members of the consortium (including the	12

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
					Commission Services)	
D11.5	Second Progress Report	WP11	1 - INFN	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D11.6	Mid-Term Meeting	WP11	1 - INFN	Other	Public	18

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	Lead beneficiary [10]	1 - INFN
Work package title	Ethics requirements		
Start month	1	End month	48

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP1 - Ethics requirements [Months: 1-48]
INFN
This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	NEC - Requirement No. 1	1 - INFN	Ethics	Confidential, only for members of the consortium (including the Commission Services)	6

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D1.1 : NEC - Requirement No. 1 [6]

6.3. The applicant must provide details on the material which will be imported to/exported from EU and provide the adequate authorisations.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP2	Lead beneficiary [10]	1 - INFN
Work package title	Gravitational Wave Physics		
Start month	1	End month	48

Objectives

O2.1: Establish a network for searches of electromagnetic counterparts to Gravitational Waves.
O2.2: Reduce the localization latency for gravitational wave events with electromagnetic counterparts.
O2.3: Develop a collaboration network for third generation detectors.
O2.4: Collaborate with LIGO on digital preservation of gravitational wave data.

Description of work and role of partners

WP2 - Gravitational Wave Physics [Months: 1-48]
INFN
T2.1: Optimization of localization strategy for gravitational wave events with electromagnetic counterpart (INFN,UNINA, UNIPI, UNIRO,CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). The multimessenger approach requires to know with a very low latency the localization of a gravitational wave event, if an electromagnetic follow up is required. The team will investigate about two different approaches to the improvement of the existing code: the design of smarter algorithms, and the “brute force” optimization of the existing one ported to an high performance (parallel or GPU) architecture.
T2.2: Definition of the evolution of the advanced detectors toward the 3rd generation (INFN,UNIPI, UNIRO,UNINA,UNIPG,CNRS,CALTECH,NINS-NAOJ,ICRR,MIT, UMI, HKU). The team will participate to the discussion inside the LIGO/Virgo collaboration aimed to define the path of organizative and R/D activities needed to move toward the 3rd generation era.
T2.3: Definition of the characteristics of a 3G observatory (INFN,UNIRO,UNINA,UNIPG,CNRS,CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). The team will participate to the design and the definition of third generation detectors. This will include the definition of the science potential of an hybrid network composed by Advanced 2nd generation and 3rd generation detectors.
T2.4: Preparation of a Virgo digital preservation structure (CNRS,INFN,CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). Digital preservation is essential for ensuring long-term data access of landmark data such that gravitational wave observations. Open science (provide a wide dissemination of scientific data) is a good practice that allows maximum return on investment, possibly leading to unexpected discoveries. With the LIGO Open Science Center www.losc.ligo.org, the Caltech group has developed an important know-how in this domain. We propose to tie close relationships with this group, collaborate on a similar project for Virgo and develop further the ideas to match the upcoming challenges for the newly born gravitational wave astronomy.

Participation per Partner

Partner number and short name [10]
1 - INFN
7 - UNIPI
10 - CNRS
11 - UNIPG
12 - UNIRO
15 - UNINA
17 - NINS-NAOJ
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP
24 - ICRR
25 - UMI
26 - MIT

Partner number and short name [10]
30 - HKU

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D2.1	Roadmap for third generation detectors	1 - INFN	Report	Public	36
D2.2	Gravitational Wave Event Localization Code	1 - INFN	Report	Public	24

Description of deliverables

The deliverables are relative to the extraction of maximum physics information from the gravitational wave events, also pursuing an electromagnetic follow up in a multimessenger approach, and to the defintion of the evolution of future advanced gravitational wave detectors.

D2.1 : Roadmap for third generation detectors [36]

A path of organizative and R/D activities needed to move toward the third generation era of gravitational wave detectors will be defined.

D2.2 : Gravitational Wave Event Localization Code [24]

The software package used to localize gravitational wave events will be developed. This is crucial in a multimessenger approach, since a very low latency localization of a GW event is necessary to provide an electromagnetic follow.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Roadmap for Third Generation Gravitational Wave Detectors	1 - INFN	36	Organization of a Workshop/ Symposium to discuss the synergies between the Einstein Telescope and LIGO collaboration, for common infrastructures.
MS2	Gravitational Wave Event Localisation Code	1 - INFN	24	The multimessenger approach requires to know with a very low latency the localization of a GW event, if an electromagnetic follow up is required.

Work package number [9]	WP3	Lead beneficiary [10]	11 - UNIPG
Work package title	Gravitational Wave Detectors		
Start month	1	**End month**	48

Objectives

O3.1: Test the frequency dependent squeezing on a full-scale prototype, before using this technique in the Advanced detectors.
O3.2: Develop a subtraction scheme for non stationary gravity gradient noise.
O3.3: Study of silica and sapphire materials for third generation monolithic suspensions.
O3.4: Study of payload and seismic suspension systems for cryogenic facilities
O3.5: Implementation of advanced control techniques for second and third generation gravitational wave detectors

Description of work and role of partners

WP3 - Gravitational Wave Detectors [Months: 1-48]
UNIPG
T3.1: Definition of an interface between a SAS and the cryogenic mirror payload (INFN,UNIPI,UNIRO,UNINA,UNIPG,Impex,CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). A cryogenic environment poses specific problems for a seismic attenuation system and a mirror payload. The heath transferred by the laser beam of the interferometer must be removed efficiently, without injecting in the system additional noise. This requires the design of an intermediate mechanical stage in the attenuation chain. Thermal gradients specification will be carefully defined and characterized. Fibers or strips used for suspending mirrors will be designed as a function of the requirements for noise minimisation and heat extraction.
T3.2: Study of a tiltmeter that, added to accelerometer, completes the gravity gradient noise evaluation (INFN, UNIPI, UNINA,CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). The subtraction of gravity gradient noise requires a network of auxiliary seismic sensors that are used to monitor the environment in a quantitative way. The most direct solution is an accelerometer. The basic figure of merit of an auxiliary sensor is its degree of coherence with the gravity gradient noise to be subtracted, and a tiltmeter can be a better option. Its properties will be studied in detail a prototype will be developed and tested.
T3.3: Preparation of quantum noise reduction using squeezed states of light (INFN, UNIPI,UNINA,CNRS, CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). Quantum squeezing is the most promising technique to decrease the quantum noise in future gravitational-wave interferometric detectors. Filter cavities are needed to decrease the quantum noise in all the detector bandwidth. APC has a collaboration with the National Astronomical Observatory of Japan to develop a 300-m filter cavity and test the frequency dependent squeezing on a full-scale prototype, before using this technique in the Advanced detectors (Advanced LIGO, Advanced Virgo and KAGRA).
T3.4: Systematic study of the resistance to stress and fatigue of silica and sapphire fibers (INFN,UNIPI,UNIPG,Impex,CALTECH,NINS-NAOJ,ICRR, MIT, UMI, HKU). Monolithic suspensions using silica or sapphire fibers will play a key role in thermal noise reduction for Advanced and third generation gravitational wave detectors. An important issue is the understanding of the robustness of this kind of system, as a failure can be a serious problem. There are experiences about this both in LIGO and Virgo, however the problem is still poorly understood. The team will start a systematic study about this, in collaboration with the LIGO and Kagra partners.
T3.5: Test of advanced control techniques for gravitational interferometer (INFN,UNIPI,CALTECH,NINS-NAOJ,ICRR,MIT,UMI, HKU). The participating will extend the use of adaptive optimal regulators, presently demonstrated for three degree of freedom of the Virgo inverted pendulum, to six degrees of freedom. This would lower the feed-back design margins with respect to a traditional approach.
T3.6: Application of advanced filtering techniques to the problem of the subtraction of gravity gradient noise (INFN,UNIPI,EGO,CALTECH,NINS-NAOJ,ICRR, MIT,UMI, HKU). Noise cancellation filters will be developed to overcome performance limitations from non-stationarity of the seismic noise. The filters will be defined with extensive use of numerical simulation and in-situ measurements.

Participation per Partner

Partner number and short name [10]
1 - INFN

Partner number and short name [10]
7 - UNIPI
10 - CNRS
11 - UNIPG
12 - UNIRO
13 - Impex
14 - EGO
15 - UNINA
17 - NINS-NAOJ
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP
24 - ICRR
25 - UMI
26 - MIT
30 - HKU

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	Design of cryogenic seismic filter	12 - UNIRO	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D3.2	Specification for a Tiltmeter	15 - UNINA	Report	Confidential, only for members of the consortium (including the Commission Services)	24

Description of deliverables

The deliverables are related to the hardware developments for future gravitation wave detectors.

D3.1 : Design of cryogenic seismic filter [36]

An intermediate mechanical stage in the attenuation chain will be designed. Thermal gradients specifications will be defined and characterized. Fiber or strips used for suspending mirrors will be designed as a function of the requirements for noise minimisation and heat extraction.

D3.2 : Specification for a Tiltmeter [24]

A tiltmeter coupled to an accelerometer allows to estimate the gravity gradient noise. We will study the characteristics of the tiltmeter and a prototype will be developed and tested.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	Design of a Cryogenic Seismic Filter	12 - UNIRO	36	Production of a complete design of the suspension.
MS4	Specification for a Tiltmeter	15 - UNINA	24	Production of a specification datasheet of the Tiltmeter.

Work package number [9]	WP4	**Lead beneficiary [10]**	1 - INFN
Work package title	Fermi-LAT Data Analysis		
Start month	1	**End month**	48

Objectives

O4.1: Compile the 4th Fermi LAT gamma-ray source catalog (4FGL, 4th Fermi Gamma-ray source List). O3.2: Constrain WIMP Dark Matter through indirect searches in gamma rays.
O4.3: Initiate astronomy with Cosmic Ray Electrons.
O4.4: Establish a network for searches of ElectroMagnetic (EM) counterparts to Gravitational Waves (GW). O3.5: Define and implement a legacy data archive of the Fermi mission.

Description of work and role of partners

WP4 - Fermi-LAT Data Analysis [Months: 1-48]
INFN
T4.1: Refine software tools, analyze the 96 months dataset and publish the 4FGL catalog (INFN, UNIPI, KIPAC,OCK,KTH,ICRR,HOG,HIU,NASA,TAM, HKU). After 8 years of operations, and three catalogs published with 1, 2 and 4 years of data respectively, the team will work on the development of the most complete catalog of stationary gamma ray emitters detected by Fermi. All analysis components will be updated. We will use the new telescope event analysis package, published in June 2018 and indicated as Pass 8, to extend analysis to ~1 TeV with increased angular and energy resolution, after studying residual hadronic backgrounds and systematics associated to the telescope performance description through Instrument Response Functions. We will systematically revisit algorithms for finding source seeds and for cross-matching 4FGL with catalogs at other wavelengths to define source association. We will derive a new model of the Diffuse Galactic Emission (DGE) component of the gamma ray sky, based on template fits to Pass 8 data and new multi-wavelength data for modeling the different spectral components of the total gamma-ray emission.
T4.2: Constrain the properties phase space of Dark Matter candidates (INFN, UNIPI,OKC, KTH,HOG,ICRR,KIPAC,HIU,NASA,TAM, HKU). The team is actively engaged in searching for gamma-ray emission from targets in the sky known to host large concentration of Dark Matter. So far only upper limits on such emissions were found from LAT data, and converted to the most constraining limits on WIMP annihilation cross sections in the ~10 to ~100 GeV mass range. The team is developing a common analysis framework to apply to all known and newly discovered targets, such as dwarf spheroidal galaxies expected to be found in the coming years from optical surveys. The aim of the work is to distribute the analysis code publicly. This will ensure consistency, a complete characterization of systematic uncertainties provided directly by LAT team members, and a framework to compare limits from different searches. Prospects for the next four years indicate the possibility to exclude canonical WIMPs up to 400 GeV in case of no detection of gamma rays. The team will also work on innovative search techniques, like dissection of gamma-ray anisotropies into contributions from different classes of gamma-ray sources, including Dark Matter satellites or Galactic halo.
T4.3: Perform searches of local sources of Cosmic Ray Electron (CRE) through spectral and anisotropy studies (INFN, UNIPI, KIPAC, OCK, KTH, ICRR, HOG, HIU, NASA,TAM, HKU). The team will extend the range of spectral measurement of the CRE population to TeV energies, to find evidence of the maximum energy at which CREs are accelerated at sources. The unparalleled statistics of million events will allow studies of anisotropy in the arrival direction of CRE events, to constrain existence of a loca population of CRE emitters. These results have the potential to effectively start the era of astronomy with charged cosmic rays.
T4.4: Extend real time searches and alerts for gamma-ray transients to GW triggers (INFN, UNIPI, KIPAC, ICRR, OCK, KTH, HOG, HIU, NASA, TAM, HKU). The LAT has recorded hundreds of Gamma-Ray Bursts and the team in this proposal is connected to the LIGO-Virgo teams to serve real time searches in response to GW triggers. Localization of potential counterparts in gamma-rays will help constraining the position of the GW event and will be distributed rapidly through the Gamma-Ray bursts Coordination Network (GCN) network.
T4.5: Define software tools for data archival and analysis to build the Fermi legacy archive (INFN, UNIPI, KIPAC, OCK, KTH, HOG, ICRR, HIU, NASA, TAM, HKU). Identification and virtualization of the supported platform for data storage and analysis; Development of a database of virtual machines and database tools for data extraction and analysis.

Participation per Partner

Partner number and short name [10]
1 - INFN
7 - UNIPI
8 - OCK
9 - KTH
18 - NASA
21 - STANFORD
23 - HOG
24 - ICRR
28 - HIU
29 - TAM
30 - HKU

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.1	Analysis Package for LAT 4th Catalog	21 - STANFORD	Other	Confidential, only for members of the consortium (including the Commission Services)	24
D4.2	Automatic pipeline for gamma-ray follow-up of gravitational wave triggers	7 - UNIPI	Report	Public	48
D4.3	Fermi Data Legacy Archive	1 - INFN	Report	Public	48

Description of deliverables

The deliverables are relative to the several software developments necessary to extract the most competitive results from the Fermi-LAT data, also in connection with gravitational wave observations, and to build the Fermi-LAT legacy archive.

D4.1 : Analysis Package for LAT 4th Catalog [24]

Refine existing and develop new software tools to analyze the 8 years Fermi-LAT dataset to publish the 4FGL catalog.

D4.2 : Automatic pipeline for gamma-ray follow-up of gravitational wave triggers [48]

Connect to the LIGO-Virgo to serve real time searches in response to gravitational wave triggers and localize potential counterparts in gamma-rays to constrain the position of the gravitational wave event.

D4.3 : Fermi Data Legacy Archive [48]

Develop the database of virtual machines and the database tools to allow fast and simple data extraction and analysis.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS5	Analysis Package for LAT 4th Catalog	21 - STANFORD	24	The new analysis package for LAT 4th catalog will be thoroughly tested, refined and used to analyse 8 years of telescope data.

Work package number [9]	WP5	Lead beneficiary [10]	7 - UNIPI
Work package title	X-ray Polarimetry		
Start month	1	**End month**	48

Objectives

O5.1: Build a fully functional lab prototype of a Gas Pixel Detector (GPD) for the focal plane of an X-ray polarimetric mission.
O5.2: Study and design the basic components of a space-grade data acquisition system for the GPD.
O5.3: Optimize event reconstruction and classification.
O5.4: Implement an observation-simulation framework for the X-ray polarimetry explorers.
O5.5: Define and implement science analysis tools for the X-ray polarimetry explorers.

Description of work and role of partners

WP5 - X-ray Polarimetry [Months: 1-48]
UNIPI
T5.1: Build a lab-grade prototype of a GPD polarimeter (UNIPI, INFN). The INFN-UNIPI group has pioneered the development of efficient photoelectric X-ray polarimetry, introducing a new detector concept (the Gas Pixel Detector, or GPD) and effectively overcoming the limitations of the traditional experimental techniques. Our concept is based on the imaging and reconstruction, through a finely segmented readout anode, of the direction of emission of the photoelectrons produced following to the X-ray absorption in gas. Over the last 15 years, the group has developed three generations of readout ASICs, the newest of which is ready to be flown at the focus of an X-ray optics. INFN has a long-standing expertise in R&D and production of X-ray detectors, particularly for space applications. INFN will build a sealed GPD assembly, where the readout ASIC, is integrated with a Gas Electron Multiplier (GEM, providing the gas gain), the components of the gas cell and the entrance window. The detector will be thoroughly tested and characterized at INFN and will serve as a base for the design and the definition of the assembly procedure of the future flight models.
T5.2: Design of the basic components of a space-grade data acquisition system for the GPD (UNIPI, INFN, Prisma, Clever). INFN has already developed a lab-grade readout and data acquisition system for the aforementioned charge-collecting anode ASIC. In collaboration with Prisma and Clever we shall carry out a design study for the implementation of a space-grade system, including the definition of a top-level architecture compliant to the relevant standards and the identification of suitable space-qualified components.
T5.3: Optimization of the event reconstruction and classification (UNIPI, INFN, KIPAC, NASA). The polarimetric sensitivity of the GPD stems from the capability of imaging and reconstructing the direction of emission of the photoelectron tracks in the gas absorption cell. With a pixel multiplicity O(100) at a few keV, the readout ASIC allows for a significant amount of topological information to be used in the reconstruction and classification stages, and effectively exploiting this information is pivotal to maximizing the polarimetric and imaging properties of the detector. The INFN-UNIPI and the SLAC groups have successfully collaborated in the past on similar pattern-recognition problems in the context of the Fermi-LAT event-level analysis.
T5.4: Implementation of an observation-simulation framework (UNIPI, INFN, KIPAC, NASA). The teams involved will develop a fully-fledged observation-simulation framework that, given the instrument response functions of a telescope and a specific source model (including spectral, temporal, morphological and polarimetric properties) will produce a simulated "event list" effectively equivalent to a real observation. The SLAC team has been largely responsible for the development of a similar framework, successfully used for the Large Area Telescope onboard the Fermi mission, and will provide crucial expertise for this part of the proposal. Once completed, the observation/simulation framework will be a crucial asset for optimization and sensitivity studies for possible future polarimetric mission, as well as for the development of the related science analysis algorithms and tools (see also T4.5).
T5.5: Definition and initial implementation of the science analysis tools (UNIPI, INFN, KIPAC, KTH, OCK, HOG,NASAL,HIU). The teams involved in this part of the proposal will share expertise and collaborate on the definition of the science analysis tools for a future X-ray polarimetric mission. While the vast majority of the analysis tools developed and traditionally used by the X-ray community are geared towards spectroscopy, timing and imaging, the part that is specific to polarization needs be designed and implemented essentially from scratch. We shall prototype and test on simulations the relevant science analysis algorithms relevant for energy-, time- and space-resolved X-ray polarimetry.

Participation per Partner

Partner number and short name [10]
1 - INFN
3 - Prisma
5 - CLEVER
7 - UNIPI
8 - OCK
9 - KTH
18 - NASA
21 - STANFORD
23 - HOG
28 - HIU

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D5.1	Design Report of a Space Grade GPD and Associated Data Acquisition System	1 - INFN	Report	Public	36
D5.2	Simulation and Science Analysis Framework for X-Ray Polarimetry	7 - UNIPI	Report	Public	48

Description of deliverables

Description

D5.1 : Design Report of a Space Grade GPD and Associated Data Acquisition System [36]

The GPD prototype will be thoroughly tested and characterized and will serve as a base for the design and definition of a space-grade assembly procedure for future flight models. A space-grade data acquisition system will also be designed.

D5.2 : Simulation and Science Analysis Framework for X-Ray Polarimetry [48]

A fully-fledged observation-simulation framework will produce a simulated event-list equivalent to real observations. This will allow to perform optimization and sensitivity studies of a polarimetric mission, and the related science analysis algorithms and tools.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	Gas Pixel Detector Prototype	1 - INFN	24	The Gas Pixel Detector prototype will be built, thoroughly tested and characterized and will serve as a base for the design and definition of the assembly

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				procedure of the future flight models.

Work package number [9]	WP6	Lead beneficiary [10]	1 - INFN
Work package title	FNAL Muon Campus Experiments		
Start month	1	**End month**	48

Objectives

O6.1: Develop analysis tools and computing infrastructure to participate in the Muon (g-2) experiment data analysis.
O6.2: Perform precision measurement of the anomalous muon magnetic moment with the full Muon (g-2) experiment collected data sample.
O6.3: Develop neutron transport simulation code and computing infrastructure for the Mu2e experiment.
O6.4: Develop GEANT4 simulation of the upgraded radiation-hard BaF2 crystal calorimeter for the Mu2e-II experiment.
O6.5: Build the CsI crystal calorimeter for Mu2e and design the upgraded BaF2 crystal calorimeter for the Mu2e-II. Test of a BaF2 crystal matrix on test beam.

Description of work and role of partners

WP6 - FNAL Muon Campus Experiments [Months: 1-48]
INFN
T6.1: Optimize the online and offline laser-based calibration procedures of the Muon (g-2) calorimeter (INFN, UNIPI,FNAL). The focus will be on the design of the rate of calibration pulses, rate and length of calibration runs, number of stored calibration parameters, all optimized in a automated procedure to give the exact quantities necessary to constrain the systematic errors on ωa at the level of 0.02 ppm.
T6.2: Foster the integration of the Muon (g-2) simulation production with the workflow management infrastructure supported by the FNAL Scientific Computing Division (INFN, UNIPI,FNAL). Take leading role in the simulation of large-scale samples of the order of 1011 muons from injection into the storage ring to fully reconstructed physics quantities for systematics estimate.
T6.3: Perform the blind analysis to measure the muon spin precession frequency ωa in collaboration with the US groups (INFN,UNIPI, FNAL). Measure the muon spin precession frequency ωa by recording the arrival times and energies of the decay positrons with energy above 1.8 GeV in the suite of 24 electromagnetic calorimeters. Take a leading role in the analysis for the ωa measurement and perform a detailed study of the main expected systematics, including calorimeter gain changes and energy-scale stability, estimate of the fractions of muons that escape the storage ring before they decay, pileup, coherent betratron oscillations, and electric field corrections. Measure the muon anomalous magnetic moment from the measurement of ωa, and of the magnetic field.
T6.4: Develop the Mu2e detector simulation (INFN, UNIPI, HZDR, FNAL). Also compare FLUKA simulation, based on a multigroup approach, and MCNP6 simulation, based on a continuous-energy approach, to Mu2e codes based on GEANT to estimate backgrounds and improve Mu2e detector shielding. Integrate simulation code with the common Mu2e software infrastructure.
T6.5: Develop FNAL computing infrastructure (INFN, UNIPI, FNAL, Clever). Integrate Mu2e data processing framework within the common FNAL data handling infrastructure. Estimate Mu2e sensitivity.
T6.6: Develop GEANT4 simulation of the Csi crystal calorimeter for Mu2e and of the upgraded radiation-hard BaF2 crystal calorimeter for the Mu2e-II (INFN, UNIPI, HZDR, FNAL). Optimize detector geometry and crystal size, estimate cluster time, energy and position resolution; estimate impact of upgraded calorimeter on Mu2e-II physics reach.
T6.7: Build the CsI crystal calorimeter for Mu2e and design upgraded radiation-hard BaF2 crystal calorimeter for the Mu2e-II (INFN, UNIPI, HZDR, FNAL, Prisma, Clever). This will imply developing and characterizing a solar blind UV-extended SiPM, characterize SiPM radiation hardness, design SiPM readout electronics. Measure performance of a BaF2 crystal matrix with complete readout on test beam.

Participation per Partner

Partner number and short name [10]
1 - INFN
2 - HZDR
3 - Prisma
5 - CLEVER

Partner number and short name [10]
7 - UNIPI
19 - FRA

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D6.1	Measurement of Muon Anomalous Magnetic Moment at Muon (g-2)	1 - INFN	Report	Public	36
D6.2	Mu2e Simulation and Reconstruction Code	7 - UNIPI	Other	Confidential, only for members of the consortium (including the Commission Services)	36
D6.3	Construction of the CsI Crystal Calorimeter for Mu2e and Simulation and Design of upgraded BaF2 Crystal Calorimeter for Mu2e-II	1 - INFN	Report	Public	48

Description of deliverables

The deliverables are relative to physics results achieved by the Muon (g-2) collaboration from the analysis of the data collected in 2018-2019 and to software development for Mu2e and Mu2e-II.

D6.1 : Measurement of Muon Anomalous Magnetic Moment at Muon (g-2) [36]

The muon anomalous magnetic moment will be measured using the data collected by the FNAL Muon (g-2) experiment in 2018-2019. The measurement will be presented at International Conferences and published in a peer reviewed journal.

D6.2 : Mu2e Simulation and Reconstruction Code [36]

A detailed simulation of the Mu2e detectors and understanding of the neutron background level is necessary in Mu2e to make sure that detector shielding is properly designed and constructed. This requires the development of a detailed simulation with the most adjourned simulation packages.

D6.3 : Construction of the CsI Crystal Calorimeter for Mu2e and Simulation and Design of upgraded BaF2 Crystal Calorimeter for Mu2e-II [48]

A CsI crystal calorimeter will be constructed for Mu2e and an upgraded radiation hard calorimeter based on BaF2 crystals and UV-extended SiPM will be studied for the upgraded Mu2e-II. A Geant4 simulation packaged will be developed to estimate the detector physics performance and optimize detector design.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS7	Measurement of the Muon Anomalous Magnetic Moment at Muon (g-2)	1 - INFN	36	The measurement of the muon anomalous magnetic moment will be presented and international Conferences

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				and published by the Muon (g-2) collaboration on a peer reviewed journal.
MS8	Simulation and Design of Upgraded BaF2 Crystal Calorimeter for Mu2e-II	1 - INFN	48	The simulation code of the BaF2 crystal calorimeter will be inserted in the official Mu2e-II simulation code and a preliminary design of the detector will be presented to the Mu2e-II collaboration.

Work package number [9]	WP7	Lead beneficiary [10]	4 - POLIMI
Work package title	Advanced Superconducting Technology for Particle Accelerators		
Start month	1	End month	48

Objectives

O7.1: Construct and install the modules for the Mu2e Transport Solenoid
O7.2: Use advanced superconducting technologies for High Field Magnets for present and future particle accelerators to design 16 T superconducting dipole made of Nb3Sn.
O7.3: Optimize state-of-the-art electrochemical techniques (US patent pending) for Nb3Sn thin layer deposition on superconducting Nb and/or conventional Cu.
O7.4: Apply optimized techniques in O6.3 to: a) superconducting Nb3Sn wires for High Field Magnets to improve critical current density and high-field performance, b) superconducting radio frequency cavities for accelerators, to increase accelerating fields and reduce cost, and for light sources, to reduce cooling requirements.

Description of work and role of partners

WP7 - Advanced Superconducting Technology for Particle Accelerators [Months: 1-48]
POLIMI
T7.1: Build and install the superconducting modules of the Mu2e Transport Solenoid (INFN, FNAL). The modules are in construction at the ASG Superconductors in Italy under a FNAL contract, with the active collaboration and supervision of INFN personnel.
T7.2: Use superconducting technologies for high field magnets to design and build a 16 T Nb3Sn accelerator dipole (FNAL, INFN). Based on state-of-the-art superconducting wire and cables, structural materials, cable insulation, curing and impregnation materials, the know-how of which will be transferred from FNAL, INFN will then collaborate with FNAL to design a 16 T dipole. This includes coil design studies, magnetic analysis, design of mechanical structure for the 4-layer coils, and coil stress analysis at the three stages of magnet operation (i.e. at room temperature, after cooling down at the operation temperature of 4 K, and at nominal operation field). INFN will contribute primarily to the mechanical design.
T7.3: Optimize state-of-the-art electrochemical techniques (US patent pending) for Nb3Sn thin layer deposition on Nb and on Cu (POLIMI, FNAL, FRD,TPU, JLAB). Achieve the best uniformity of the deposit across both flat and curved surfaces, purity (elimination of organic additives found in commercial plating baths that could interfere with the superconductivity of the Nb3Sn phase), and improve adhesion of the film prior to thermal treatment (reduction of any oxide film on the Nb surface). Electrical and other parameters include DC conditions, application of pulse-reverse waveforms and their dependence on thickness layer. R&D on deposit uniformity and purity, bath composition and electrical conditions will be performed by POLIMI in collaboration with FRD. Perform thermal treatment at FNAL and FRD. Study and characterize samples at POLIMI and FNAL.
T7.4: Apply optimized deposition techniques to superconducting Nb3Sn wires for High Field Magnets to improve critical current density and performance (POLIMI, FNAL, FRD,TPU, JLAB).
T7.5: Apply optimized deposition techniques to superconducting Nb3Sn radio-frequency cavities (POLIMI, FNAL, FRD,TPU). The goal is to increase accelerating field, reduce cooling requirements and decrease cost. FRD has electrochemical cells that can accommodate small radio-frequency cavities.
T7.6: Apply optimized deposition techniques to superconducting magnetic shields (POLIMI, FNAL, FRD,TPU, JLAB).

Participation per Partner

Partner number and short name [10]
1 - INFN
4 - POLIMI
19 - FRA
20 - Faraday Technology Inc.
31 - TPU
32 - JLAB

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D7.1	16 Tesla Dipole Designed	1 - INFN	Report	Public	24
D7.2	Nb3Sn Deposition Technique Optimised on Niobium and Copper	4 - POLIMI	Report	Public	42

Description of deliverables

The deliverables are related to advancements in the accelerator technology, high field superconducting magnets and electrochemical techniques applied to the fabrication of superconducting wires and radio-frequency cavities.

D7.1 : 16 Tesla Dipole Designed [24]

Verify the design studies, magnetic analysis, mechanical structure design, coil stress analysis at the three stages of magnet operation (i.e. room temperature, after cooling down at the temperature of operation of 4 K, and at nominal magnetic field operation).

D7.2 : Nb3Sn Deposition Technique Optimised on Niobium and Copper [42]

State of the art electrochemical techniques will be optimized to achieve the best uniformity of the deposit across the surface, the best purity and improve the adhesion of the film. Samples will be experimentally characterized.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS9	Mu2e Transport Solenoid Constructed	1 - INFN	20	The superconducting modules will be constructed by the Italian ASG Superconductors with the active collaboration of INFN personnel. The modules will be installed and tested in the FNAL muon beamline.
MS10	Feasibility of Deposition Techniques for Nb3Sn wires/ RF Cavities	19 - FRA	48	Studies will performed to apply the optimized electrochemical techniques to the fabrication of superconducting Nb3Sn wires, to increase the critical current density and the generated magnetic field, and to the fabrication of Nb3Sn radio-frequency cavities, to increase the accelerating field and reduce the cooling requirements.

Work package number [9]	WP8	**Lead beneficiary [10]**	6 - UNIGE
Work package title	Advanced Superconducting Technology for Particle Detectors		
Start month	1	**End month**	48

Objectives

O8.1: Develop the design of antenna coupled superconducting TES bolometers sensitive to the polarization for large area focal plane of microwave telescope at 50-100 mK and very high sensitivity test in the LSPE Balloon cosmology program.
O8.2: Choice of the material and characterization of thermal and transport properties of superconducting material for the detector.
O8.3: Define fabrication processes and tools and provide a TES Bolometer prototype for laboratory qualification test.
O8.4: Integration of demonstrative few channel instrument in CMB telescope and data taking and analysis.
O8.5: Investigation of materials, structures and operating mode of superconducting single photon detector in the 100 GHz band.
O8.6: Fabrication of a prototype of superconducting single photon detector in the 100 GHz band and first operation test.

Description of work and role of partners

WP8 - Advanced Superconducting Technology for Particle Detectors [Months: 1-48]
UNIGE
T8.1: Design and modelling (UNIGE, CALTECH,FNAL,STANFORD,ISU). Design of an antenna coupled bolometer for mm wave multiband with polarization sensitivity. This include the study of the EM coupling in a planar broad band polarization sensitive antenna, a superconducting planar transmission line in the 100-800 GHz band, the filtering in sub-bands and the power dissipation in a small bolometer. The modelling will couple the EM and the Thermal sub systems as a whole.
T8.2: Materials and fabrication processes (UNIGE, CALTECH,FNAL,STANFORD,ISU). Materials are of primary importance for the superconducting high efficiency transmission line and filtering at this frequency band. Absorber and TES must be carefully designed for best performance. After the requirement's definition, material choice or synthesis, characterizations and tests are mandatory.
T8.3: Prototype fabrication and qualification (UNIGE, CALTECH,FNAL,STANFORD,ISU). The prototype of an antenna coupled TES bolometer will be tested in dilution fridge system coupled with microwave generator.
T8.4: Data taking in ground or balloon telescope (UNIGE, CALTECH,FNAL,STANFORD,ISU). We expect to integrate a small prototype in ground telescope (at the site of QUBIC experiment) or in the LSPE Ballon telescope.
T8.5: Single photon detector in the 10-100 GHz (UNIGE, CALTECH,STANFORD,FNAL,ISU). This is a highly innovative investigation that will take advantage of the expertise in developing antenna coupled bolometers, new materials, nanostructuring and very low temperature operations (10 mK or lower). A prototype to be tested with mm-wave EM field is foreseen.

Participation per Partner

Partner number and short name [10]
6 - UNIGE
19 - FRA
21 - STANFORD
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP
27 - ISU

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D8.1	Single Photon Detector at 100 GHz Study	6 - UNIGE	Report	Public	42
D8.2	Data from CMB Telescope of the Antenna Coupled TES Bolometer	6 - UNIGE	Report	Public	48

Description of deliverables

The deliverables are relative to the development of the detector and a data taking campaign to characterize the detector performance. The deliverables require that design, modelling, materials, fabrication processes and prototype fabrication and qualification have been successfully completed.

D8.1 : Single Photon Detector at 100 GHz Study [42]

The feasibility of a single photon detector at 100 GHz will be studied. This will require expertise in new materials, nanostructuring and few mK temperature detector operation.

D8.2 : Data from CMB Telescope of the Antenna Coupled TES Bolometer [48]

A small prototype will be assembled and short campaign of data taking will be performed in a ground or balloon telescope. Detector performance will be characterized.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS11	Cooldown and NEP Measurement of Antenna Coupled Bolometer	6 - UNIGE	30	The prototype of an antenna coupled bolometer will be fabricated and tested with a microwave generator. Characterization will include noise-equivalent power measurements.

Work package number [9]	WP9	**Lead beneficiary** [10]	11 - UNIPG
Work package title	Dissemination and Outreach		
Start month	1	**End month**	48

Objectives

O9.1 Promote the communication between the scientific community and the general public and increase the science awareness

Description of work and role of partners

WP9 - Dissemination and Outreach [Months: 1-48]
UNIPG
T9.1: Workshop day (ALL): In coincidence with the annual general meeting, we will organize a one-day workshop. The target of the seminars and lectures given by the project researchers will be university students in physics, engineering, computing science and materials science, and, possibly, technical high school students at the last year. The laboratories will be open for demonstrations.
T9.2: Open Day (ALL): The project partners already take part in the "European Researchers Night" and "Night of Science". To coincide with this event, all the laboratories will be open to the general public to show and discuss the results of our research. We will prepare posters and brief interactive computer simulations.
T9.3: Annual Physics Meeting at INFN-LNF (INFN): The target of this three-day event are high school teachers and the goal is to give information on the recent advancements in the field of sub-nuclear and nuclear physics and particle detector developments. A special effort will be made to prepare the experiments which involve the new detectors developed by the project participants.
T9.4: Summer School at FNAL and other US Laboratories (ALL): Organize a three-day training on the project research activities for the students of the "Summer School at FNAL and other US Laboratories". Effort will be made to give the students the opportunity to meet researchers of the non-academic Partners and discuss the prospects of working on research and development in European private companies.
T9.5: Outreach web site (ALL): We will develop a public web site with a detailed description of the project and with all the information for the general public.

Participation per Partner

Partner number and short name [10]
1 - INFN
2 - HZDR
3 - Prisma
4 - POLIMI
5 - CLEVER
6 - UNIGE
7 - UNIPI
8 - OCK
9 - KTH
10 - CNRS
11 - UNIPG
12 - UNIRO
13 - Impex
14 - EGO
15 - UNINA

Partner number and short name [10]
17 - NINS-NAOJ
18 - NASA
19 - FRA
20 - Faraday Technology Inc.
21 - STANFORD
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP
23 - HOG
24 - ICRR
25 - UMI
26 - MIT
27 - ISU
28 - HIU
29 - TAM
30 - HKU
31 - TPU
32 - JLAB

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D9.1	Summer Students at US Laboratories	7 - UNIPI	Other	Public	12
D9.2	Workshop Day/Open Day	1 - INFN	Other	Public	9

Description of deliverables

The deliverables are relative to the several initiatives aimed at spreading the knowledge acquired by the project researchers among the general public and, in particular, young generations.

D9.1 : Summer Students at US Laboratories [12]

Seminars on the NEWS activites and visits to the laboratories will be organised for the students of the Summer School "Summer Students at FNAL and other US Laboratories". These will take place in M12, M24, M36, M48.

D9.2 : Workshop Day/Open Day [9]

In coincidence with the annual General Meetings, we will organize specific training events for the project participants and also public events for the general public, including high-school and university students, as Open Days with visits to our laboratories. These will take place on M9, M21, M33, M45.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP10	**Lead beneficiary** [10]	15 - UNINA
Work package title	Transfer of Knowledge		
Start month	1	**End month**	48

Objectives

O10.1: Coordinate all the activities dedicated to the training of personnel, to achieve the maximum transfer of knowledge among project participants and increase the quality of the research and the competitiveness of participant Institutions.
O10.2: Provide trained personnel with enough capabilities to be independent in the acquired skills.

Description of work and role of partners

WP10 - Transfer of Knowledge [Months: 1-48]
UNINA
T10.1: Research-Industry Transfer of Knowledge (ALL): Maximization of the Transfer of Knowledge among research institutions, international Laboratories, and companies which will be placed in contact with the most recent developments in science and acquire new competences.
T10.2: GPD polarimeter for space applications (INFN, UNIPI, Prisma, Clever): INFN will transfer its long-standing expertise in integration and production of X-ray detectors for space applications. The GPD prototypes will be thoroughly tested and characterized at INFN and the final design implementation and will serve as a base for the definition of the assembly procedure of all flight models.
T10.3: Radiation hard electronics components for particle physics and space applications (INFN, UNIPI, HZDR, OIA, Prisma, Clever): INFN, UNIPI and OIA will transfer their expertise in the design of radiation hard electronics components for particle physics and space applications to Prisma and Clever. This will be important for future involvement of these companies in projects for the development of components for space or medical applications for in-vivo dosimetry at proton and ion beams. HZDR will provide training on the use of irradiation facilities.
T10.4: State-of-the-art electrochemical techniques (POLIMI, FNAL, FRD): Transfer of knowledge between POLIMI, FNAL and FRD to optimize electrochemical techniques for Nb3Sn thin layer deposition on Nb and Cu surfaces to develop superconducting wires and radio-frequency cavities. T9.5: High-Speed Computing (ALL): Transfer of the US Laboratories Scientific Computing Divisions competencies in the field of high-speed computing, grid, cloud computing, to European research Institutions involved in the development of computing infrastructures and data analysis.
T10.6: Training courses (ALL): Organization of special training courses in connection with the General Meetings. Training Sessions will be devoted to trainings on specific advanced topics from research development in fundamental physics or from technological developments from companies.

Participation per Partner

Partner number and short name [10]
1 - INFN
2 - HZDR
3 - Prisma
4 - POLIMI
5 - CLEVER
6 - UNIGE
7 - UNIPI
8 - OCK
9 - KTH
10 - CNRS
11 - UNIPG
12 - UNIRO

Partner number and short name [10]
13 - Impex
14 - EGO
15 - UNINA
17 - NINS-NAOJ
18 - NASA
19 - FRA
20 - Faraday Technology Inc.
21 - STANFORD
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP
23 - HOG
24 - ICRR
25 - UMI
26 - MIT
27 - ISU
28 - HIU
29 - TAM
30 - HKU
31 - TPU
32 - JLAB

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D10.1	Trainings	15 - UNINA	Report	Confidential, only for members of the consortium (including the Commission Services)	9

Description of deliverables

In coincidence with the General Meetings trainings will be organized to spread the acquired knowledge by the experts of each area among all the project participants.

D10.1 : Trainings [9]

In coincidence with the General Meetings, trainings for the project researchers will be organized. There will be trainings delivered both by external experts and by the project researchers. These will take place on M9, M21, M33, M45.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP11	Lead beneficiary [10]	1 - INFN
Work package title	Management		
Start month	1	End month	48

Objectives

O11.1: Ensure the efficient, transparent and productive organization of the project.
O11.2: Supervise secondments and organize trainings, monitor activities and the achievement of deliverables
O11.3: Maximize knowledge sharing among the involved Institutions, provide equal opportunity for all participants and the visibility of the project.

Description of work and role of partners

WP11 - Management [Months: 1-48]
INFN
T11.1: Project Supervision (ALL): All Institutions will participate to the management structure, composed by the Management Board, which is in charge of the administrative activities, the authorization and supervision of secondments, and the Scientific Board, which is in charge of the coordination of the network activities, including planning secondments and trainings, monitoring Work Packages activities and deliverables.
T11.2: Organization of meetings (ALL): All Institutions will participate to the planning and organization of the Management Board/Scientific Board/General Meetings. Minutes of the meetings will be available on the web and distributed to dedicated mailing lists.
T11.3: Preparation of general and periodic reports (ALL): Periodic written reports on the on-going activities in all Work Packages and on the status of secondments and deliverables will be available to all participants through the web site and will be distributed to dedicated mailing lists. These reports will be used to monitor the progress of the on-going tasks.
T11.4: Web site (ALL): Project information, both for general public and restricted to the project participants, will be distributed through a world wide web site. It will be organized with a private section available only to the project participants, to ensure appropriate sharing of confidential documents and information, and with a public section for the general public, to maximize the visibility and the outreach aspects.

Participation per Partner

Partner number and short name [10]
1 - INFN
2 - HZDR
3 - Prisma
4 - POLIMI
5 - CLEVER
6 - UNIGE
7 - UNIPI
8 - OCK
9 - KTH
10 - CNRS
11 - UNIPG
12 - UNIRO
13 - Impex
14 - EGO
15 - UNINA
17 - NINS-NAOJ

Partner number and short name [10]
18 - NASA
19 - FRA
20 - Faraday Technology Inc.
21 - STANFORD
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP
23 - HOG
24 - ICRR
25 - UMI
26 - MIT
27 - ISU
28 - HIU
29 - TAM
30 - HKU
31 - TPU
32 - JLAB

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D11.1	Kick-Off Meeting	1 - INFN	Other	Confidential, only for members of the consortium (including the Commission Services)	1
D11.2	General Meetings	1 - INFN	Other	Confidential, only for members of the consortium (including the Commission Services)	9
D11.3	NEWS web site	7 - UNIPI	Websites, patents filling, etc.	Public	5
D11.4	First Progress Report	1 - INFN	Report	Confidential, only for members of the consortium (including the Commission Services)	12
D11.5	Second Progress Report	1 - INFN	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D11.6	Mid-Term Meeting	1 - INFN	Other	Public	18

Description of deliverables

All the deliverables are relative to the organization of the management structure of the project and the interaction with the European Community.

D11.1 : Kick-Off Meeting [1]

At the Kick-Off meeting the Management Board and the Scientific Board will be appointed. The Management Board will be composed of each participant's contact person and will be chaired by the project coordinator (for INFN there will be one person for each INFN Department). The Scientific Board will be composed of the co-leaders of each Work Package and will be chaired by one member of the Management Board.

D11.2 : General Meetings [9]

We will have one General Meeting per year, in M9, M21, M33, and M45. In coincidence with the General Meeting we will have training sessions and seminars and public events.

D11.3 : NEWS web site [5]

The project web site will be developed for internal communication, exchange documents between the participants, collect reports, and to external communication, to make the project field of research, objectives, and results available to the general public.

D11.4 : First Progress Report [12]

First progress report of the entire NEWS activity

D11.5 : Second Progress Report [36]

Second progress report of the entire NEWS project

D11.6 : Mid-Term Meeting [18]

Mid-Term review of the entire NEWS project with the EU officers

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**

1.3.4. WT4 List of milestones

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS1	Roadmap for Third Generation Gravitational Wave Detectors	WP2	1 - INFN	36	Organization of a Workshop/ Symposium to discuss the synergies between the Einstein Telescope and LIGO collaboration, for common infrastructures.
MS2	Gravitational Wave Event Localisation Code	WP2	1 - INFN	24	The multimessenger approach requires to know with a very low latency the localization of a GW event, if an electromagnetic follow up is required.
MS3	Design of a Cryogenic Seismic Filter	WP3	12 - UNIRO	36	Production of a complete design of the suspension.
MS4	Specification for a Tiltmeter	WP3	15 - UNINA	24	Production of a specification datasheet of the Tiltmeter.
MS5	Analysis Package for LAT 4th Catalog	WP4	21 - STANFORD	24	The new analysis package for LAT 4th catalog will be thoroughly tested, refined and used to analyse 8 years of telescope data.
MS6	Gas Pixel Detector Prototype	WP5	1 - INFN	24	The Gas Pixel Detector prototype will be built, thoroughly tested and characterized and will serve as a base for the design and definition of the assembly procedure of the future flight models.
MS7	Measurement of the Muon Anomalous Magnetic Moment at Muon (g-2)	WP6	1 - INFN	36	The measurement of the muon anomalous magnetic moment will be presented and international Conferences and published by the Muon (g-2) collaboration on a peer reviewed journal.
MS8	Simulation and Design of Upgraded BaF2 Crystal Calorimeter for Mu2e-II	WP6	1 - INFN	48	The simulation code of the BaF2 crystal calorimeter will be inserted in the official Mu2e-II simulation code and a preliminary design of the detector will be presented to the Mu2e-II collaboration.
MS9	Mu2e Transport Solenoid Constructed	WP7	1 - INFN	20	The superconducting modules will be constructed by the Italian ASG Superconductors with the active collaboration of INFN personnel. The modules will be installed and

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
					tested in the FNAL muon beamline.
MS10	Feasibility of Deposition Techniques for Nb3Sn wires/RF Cavities	WP7	19 - FRA	48	Studies will performed to apply the optimized electrochemical techniques to the fabrication of superconducting Nb3Sn wires, to increase the critical current density and the generated magnetic field, and to the fabrication of Nb3Sn radio-frequency cavities, to increase the accelerating field and reduce the cooling requirements.
MS11	Cooldown and NEP Measurement of Antenna Coupled Bolometer	WP8	6 - UNIGE	30	The prototype of an antenna coupled bolometer will be fabricated and tested with a microwave generator. Characterization will include noise-equivalent power measurements.

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Delay in code development for fast localization of gravitational wave events	WP2	Involve more researchers at local institutions
2	Delay in delivery of tiltmeter prototype	WP3	Involve more researchers at local institutions
3	Delay in Fermi data legacy archive	WP4	Involve more researchers at local Institutions
4	Delay in software development for Muon (g-2)/ Mu2e	WP6	Involve more researchers at local Institutions; Request additional funding from National funding agencies to hire new postdocs
5	Delay in Mu2e Transport Solenoid	WP7	Involve more FNAL personnel
6	Dropping out of participant	WP1, WP10, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Shift dropping participant's tasks to a participant with similar profile or add new participant
7	Delays in planned secondments or schedule changes	WP1, WP10, WP11, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Fast re-organization of the secondment plan and schedule

1.3.6. WT6 Summary of project effort contribution

	WP1	**WP2**	**WP3**	**WP4**	**WP5**	**WP6**	**WP7**	**WP8**	**WP9**	**WP10**	**WP11**
1 - INFN		✓	✓	✓	✓	✓	✓		✓	✓	✓
2 - HZDR						✓			✓	✓	✓
3 - Prisma					✓	✓			✓	✓	✓
4 - POLIMI							✓		✓	✓	✓
5 - CLEVER					✓	✓			✓	✓	✓
6 - UNIGE								✓	✓	✓	✓
7 - UNIPI		✓	✓	✓	✓	✓			✓	✓	✓
8 - OCK				✓	✓				✓	✓	✓
9 - KTH				✓	✓				✓	✓	✓
10 - CNRS		✓	✓						✓	✓	✓
11 - UNIPG		✓	✓						✓	✓	✓
12 - UNIRO		✓	✓						✓	✓	✓
13 - Impex			✓						✓	✓	✓
14 - EGO			✓						✓	✓	✓
15 - UNINA		✓	✓						✓	✓	✓
23 - HOG				✓	✓				✓	✓	✓
31 - TPU							✓		✓	✓	✓
30 - HKU		✓	✓	✓					✓	✓	✓
32 - JLAB							✓		✓	✓	✓
28 - HIU				✓	✓				✓	✓	✓
26 - MIT		✓	✓						✓	✓	✓
27 - ISU								✓	✓	✓	✓

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11
25 - UMI		✓	✓						✓	✓	✓
21 - STANFORD				✓	✓			✓	✓	✓	✓
18 - NASA				✓	✓				✓	✓	✓
24 - ICRR		✓	✓	✓					✓	✓	✓
20 - Faraday Technology Inc.							✓		✓	✓	✓
17 - NINS-NAOJ		✓	✓						✓	✓	✓
22 - CALIFORNIA INSTITUTE OF TECHNOLOGYCORP		✓	✓					✓	✓	✓	✓
19 - FRA						✓	✓	✓	✓	✓	✓
29 - TAM				✓					✓	✓	✓

1.3.7. WT7 Tentative schedule of project reviews

No project reviews indicated

1.4. List of Partner Organisations

Participant number	Partner Organisation Full Name	Partner Organisation Short name	Country
17	INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION NATIONAL INSTITUTES OF NATURAL SCIENCES	NINS-NAOJ	Japan
18	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	NASA	United States
19	FERMI RESEARCH ALLIANCE LLC	FRA	United States
20	FARADAY TECHNOLOGY INC.	Faraday Technology Inc.	United States
21	BOARD OF TRUSTEES OF THE LELAND STANFORD JUNIOR UNIVERSITY	STANFORD	United States
22	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	United States
24	NATIONAL UNIVERSITY CORPORATION THEUNIVERSITY OF TOKYO	ICRR	Japan
25	The Curators of the University of Missouri	UMI	United States
26	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	MIT	United States
27	IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY	ISU	United States
28	NATIONAL UNIVERSITY CORPORATION HIROSHIMA UNIVERSITY	HIU	Japan
29	Texas A&M University	TAM	United States
30	THE UNIVERSITY OF HONG KONG	HKU	Hong Kong
31	TOMSK POLYTECHNIC UNIVERSITY	TPU	Russian Federation
32	JEFFERSON SCIENCE ASSOCIATES LLC	JLAB	United States

1.5. Secondments

1.5.1. Summary of secondments per Participant

Partner number	Partner short name	Country	EU/AC or TC	Academic sector	Total Number of secondments	Total Researcher Months Period 1	Total Researcher Months Period 2	Total Researcher Months Overall	Total Researcher Months (%)
1	INFN	Italy	EU/AC	Yes	117	65.00	95.00	160.00	45.98%
2	HZDR	Germany	EU/AC	Yes	6	0.00	6.00	6.00	1.72%
3	Prisma	Greece	EU/AC	No	9	2.00	7.00	9.00	2.59%
4	POLIMI	Italy	EU/AC	Yes	10	1.00	9.00	10.00	2.87%
5	CLEVER	France	EU/AC	No	14	6.00	14.00	20.00	5.75%
6	UNIGE	Italy	EU/AC	Yes	16	14.00	13.00	27.00	7.76%
7	UNIPI	Italy	EU/AC	Yes	14	7.00	11.00	18.00	5.17%
8	OCK	Sweden	EU/AC	Yes	14	9.00	7.00	16.00	4.60%
9	KTH	Sweden	EU/AC	Yes	12	2.00	11.00	13.00	3.74%
10	CNRS	France	EU/AC	Yes	11	7.00	7.00	14.00	4.02%
11	UNIPG	Italy	EU/AC	Yes	26	18.00	12.00	30.00	8.62%
12	UNIRO	Italy	EU/AC	Yes	3	2.00	1.00	3.00	0.86%
13	Impex	Germany	EU/AC	No	1	0.00	1.00	1.00	0.29%
14	EGO	Italy	EU/AC	Yes	11	4.00	7.00	11.00	3.16%
15	UNINA	Italy	EU/AC	Yes	6	4.00	4.00	8.00	2.30%
23	HOG	Sweden	EU/AC	Yes	2	0.00	2.00	2.00	0.57%
17	NINS-NAOJ	Japan	TC	Yes	0	0.00	0.00	0.00	0.00%
18	NASA	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
19	FRA	United States	TC	No	0	0.00	0.00	0.00	0.00%
20	Faraday Technology Inc.	United States	TC	No	0	0.00	0.00	0.00	0.00%
21	STANFORD	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
22	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
24	ICRR	Japan	TC	Yes	0	0.00	0.00	0.00	0.00%
25	UMI	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
26	MIT	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
27	ISU	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
28	HIU	Japan	TC	Yes	0	0.00	0.00	0.00	0.00%
29	TAM	United States	TC	Yes	0	0.00	0.00	0.00	0.00%
30	HKU	Hong Kong	TC	Yes	0	0.00	0.00	0.00	0.00%
31	TPU	Russian Federation	TC	Yes	0	0.00	0.00	0.00	0.00%

Partner number	Partner short name	Country	EU/AC or TC	Academic sector	Total Number of secondments	Total Researcher Months Period 1	Total Researcher Months Period 2	Total Researcher Months Overall	Total Researcher Months (%)
32	JLAB	United States	TC	No	0	0.00	0.00	0.00	0.00%
TOTAL					**272**	**141.00**	**207.00**	**348.00**	**100.00%**

1.5.2. Summary of secondments funded by EU per Beneficiary

(secondments from the Beneficiary and from funded Partner Organisations to the Beneficiary)

Partner number	Partner short name	Country	Number of secondments funded by EU	Researcher Months funded by EU Period 1	Researcher Months funded by EU Period 2	Researcher Months funded by EU Overall
1	INFN	Italy	117	65.00	95.00	160.00
2	HZDR	Germany	6	0.00	6.00	6.00
3	Prisma	Greece	9	2.00	7.00	9.00
4	POLIMI	Italy	10	1.00	9.00	10.00
5	CLEVER	France	14	6.00	14.00	20.00
6	UNIGE	Italy	16	14.00	13.00	27.00
7	UNIPI	Italy	14	7.00	11.00	18.00
8	OCK	Sweden	14	9.00	7.00	16.00
9	KTH	Sweden	12	2.00	11.00	13.00
10	CNRS	France	11	7.00	7.00	14.00
11	UNIPG	Italy	26	18.00	12.00	30.00
12	UNIRO	Italy	3	2.00	1.00	3.00
13	Impex	Germany	1	0.00	1.00	1.00
14	EGO	Italy	11	4.00	7.00	11.00
15	UNINA	Italy	6	4.00	4.00	8.00
23	HOG	Sweden	2	0.00	2.00	2.00
TOTAL			**272**	**141.00**	**207.00**	**348.00**

1.5.3. Secondments plan

Overview of secondments

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
1	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	5	2

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
1	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	24	8
1	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	40	1
2	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	8	1
3	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	30	1
4	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	9	1
5	ER	INFN	IT	EU/AC	yes	STANFORD	US	TC	yes	WP4	8	1
6	ER	EGO	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	26	1
6	ER	EGO	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	18	1
6	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	30	1
7	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	27	1
7	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	38	1
7	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	31	1
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	26	2
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	12	1
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	30	1
9	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	34	1
10	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	30	1
10	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	34	1
11	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	16	1
2	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	32	1
233	ESR	UNIPI	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	34	1
233	ESR	UNIPI	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	16	1
4	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	33	1
4	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	12	1
5	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	32	1
226	ER	UNIPI	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	8	1
226	ER	UNIPI	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	28	1
226	ER	UNIPI	IT	EU/AC	yes	UMI	US	TC	yes	WP2	32	1
227	ER	UNIPI	IT	EU/AC	yes	HKU	HK	TC	yes	WP2	28	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
227	ER	UNIPI	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	25	1
227	ER	UNIPI	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	37	1
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	38	1
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	20	1
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	32	1
8	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	44	1
9	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	26	1
10	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	32	1
10	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	40	1
12	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	16	1
13	ER	INFN	IT	EU/AC	yes	NASA	US	TC	yes	WP5	31	1
14	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	23	1
14	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	10	1
15	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	22	1
15	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	9	1
15	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	21	1
16	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	20	1
16	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP9	38	1
17	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	8	1
17	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	20	1
17	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	32	1
17	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	44	1
18	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	22	1
18	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	40	1
19	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	24	1
19	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	42	1
20	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	23	1
20	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	41	1
21	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	21	1
21	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	39	1
22	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	20	1
22	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	38	1
23	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	26	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
23	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	44	1
24	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	12	2
24	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	18	2
24	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	24	2
24	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	30	2
25	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	10	2
25	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	32	2
25	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	44	2
26	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	18	2
26	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	30	2
26	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	42	2
27	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	8	1
27	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	32	1
228	ER	UNIPI	IT	EU/AC	yes	FRA	US	TC	no	WP6	10	1
28	ER	UNIPI	IT	EU/AC	yes	MIT	US	TC	yes	WP2	34	1
29	ESR	UNIPI	IT	EU/AC	yes	MIT	US	TC	yes	WP2	16	2
29	ESR	UNIPI	IT	EU/AC	yes	MIT	US	TC	yes	WP2	22	2
229	ER	UNIPI	IT	EU/AC	yes	FRA	US	TC	no	WP6	34	2
229	ER	UNIPI	IT	EU/AC	yes	FRA	US	TC	no	WP6	46	2
30	ER	HZDR	DE	EU/AC	yes	FRA	US	TC	no	WP6	26	1
30	ER	HZDR	DE	EU/AC	yes	FRA	US	TC	no	WP6	32	1
30	ER	HZDR	DE	EU/AC	yes	FRA	US	TC	no	WP6	44	1
31	ER	HZDR	DE	EU/AC	yes	FRA	US	TC	no	WP6	36	1
31	ER	HZDR	DE	EU/AC	yes	FRA	US	TC	no	WP6	28	1
31	ER	HZDR	DE	EU/AC	yes	FRA	US	TC	no	WP6	40	1
32	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	13	1
32	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP7	25	1
33	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP7	10	1
33	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP7	22	1
120	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	10	2
34	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP7	18	2
34	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP7	30	2
35	ER	POLIMI	IT	EU/AC	yes	TPU	RU	TC	yes	WP7	26	1
35	ER	POLIMI	IT	EU/AC	yes	TPU	RU	TC	yes	WP7	40	1
36	ER	POLIMI	IT	EU/AC	yes	TPU	RU	TC	yes	WP7	24	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
36	ER	POLIMI	IT	EU/AC	yes	TPU	RU	TC	yes	WP7	32	1
36	ER	POLIMI	IT	EU/AC	yes	TPU	RU	TC	yes	WP7	36	1
36	ER	POLIMI	IT	EU/AC	yes	TPU	RU	TC	yes	WP7	38	1
37	ESR	POLIMI	IT	EU/AC	yes	JLAB	US	TC	no	WP7	26	1
37	ESR	POLIMI	IT	EU/AC	yes	JLAB	US	TC	no	WP7	36	1
37	ESR	POLIMI	IT	EU/AC	yes	JLAB	US	TC	no	WP7	42	1
37	ESR	POLIMI	IT	EU/AC	yes	JLAB	US	TC	no	WP7	43	1
38	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	22	1
38	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	40	1
38	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	41	1
39	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	24	1
39	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	38	1
39	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	39	1
40	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	25	1
40	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	42	1
40	ER	Prisma	EL	EU/AC	no	INFN	IT	EU/AC	yes	WP6	43	1
41	ER	CLEVER	FR	EU/AC	no	UNIPI	IT	EU/AC	yes	WP5	12	1
41	ER	CLEVER	FR	EU/AC	no	UNIPI	IT	EU/AC	yes	WP5	24	1
41	ER	CLEVER	FR	EU/AC	no	UNIPI	IT	EU/AC	yes	WP5	36	1
41	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP6	14	2
41	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP6	26	2
41	ER	CLEVER	FR	EU/AC	no	FRA	US	TC	no	WP6	38	3
41	ER	CLEVER	FR	EU/AC	no	UNIPI	IT	EU/AC	yes	WP10	42	1
41	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP10	46	1
42	ER	CLEVER	FR	EU/AC	no	UNIPI	IT	EU/AC	yes	WP5	10	1
42	ER	CLEVER	FR	EU/AC	no	UNIPI	IT	EU/AC	yes	WP5	34	1
42	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP6	24	2
42	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP6	32	1
42	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP10	33	1
42	ER	CLEVER	FR	EU/AC	no	INFN	IT	EU/AC	yes	WP6	40	2
250	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	30	1
250	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	38	1
250	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	34	1
250	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	40	1
47	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP2	6	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
47	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP2	18	1
47	ER	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	30	1
47	ER	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	42	1
47	ER	UNIPG	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	9	2
47	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	21	2
47	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	33	1
47	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	45	1
47	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	14	1
48	ER	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	7	1
48	ER	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	19	1
48	ER	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	31	1
48	ER	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	43	1
49	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	5	2
49	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	17	2
49	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	29	1
49	ER	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	35	1
49	ER	UNIPG	IT	EU/AC	yes	Impex	DE	EU/AC	no	WP3	14	1
49	ER	UNIPG	IT	EU/AC	yes	Impex	DE	EU/AC	no	WP3	38	1
50	Technical_staff	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	7	1
50	Technical_staff	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	19	1
50	Technical_staff	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	31	1
50	Technical_staff	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	43	1
51	Technical_staff	UNIPG	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	4	1
51	Technical_staff	UNIPG	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	22	1
51	Technical_staff	UNIPG	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	40	1
131	ER	HOG	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	28	1
131	ER	HOG	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	30	1
401	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	36	1
401	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	42	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
220	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	32	1
220	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	34	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	34	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	46	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	11	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	23	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	35	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	41	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	16	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	40	1
140	ER	OCK	SE	EU/AC	yes	ICRR	JP	TC	yes	WP4	14	1
56	ER	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	38	1
56	ER	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	6	1
56	ER	KTH	SE	EU/AC	yes	HIU	JP	TC	yes	WP5	28	1
56	ER	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	30	1
57	ESR	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	42	1
58	ESR	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	7	1
58	ESR	KTH	SE	EU/AC	yes	HIU	JP	TC	yes	WP5	29	1
59	ER	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	31	2
59	ER	KTH	SE	EU/AC	yes	HIU	JP	TC	yes	WP5	30	1
59	ER	KTH	SE	EU/AC	yes	HIU	JP	TC	yes	WP5	42	1
60	ER	KTH	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	32	1
60	ER	KTH	SE	EU/AC	yes	HIU	JP	TC	yes	WP5	44	1
61	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	38	1
62	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	34	1
63	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	33	1
64	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	35	1
65	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	42	1
66	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	18	1
66	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	20	2
67	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	10	1
67	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	22	1
68	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	28	1
68	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	42	1
69	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	16	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
69	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	28	1
270	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	36	3
70	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	30	2
70	Technical_staff	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	42	2
71	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	26	3
71	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	18	2
71	ER	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	36	1
72	ESR	UNIGE	IT	EU/AC	yes	ISU	US	TC	yes	WP8	34	4
72	ESR	UNIGE	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP8	16	2
73	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	34	4
73	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	26	1
74	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	18	1
75	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	16	2
75	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	28	2
76	ESR	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	30	2
77	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	5	1
78	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	9	1
79	ER	UNIGE	IT	EU/AC	yes	FRA	US	TC	no	WP8	22	2
80	ESR	UNIGE	IT	EU/AC	yes	STANFORD	US	TC	yes	WP8	16	2
80	ESR	UNIGE	IT	EU/AC	yes	STANFORD	US	TC	yes	WP8	30	2
81	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	2	2
81	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	14	2
81	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	26	2
81	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	38	2
81	ER	INFN	IT	EU/AC	yes	FRA	US	TC	no	WP6	28	3
82	ER	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	33	1
82	ER	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	45	2
83	ER	UNINA	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	2	1
83	ER	UNINA	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	14	1
283	ESR	UNINA	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	26	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
283	ESR	UNINA	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	38	1
84	ESR	UNINA	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	21	2
84	ESR	UNINA	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	33	2
221	ER	CNRS	FR	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	45	2
221	ER	CNRS	FR	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	4	2
221	ER	CNRS	FR	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	28	2
86	ER	EGO	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	5	1
87	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	18	1
88	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	32	1
89	ER	EGO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	40	1
90	ER	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	30	1
91	ER	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	42	1
92	ER	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	32	1
93	ER	UNIRO	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	15	1
94	ER	UNIRO	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	25	1
95	ER	UNIRO	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	13	1
96	ER	OCK	SE	EU/AC	yes	TAM	US	TC	yes	WP4	8	2
97	ER	OCK	SE	EU/AC	yes	TAM	US	TC	yes	WP4	10	2
97	ER	OCK	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	22	1
97	ER	OCK	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	34	1
97	ER	OCK	SE	EU/AC	yes	STANFORD	US	TC	yes	WP4	46	1
98	ESR	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	16	2
99	ER	INFN	IT	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	28	1
99	ER	INFN	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	6	2
99	ER	INFN	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP2	18	2
100	ESR	CNRS	FR	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP9	10	1
100	ESR	CNRS	FR	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	28	1

Staff member ID	Staff member profile	Sending Org. (Short Name)	Sending Org. (Country)	Sending Org. (Region)	Sending Org. (Academic Sector)	Seconded to Org. (Short Name)	Seconded to Org. (Country)	Seconded to Org. (Region)	Seconded to Org. (Academic Sector)	Work package number	Secondment Starting month	Duration of secondment (researcher-months)
100	ESR	CNRS	FR	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	40	1
101	ER	CNRS	FR	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	16	1
101	ER	CNRS	FR	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	40	1
102	ER	CNRS	FR	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	10	1
103	ER	CNRS	FR	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP2	8	1
104	ER	CNRS	FR	EU/AC	yes	CALIFORNIA INSTITUTE OF TECHNOLOGYCORP	US	TC	yes	WP3	14	1
105	ER	INFN	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	10	1
106	ER	INFN	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	14	1
107	ESR	INFN	IT	EU/AC	yes	NINS-NAOJ	JP	TC	yes	WP3	18	2
108	ER	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP2	22	1
109	ESR	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP2	14	1
110	ER	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	9	1
111	Technical_staff	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	12	1
112	Technical_staff	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	8	1
151	ER	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	30	1
151	ER	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	12	1
151	ER	INFN	IT	EU/AC	yes	ICRR	JP	TC	yes	WP3	28	1
113	ER	Impex	DE	EU/AC	no	INFN	IT	EU/AC	yes	WP3	30	1

Plan for reporting period 1

Staff member ID	Secondment Starting month	Duration of secondment (researcher-months)	Period 1																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	5	2																								
1	24	8																								
1	40	1																								
2	8	1																								
3	30	1																								
4	9	1																								
5	8	1																								

Staff member ID	Secondment Starting month	Duration of secondment (researcher-months)	Period 1																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
6	26	1																								
6	18	1																		■						
6	30	1																								
7	27	1																								
7	38	1																								
7	31	1																								
8	26	2																								
8	12	1												■												
8	30	1																								
9	34	1																								
10	30	1																								
10	34	1																								
11	16	1																■								
2	32	1																								
233	34	1																								
233	16	1																■								
4	33	1																								
4	12	1												■												
5	32	1																								
226	8	1								■																
226	28	1																								
226	32	1																								
227	28	1																								
227	25	1																								
227	37	1																								
8	38	1																								
8	20	1																				■				
8	32	1																								
8	44	1																								
9	26	1																								
10	32	1																								
10	40	1																								
12	16	1																■								
13	31	1																								

Staff member ID	Secondment Starting month	Duration of secondment (researcher-months)	Period 1																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
14	23	1																								
14	10	1																								
15	22	1																								
15	9	1																								
15	21	1																								
16	20	1																								
16	38	1																								
17	8	1																								
17	20	1																								
17	32	1																								
17	44	1																								
18	22	1																								
18	40	1																								
19	24	1																								
19	42	1																								
20	23	1																								
20	41	1																								
21	21	1																								
21	39	1																								
22	20	1																								
22	38	1																								
23	26	1																								
23	44	1																								
24	12	2																								
24	18	2																								
24	24	2																								
24	30	2																								
25	10	2																								
25	32	2																								
25	44	2																								
26	18	2																								
26	30	2																								
26	42	2																								
27	8	1																								

Staff member ID	Secondment Starting month	Duration of secondment (researcher-months)	Period 1																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
27	32	1																								
228	10	1																								
28	34	1																								
29	16	2																								
29	22	2																								
229	34	2																								
229	46	2																								
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Plan for reporting period 2

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1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent fillings, videos, etc.
OTHER	
ETHICS	Ethics requirement
ORDP	Open Research Data Pilot

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU	Public
CO	Confidential, only for members of the consortium (including the Commission Services)
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
EU-SEC	Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number:MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

VA	if virtual access,
TA-uc	if trans-national access with access costs declared on the basis of unit cost,
TA-ac	if trans-national access with access costs declared as actual costs, and
TA-cb	if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

Marie Skłodowska-Curie Actions (MSCA)
Research and Innovation Staff Exchange (RISE)
H2020-MSCA-RISE-2016

Project Acronym: NEWS – Project Number: 734303
Annex 1 to the Grant Agreement
(Description of the Action)
Part B

Table of contents

2. Excellence

NEWS will promote and reinforce the collaboration between US, American and Japanese research institutions involved in some of the most important research projects in fundamental physics. In the last few years the NEWS researchers have given leading contributions to the development of cutting-edge physics experiments capable of opening new windows in the exploration of the universe and the study of particle physics. They are now involved in the data analysis of these experiments, as well as in new experimental challenges which require substantial technological advancements. The LIGO and Virgo collaborations have built the largest gravitational wave observatories in the world in US and Italy. Based on km-long laser interferometers located thousands of kilometres apart, LIGO and Virgo exploit the physical properties of light and spacetime itself to detect gravitational waves and probe their astrophysical sources. The recent first observation of gravitational waves [1] from a merging black hole system has inaugurated the era of gravitational wave astronomy. The Large Area Telescope (LAT) collaboration built and now operates the principal scientific instrument on the Fermi Gamma Ray Space Telescope spacecraft launched in the year 2008. The LAT is a high-energy gamma-ray telescope covering the energy range from about 20 MeV to about 1 TeV and operates mostly in sky-survey mode, covering one 20% of the sky at any time and the entire sky every 3 hours. The LAT has recorded more than one billion photons uniformly and continuously over the whole sky, and released the most complete catalog of more than three thousand sources in conditions of strong gravity and magnetic fields, where high-energy photons are emitted by particles accelerated close to the speed of light. Fermi's public archive of gamma-rays is a thousand times deeper than any other similar instrument, and sensitive to flux variations on timescales of one millisecond to years. No other instrument is surveying the gamma-ray sky with such sensitivity and coverage, making Fermi the reference all-sky gamma-ray monitor in the network of multi-messenger observatories of extreme transient events where strong gamma-ray emission is expected, like flares of Active Galactic Nuclei powered by supermassive black holes, Gamma-Ray Bursts, solar flares. Fermi is also key to probe with unprecedented detail the physics of many astrophysical sources, including pulsars, close binary systems, and supernova remnants, as well as the interactions of Cosmic Rays. The observations of Fermi are fundamental to carry on a multimessenger study of the cosmos, that combines photons with other "messengers" like cosmic rays, neutrinos, and gravitational waves. This multi-messenger observation strategy in astronomical searches will soon be enriched by X-ray polarization measurements: in fact, a new generation of spaceborne telescopes based on a new class of detectors is emerging. They will perform accurate measurements of the direction, energy, time and for the first time polarization angle of cosmic X-ray in the 1-10 keV energy band. Besides providing images with arcsecond resolution, these instruments will provide the angle and the degree of polarization of X-rays from the parent sources, thus probing the curvature of space in the vicinity of black holes and neutron stars, verifying quantum electrodynamics in regions of extreme magnetic fields and opening a new discovery window on exotic phenomena like the existence of axion-like particles. A collaboration of European and US research institutions has proposed space missions dedicated to X-ray polarimetry which are based on this technology. A complementary approach to cosmology studying the universe as the largest particle accelerator uses particle accelerators built in laboratories. The Muon Campus is a world-leading facility under construction at Fermi National Accelerator Laboratory (FNAL). It will provide the most intense pulsed muon-beams, which are among the cleanest probes when searching for new phenomena beyond the Standard Model (BSM) of fundamental interactions [2-3]. Although theoretical arguments and astrophysics observations strongly point to the existence of BSM physics, no experimental evidence was found yet. A complementary approach to direct searches for BSM particles at the Large Hadron Collider (LHC) [4] is adopted in two world-class muon experiments at FNAL, the measurement of the anomalous magnetic moment (a_μ) of the muon with unprecedented precision at the Muon (g-2) experiment [5], and the "Mu2e" experiment [6]. Mu2e will search for the Charged Lepton Flavour Violating (CLFV) neutrinoless muon conversion to an electron, with four orders of magnitude improved sensitivity with respect to the previous experiments. The observation of CLFV would be an unambiguous evidence of new physics. All these world-class scientific endeavours are the product of innovative detecting machines, based on cutting-edge technology, and are the result of the efforts of hundreds of researchers. NEWS proposes an international program of exchange and training focused on the development of new facilities and technologies aiming at opening new "windows" in fundamental physics. We plan to improve the existing network of European, US and Japanese scientists working on the most advanced fields in fundamental physics, and build new connections to favour the cross fertilization among fields.

2.1. Quality and credibility of the research/innovation project; level of novelty and appropriate consideration of inter/multidisciplinary, intersectoral and gender aspects

Specific objectives and the relevance of the research and innovation project to the scope of the call and in relation to the "state of the art".

Gravitational-wave astronomy. Gravitational-wave astronomy is now a reality thanks to the first detection of a gravitational wave signal by the LIGO and Virgo Collaboration [1]. This result was achieved during the first science run (O1) of the two Advanced LIGO detectors that lasted from mid September 2015 to mid January 2016. During 2016 also the Advanced Virgo interferometer will start observations, after some years focused on subsystem upgrades. NEWS researchers have been directly involved in this discovery, as members of the LIGO-Virgo collaboration. Advanced LIGO and Advanced Virgo represent the second generation of gravitational wave detectors, with a design sensitivity about 10 times larger than the previous generation. This improvement in sensitivity corresponds to a volume 1000 times larger that can be probed, enhancing by the same factor the rate GW transient signals that will become detectable. The final jump in sensitivity, that will be reached in successive steps, is the result of different improvements in the detector. The power of the laser beam is increased to reduce the high-frequency shot noise, requiring the introduction of a compensation system to avoid the negative effect of optical distorsions induced by the absorbed light. The thermal noise is suppressed by using a sophisticate mirror suspension technology based on silica fibers, and by enhancing the mirror itself which is larger and with higher optical performances. Here a crucial issue is the optimization of the reflective coating of the mirror, which is the dominant source of thermal noise in the more sensitive region of the detectors, a problem which still needs to be investigated. More advanced improvements are foreseen in perspective, such as the use of non classical states of light (squeezed vacuum) to reduce quantum noise, and the implementation of subtraction techniques to reduce gravity gradient noise in the low frequency region. NEWS participants from Virgo will be directly committed to the design and implementation of these updates.
The first detection of GW was related to the merger of two massive black holes (BH), but there are many other promising sources of GWs. First of all, the mergers of other compact objects binaries, e.g neutron star-neutron star (NS-NS), and neutron star-black holes (NS-BH), that are expected to produce a transient GW signal. Rotating neutron stars should produce a continuous, substantially periodic GW signal. A supernova event can generate a short burst of gravitational waves. Furthermore, we expect a continuous stochastic background that should be due to the sum of many unresolved sources, of astrophysical or cosmological origin. The first objective of the LIGO/Virgo collaboration is the direct detection of all these sources. However with the final design sensitivity, or with an enhanced one, it will become possible to study in a more and more accurate way the parameters of the source. This will open a new era where accurate tests of general relativity, nuclear physics and, in perspective, theories of fundamental interactions will be possible. Detecting a GW signal and extracting physical parameters from it requires sophisticated analysis techniques. These are often quite demanding from a computational point of view and there is a large space for their improvement. In order to localize the source and to study the polarization of the signal in an accurate way at least three non aligned detectors are needed. Data analysis is a truly collaborative effort of the LIGO/Virgo collaboration, and frequent contacts between the members of the collaboration are required. Very soon other detectors, such as KAGRA in Japan, will join this effort, allowing a further increase of the precision and sensitivity of the detector network. NEWS project is expected to give a significant improvement to these activities.
Multi-messenger astronomy. The second generation of gravitational wave detectors allows to study the most violent phenomena in the Universe in a new multi-messenger way, by taking advantage of the simultaneous observations of different cosmic messengers, such as gravitational waves (GWs) and electromagnetic (EM) radiation at all wavelengths. Several detectable GW sources, like core-collapse supernovae, NS-NS or NS-BH mergers, and the early evolution of newly born highly magnetized NSs, are expected to also emit electromagnetic emission across the spectrum. Sources of continuous GWs, like asymmetric spinning NSs, isolated or in binary systems, can be associated to EM emission too (e.g. pulsars), ranging from the radio to the gamma-ray band. EM observations are crucial to find and identify a counterpart, to probe the physics of the source and its environment. In fact, while GW probe the distribution of matter in the source, EM radiation tells us about acceleration and phenomena, as well as the environment where the source is. To better exploit these multimessenger opportunities, a EM follow-up program has been put together by the LIGO and Virgo collaboration, consisting in a series of collaborations with partners at various EM wavelength. This program has proven to work smoothly during the first detection, where a full EM follow-up campaign was carried on, with many instruments observing the error region associated to the

event. Inside the NEWS project competences from the gravitational wave and astroparticle communities coexist and an increase of synergy is expected, in particular between Virgo and Fermi.

Astroparticle physics. In the last ~30 years the fields of high energy astrophysics and particle physics have grown a solid partnership based on complementary science goals, detection technologies, system engineering and analysis techniques. The resulting science is now commonly known as astroparticle physics. The NEWS project builds on this rich diversity of scientific cultures and hosts champions at different stages of their maturity.

Fermi LAT**.** The collaboration between particle physicists and astrophysicists has proven particularly productive in bringing together excellence of high performing particle detectors and a strong culture to support long term space operations, in order to maximize the mission return on a multitude of science goals. Launched in 2008, the Fermi mission has revolutionized the field of high-energy astroparticle physics with accurate and high-statistics observations of photons in the 100 MeV - 1 TeV range from a multitude of sources never before observed in the sky. Thanks to this success NASA has decided to extend the mission beyond the nominal 5-year phase. The LAT is performing extraordinarily well and is continuing to study the violent, gamma-ray side of the Universe with unprecedented detail. Science prospects for the upcoming years were recently boosted by a new event analysis package, released in June 2015 and dubbed Pass 8, which significantly improves the LAT performance. Together with the absence of consumables and very stable operations, this offers improved science discovery potential in four major themes: multi-wavelength and multi-messenger studies, dark matter searches, particle and time domain astrophysics. NEWS aims at specific advances in all these areas of Fermi science through well identified science targets. We will consolidate and disseminate the most accurate knowledge of the gamma-ray sky with the fourth iteration of the LAT gamma-ray source catalog (4FGL). This is the primary science output of the Fermi observatory and encodes precious information for studying the highest energy emissions in different source classes and after particle propagation and interactions across the Universe. Construction of the 4FGL will use the most advanced knowledge of the telescope instrumental response and of multiwavelength catalogs. Starting from this accurate description of the sky, we will be able to set stringent limits on excess gamma-ray emission from putative Dark Matter sources in the sky, therefore constraining the phase space for potential particle candidates to explain the missing mass in the Universe. The LAT is expected to either discover or exclude a conventional WIMP with thermal relic annihilation cross section up to masses of ~400 GeV within 2023 (15 years of observations), relying on the Pass 8 improved sensitivity and synergies with upcoming optical surveys that will discover many more dwarfs spheroidal systems. We will document the intrinsically dynamic nature of the gamma-ray sky by capturing transient emissions and connecting them to detections from a multi-messenger network of observatories sensitive to other types of radiation, like neutrinos or Gravitational Waves. The LAT is the only gamma-ray observatory that can search for variability from the scale of ms, typical of GRBs, Solar Flares and Terrestrial Gamma-Ray Flashes, to the scale of days, typical of AGNs, and of years, that characterizes complex long-period binary systems. Finally, we propose to work on a virtualized computational model to preserve the ability to store and analyse Fermi heritage data for years to come and independently of changes to operating systems and underlying hardware. This project will leverage on the long existing experience with public data servers and analysis tools that the Fermi Collaboration and the Fermi Science Support Center maintain.

X-ray polarimetry. After about a decade of intensive technological developments, X-ray polarimeters based on Gas Pixel Detectors (GPD) have reached full maturity for application in astrophysical observations from space. The GPD couples an amplifying Gas Electron Multiplier (GEM) to a high density, 50 micron pitch, pixelated readout CMOS ASIC, and samples the photoelectron track inside the gas for each incoming event on the detector plane, thus significantly improving the efficiency of the measurement with respect to traditional, selective diffraction Bragg crystals. Additionally, the GPD intrinsically features excellent imaging and spectroscopic performance, therefore offering direct access to the traditional X-ray observables and adding for the first time the new dimension of polarization. A new generation of dedicated X-ray space telescopes based on this technology is emerging. They will measure with high accuracy the polarization of X-rays captured by the detector in the 1-10 keV regime. Besides providing images with arcsecond resolution, these instruments will measure the angle and the degree of polarization of X-rays from the parent sources, thus probing the curvature of space in the vicinity of black holes and neutron stars, verifying quantum electrodynamics in regions of extreme magnetic fields and opening a new discovery window on exotic phenomena like existence of axion-like particles. Two missions concepts, XIPE and IXPE rely on the GPD and have been selected in 2015 by the ESA and NASA space agencies for upcoming mission opportunities, and technical designs of the telescopes are being laid out. This shows the high technology readiness for space operations of X-ray polarimetry (between 5 and 6 on the standard ISO scale), and confirms the large interest in the science community for a first-ever survey of X-ray polarization from a significant number of sources. While polarization is in fact expected from many non-thermal sources in the sky, only a single, pioneering measurement of the bright Crab nebula was performed with standard imaging techniques coupled to selective polarimetric filters, which operate at very low sensitivity and resolution.

Cosmic Microwave Background (CMB) polarization measurements**.** This intriguing fundamental research field is now taking advantage of the technological advancements of the Transition Edge Sensors (TES) bolometers and microcalorimeters [7]. After WMAP and PLANCK CMB missions [8-10], the next goal is the search for the B-mode polarization features. B-modes give unique access to the primordial Universe physics at the inflation epoch, i.e. within few seconds after the big-bang and to the physics at energy scales of 10^{16} GeV. NEWS researchers are giving leading contributions to the development of bolometer and SQUID front-end electronics for the stratospheric balloon borne mission called Large Scale Polarization Explorer (LSPE) [11], scheduled to fly over the arctic in the winter 2017-2018. LSPE will measure the ratio of scalar to tensor components of the CMB polarization at the level of 1 % - 3 % at large angular scales (i.e. low multipoles), with with 1.3° FWHM angular resolution. LSPE will face the difficult work to extract the B-mode signal within a huge foreground. Therefore, in the next future a bigger and coordinate effort for a wide investigation of the overall CMB parameters is needed. This will require longer exposures and very large number of detectors. Two proposals are currently under discussion within the community: a medium-large size satellite mission, CORE++ , and the medium-small mission LiteBIRD in combination with the large ground telescope array called "Stage 4". Both proposals need huge arrays of polarization sensitive and multiband bolometers. The basic technology developments are at the first study phase in Europe while in the USA and Japan there are research institutes in advanced phase, thanks also to the step by step strategy of testing the detectors in ground and balloon telescopes. CALTECH is one of the most advanced centers for the study of very sensitive antenna coupled mm-wave bolometers that are very well suited for the next space, balloon and ground observations.

Muon Campus experiments at Fermilab and advanced superconducting techniques for particle accelerators and detectors. In the next decade the Muon Campus will provide the most intense pulsed muon-beams, which are among the cleanest probes when searching for new phenomena beyond the Standard Model (BSM) of fundamental interactions. The goal of the Muon (g-2) experiment at FNAL is to solve the puzzle originated by the existing 3 standard deviations discrepancy between the value of aμ predicted in the Standard Model (SM) and the measurement performed by the E-821 Collaboration at Brookhaven [12]. Muon (g-2) aims for a precision of 0.14 parts per million (ppm) on aμ, which corresponds to a factor of 4 improvement with respect to the BNL measurement. This accuracy will provide more than 5 standard deviations discrepancy from the existing theoretical prediction if the aμ central value remains unchanged. Mu2e will search for the Charged Lepton Flavour Violating (CLFV) neutrinoless, coherent muon conversion to an electron in the Coulomb field of a nucleus, with four orders of magnitude improved sensitivity with respect to previous experiments. The observation of lepton flavour violation in the neutral lepton sector, named "neutrino oscillations", was accommodated by an ad-hoc modification of the SM, but no mechanism within the model allows for a measurable rate of CLFV. The observation of CLFV would be an unambiguous evidence of new physics. An international program is currently underway to improve the sensitivity reach using muons probes, which are free of the complications of hadronic uncertainties. In Europe the upgrade of the MEG [13] experiment at Paul Scherrer Institute (PSI) has the goal to search for the muon decay in flight to an electron and a photon. There is also the new proposal of the Mu3e [14] experiment at PSI, whose goal is to search for the muon decay to e-e+e-. Mu2e at FNAL and COMET [15] at J-PARC will search for the muon coherent conversion to an electron in the Coulomb field of a nucleus. These experiments complement and extend the current MEG and Mu3e searches. CLFV phenomena probe new physics at a mass scale significantly beyond LHC direct searches and may provide the first evidence of new physics. Furthermore, many models predicting new physics at the mass scale accessible at LHC, also predict CLFV processes at rates within Mu2e reach. Mu2e will thus provide complementary information in case of a discovery at LHC [16]. In the Muon (g-2) and Mu2e experiments the NEWS researchers have leading roles in the detectors development and in the beam-line infrastructure. They have designed and will contribute to the construction of the Mu2e superconducting solenoid transporting the high intensity muon beam from the production to the stopping target, where muons decay or possibly convert. NEWS researchers will participate in the international effort for the development of the Nb_3Sn technology to produce 16 T Nb_3Sn solenoid and bending magnets, which are fundamental for future particle collider projects. In collaboration with FNAL and CALTECH, NEWS researchers will also develop superconductivity-based detectors, bolometers and microcalorimeters, for applications in cosmology, astrophysics and particle physics. These detectors are well suited for the multi-messenger approach, given the wide range of detectable radiation, from millimeter waves, to optical photons, X-rays, gamma-rays, nuclear decays and energetic particles. NEWS focus is on the development of Transition Edge Sensors (TES), which offer unprecedented detecting capabilities for LSPE and future experiments.

Methodological approach.

Gravitational-wave astronomy. The current network of detectors of gravitational waves is composed of three interferometers with state of the art sensitivity, Advanced Virgo in Europe and the two Advanced LIGO ones in USA. In the near future the Japanese KAGRA detector will join it. The sensitivity of Advanced Virgo is foreseen to evolve toward the final design one in successive steps (see right top of Figure #GW1). The NEWS researcher will be deeply involved in optimization of these incremental improvements and in the simultaneous activity of R/D is foreseen, in collaboration with the other members of gravitational wave community. The target of experimental and R&D efforts in the near future will be the study and implementation of techniques to improve the sensitivity of advanced gravitational wave detectors. The main noises which are relevant in the low frequency band, which is particularly interesting from the point of view of scientific motivations, are Seismic Noise, Newtonian Noise and Thermal Noise. Another noise which is quite important and relevant over all the frequency band is the Quantum one. Reducing seismic noise is mandatory to extend the bandwidth of detection below 10 Hz. Seismic noise couples to the apparatus both through the seismic attenuators transfer function (see left of Figure #GW1 for a schematic description of the Advanced Virgo seismic attenuation system), and through the actuators of the feed-back control used to keep the interferometer around the working point. The RMS relative motion of the mirrors of the interferometers, in order to have the interferometers in the correct working point, must be kept within 10^{-16}E while the residual noise re-injected above 10 [illegible]E must be below about10^{-21}E/$\sqrt{[illegible]E}$. This limit imposes severe constraints on the actuation dynamic range of the force. To increase further the detection bandwidth the control approach must be updated. This will be done both by improving the sensors and the control algorithms. Below 100 [illegible]E the signals are generally dominated by tilts. An attempt to realize low frequency tilt meters to improve the control strategy is in progress. In Advanced Virgo the platform of the inverted pendulum at which the Super Attenuator chain is hanged is controlled using accelerometer sensors. An important activity will be the extension of the use of adaptive optimal regulators, based on advanced control techniques. The NEWS researcher will participate to the collaborative effort in the Advanced GW detectors community to understand and implement these. Another relevant issue is the reduction of Newtonian Noise. For the Advanced detector generation the main goal is to develop a gravity-noise cancellation system. There are several steps needed for this. First, a detailed characterization of the detectors' sites will be carried out to characterize the seismic fields. This characterization is fundamental to the design of the seismic arrays for the purpose of noise cancellation.[17-18].

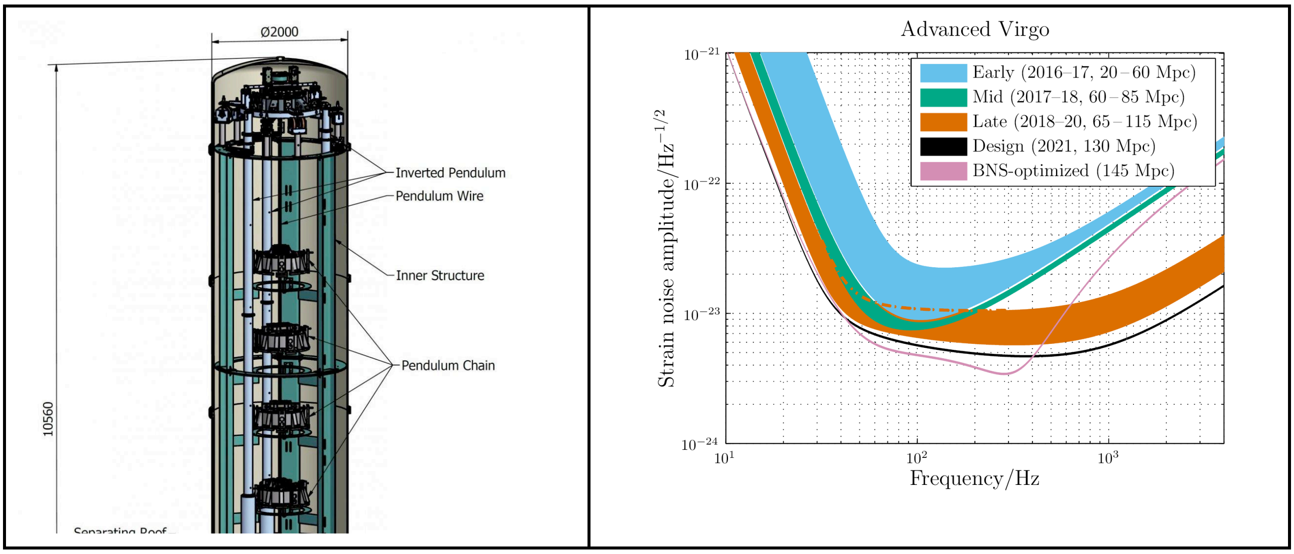

Fig. #GW1: (Left) the structure of an Advanced Virgo seismic attenuation tower. The basic principle is that a chain of oscillators provides a reduction of the seismic noise above the characteristic frequencies of the system. (Right Bottom) a detail of the attachment points between the Advanced Virgo mirror and the monolithic silica fibers suspension. (Right Top) The foreseen evolution of sensitivity curve for Advanced Virgo. An interferometric detector of gravitational waves has a large sensitivity band, which allows to detect a large number of sources and to extract accurately their parameters.

The characterization will be done using a large number of seismometers, combined with numerical simulations that will help to improve the noise model. The seismic arrays will be used also to attempt a first coherent detection of gravity noise in the gravitational-wave (GW) channel. As a byproduct, this will lead to the possibility of experimenting the method planned for noise cancellation: seismic arrays monitoring seismic displacement in the vicinity of the test masses will provide a coherent estimate of gravity noise, which can then be subtracted from the GW channel. While the average gravity noise is predicted to lie at the same level of other low-frequency noises in Advanced Virgo, the non-stationary nature of seismic fields can lead to much greater transient gravity noise. It is estimated that about 5% of the time, Newtonian noise will exceed other instrumental noise by a factor greater than 3 up to factors greater than 10. These transients can greatly limit the sensitivity towards low-frequency GW signals such as the merger of two intermediate-mass black holes. The challenge is therefore not only a reduction of the stationary component of gravity noise, but above all to reduce the number and power of these transients. The solution to this problem goes beyond conventional coherent filtering such as Wiener filtering, and more advanced solutions will be studied, using for example machine-learning algorithms to find optimal filters. It should be noted that most of the experience gained with the detection of gravity noise and the development of a cancellation system for Advanced Virgo will also directly be relevant to the LIGO detectors, and for the future ones like Kagra. Scientific exchange about this issue will involve several NEWS researcher and will be beneficial for the profit of the collaborations. A fundamental limit for the sensitivity is thermal noise. There are several different aspects of this problem. Suspension fused silica fibers need to be studied better, particularly from the point of view of their sensitivity to environmental effects. Understanding the losses connected to the bonding of the fibers to the mirrors is also crucial. Another aspect of thermal noise is the minimization of losses generated by the optical coatings of the mirrors, which can be done by doping the coating material[19-20]. In the Virgo collaboration a feasibility study for having a cryogenic detector at the EGO site as a upgrade is foreseen. Virgo has already installed a cryogenic line, at 77 K, implementing the cryotraps. The NEWS project will take advantage of the possibility of collaborating with Kagra, to compare their solutions with available methods for pulse tube noise attenuation. The last stage suspension system for screening the mirrors to the extra vibration will be designed, in such a way that an efficient thermal path for the propagation of the refrigeration power could be made available. New sensors compatible with cryogenic temperatures will be built and installed. Quantum noise is a fundamental limit for the detector sensitivity. Several strategies have been elaborated in order to reduce it, mostly based on the use of squeezed states of light. The production of squeezed states is a well demonstrated procedure. The peculiarity of squeezed light needed in gravitational wave experiments is that a good squeezing must be available at the comparatively low frequencies of interest for the sensitivity. The effort to increase the squeezing level and to demonstrate the possibility of tuning the squeezing angle in a frequency dependent way is ongoing with the participation of several NEWS researchers and is expected to produce relevant results in the next years.

Multi-messenger approach. NEWS scientists are deeply involved in the data analysis activities and in multi-messenger analysis which connect together researchers from different detectors and experiments. The multi-messenger approach opens new avenues in astrophysics. The EM signature will provide constraints on emission mechanisms, progenitors and energetics of the GW source and its environment. For transient GW sources, multiwavelength observations are crucial to find an EM counterpart and improve its localization, leading to the identification of the host galaxy and measurement of the redshift. This will allow to determine the EM intrinsic luminosity of the GW source and improve upon the measurement of its extrinsic GW properties (e.g. luminosity distance). This breaks degeneracies of the signal and obtains for the first time an independent measurement of the Hubble constant using general relativity as only calibrator [26-27]. EM observations will also help in supporting and guiding searches for continuous GW sources and will be crucial to probe the physics of matter at supranuclear densities that can not be tested on Earth laboratories and the environment of strongest gravitational fields in the Universe, leading to a breakthrough of paramount importance to both physics, astrophysics and cosmology. A first line of research consists in the real time identification of GW event candidates, with multiwavelength follow-up observations. The coalescence of compact objects, such as neutron stars (NSs) and/or black holes (BHs) are believed to be the most promising GW sources. Transients GW emitted in these events, as well as those from core-collapse of massive stars, will be ideal targets for our investigations. A multi-messenger study requires to promptly identify the candidate event in the GW data, send alerts to the astronomers and obtain prompt EM observations. The error region associated to the GW localizations is in the order of hundreds of square degrees. Therefore, EM observatories have to rapidly cover this large portion of the sky, identify and characterize as many EM transients as possible, in order to pinpoint the right EM counterpart. Low-latency detection and reconstruction of transient GWs with the Advanced LIGO-Virgo network must be developed and optimized, together with optimal EM observational strategies. Another line of research deals with the searches for continuous gravitational emission (CW) from pulsars, maximizing the information coming from EM observations. EM radiation is important to guide these searches, since it provides the rotational parameters for known pulsars, fundamental for targeted and narrow-band searches, or the localization of potential emitters, such as NSs in supernova remnants (SNRs) or gamma-ray unidentified sources. We will also need new robust and computationally efficient methods for more sensitive CW searches. A database of all available timing parameters of pulsars (i.e. sky position, spin frequency and its derivative), based on EM observations at various wavelengths will be implemented. The database will also include information on pulsar glitches, thought to generate burst-like GW signals, and a list of known astrophysical sources that could potentially host undiscovered pulsar (e.g. SNRs). A timing pipeline for gamma-ray pulsars will be also developed. Gamma-ray emitting pulsars, such as those discovered by Fermi-LAT, are very promising GW candidates, since they are young, very energetic and close. The continuous data stream of Fermi allows for a continuous monitoring of the time evolution of these pulsars, crucial to build updated timing solutions, that can be loaded in the database described previously and made accessible of all the CW pipelines. Searches for CW from isolated pulsars, both known and unknown (all-sky search), are typically performed using matched-filtering based methods and Hough-transform hierarchical approaches, respectively. Several improvements are foreseen: analysis pipelines will be integrated with the timing database, new methods will be implemented in order to improve the sensitivity of all-sky searches and the efficiency of GW follow-up methods for all-sky candidates. An efficient strategy to perform electromagnetic follow-up of interesting CW candidates identified in all-sky searches for unknown pulsars will also be defined. A search where the location accuracy provided by Fermi will be crucial is the one of continuous GW from pulsars in Fermi-LAT unidentified sources. These are likely NSs for which the position is relatively well known, while the rotational parameters are completely unknown. EM information will allow to perform deep searches by using semi-coherent methods. Another relevant issue is the search for continuous GW signals from NSs in binary systems. New techniques will target the so-called "irregular" binaries, where the perturbations due to orbital couplings or accretion disks must be taken into account. EM information will be crucial to restrict the parameter space to be explored, allowing for a reduction of the computational burden.

Fermi. The main instrument onboard Fermi, the Large Area Telescope, is composed of three subsystems. The core detector is a silicon-strip tracker-converter (TKR), serving the twofold purpose of (i) converting the incoming gamma rays into electron-positron pairs and (ii) reconstructing the positron and electron tracks to recover the original photon direction. The TKR has been integrated, tested and qualified for space operation by INFN and, with ~900,000 independent readout channels and over 73 m^2 of silicon active area, it is the largest silicon tracker ever built for space applications. In addition, a hodoscopic CsI(Tl) Calorimeter (CAL) measures the energy of the incoming gamma rays and helps suppressing hadronic backgrounds through 3D shower imaging. Finally an outer Anti-Coincidence Detector (ACD) made of plastic scintillator tiles discriminates photons from charged minimum ionizing cosmic rays and heavier ions. The Large Area Telescope has now been operating flawlessly in orbit for almost 8 years, with no appreciable sign of performance degradation. In fact the continuous effort that the collaboration has put into improving the event-level analysis and the high-level science analysis tools (incorporating the lessons learned from operating the instrument in space) has effectively resulted into a significant improvement of the detector sensitivity into all the relevant science areas. This improvement applies equally to the new data being collected, as well as to the archival data, that are periodically reprocessed and re-analysed. Continuing this process in the future, which is one of the objectives of this proposal, will be pivotal in taking full advantage of the enlarged statistics collected by the Fermi LAT, provide the deepest possible view of the high-energy gamma-ray sky, and maximize the science return from the new multi-messenger opportunities (most notably, the beginning of gravitational-wave and neutrino astronomy) that have just recently become available. Equally important, given the public nature of the Fermi data policy, is to guarantee that the Community at large has prompt access to the improvements in the data reduction and science analysis software developed by the Collaboration, and that the accessibility of the data and associated analysis tools is properly preserved after the end of the mission.

X-ray Polarimetry Explorers (XIPE). The photoelectric effect is an ideal analyzer for X-ray polarization measurements. The polarimetric signature is given by the direction of emission of the photoelectron that, for a K-shell absorption and 100% linearly polarized incident radiation, features a 100% intrinsic modulation around the polarization direction. The photoelectric effect is the physical process with the largest cross section below ~10 keV, making it well suited for this energy window, where the source fluxes are relatively large and the grazing-incidence optics provide reasonable efficiency. The main difficulty inherent to this approach (that for a long time prevented any practical implementation of a photoelectric polarimeter) is that at these energies electrons propagate in matter much less than photons. The Gas Pixel Detector couples an amplifying Gas Electron Multiplier (GEM) to a high density, 50 micron pitch, pixelated readout CMOS ASIC (Fig #XR1). The fine segmentation of the readout plane and the full integration of the latter with the front-end electronics allow for the first time to exploit the photoelectric effect for high-efficiency X-ray polarimetry and, simultaneously, imaging, timing and spectroscopy. These characteristics make the GPD the ideal candidate for the focal plane of a possible future polarimetric mission. The realization of a detector prototype built with space-grade materials to be tested and fully characterized in the lab, and the initial design of a space-grade data acquisition system are two fundamental milestones toward a successful concept for a space mission, and are part of this proposal. In addition, the optimization of the event reconstruction and classification, the implementation of an observation-simulation framework and the definition of the basic tools for high-level science analysis will also be part of the proposal.

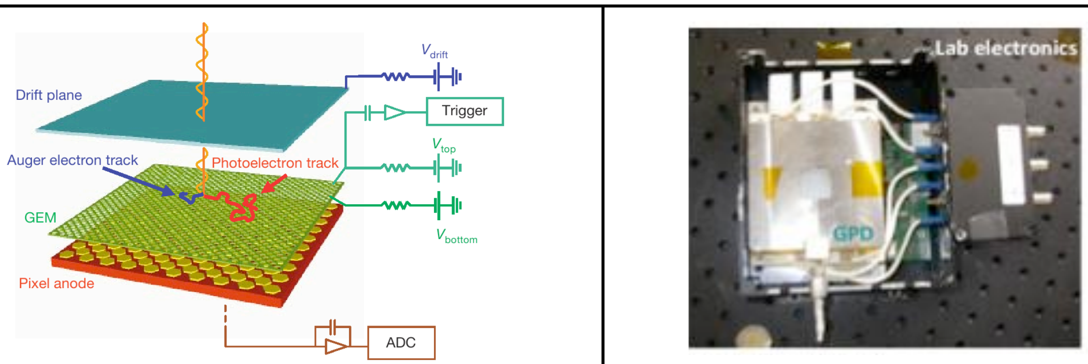

Fig. #XR1: (Left) Working principle of a Gas Pixel Detector; (Right) First prototype of a Gas Pixel Detector.

Transition Edge Sensors (TES). Superconductivity is applied to develop bolometers and microcalorimeters widely used in cosmology, astrophysics and particle physics. The achieved performance is excellent: from microwave bolometers for CMB with Noise Equivalent Power (NEP) down to 10^{-20} -10^{-19} W/H$^{1/2}$, to single photon detectors from THz-IR and UV with 0.1 eV FWHM energy resolution at 1550 nm, to X-ray with 1-2 eV FWHM energy resolution in the 0.1-10 keV and 50 eV FWHM in the 10-100 keV band. NEWS researches will focus on TES detectors. UNIGE has designed an array of about 300 TES bolometers with 3 frequency channels, one called "CMB channel" at 140 GHz, the other ones respectively at 220 and 240 GHz to monitor the level and slope of the polarized dust emission. The detector will be used in LSPE, which will provide an improvement with respect to Planck HFI of about a factor 3 -5, mainly due to a larger number of detectors (10x factor), integration time per beam (20x factor) and a better NET (10x factor).

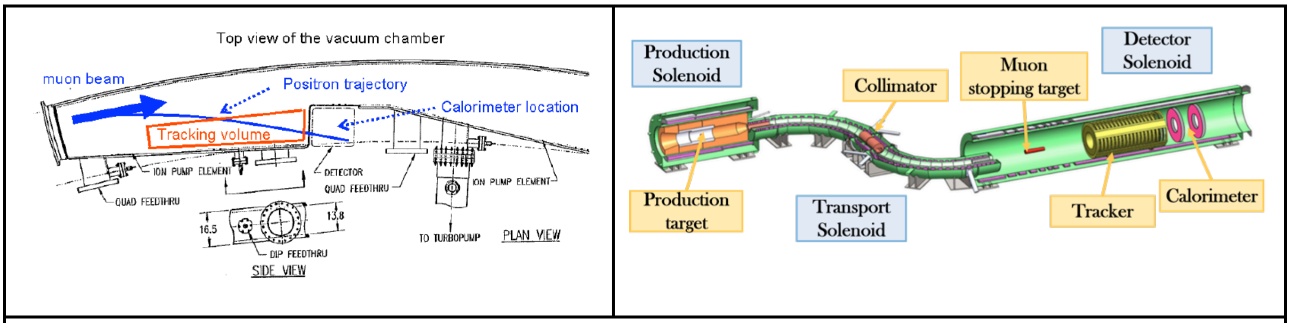

Fig. #MC1: (Left) the proposed Muon (g-2) apparatus. View of one of the three scallop regions instrumented with tracking detectors. The decay positrons exit the beam pipe and are detected inside the muon storage ring. (Right) the proposed Mu2e apparatus. Shielding and Cosmic Ray Veto that surround the Detector Solenoid, absorbers inside the Detector Solenoid, the extinction and stopping target monitors are not shown.

Balloon borne mission can test the readiness level of the technology for space application. NEWS researchers will also push TES technology to the far edge, in order to develop more advanced applications as single photon counting from the THz band, which has already been demonstrated, down to the GHz band. This would be extremely interesting for Axion searches, or searches for Axion-like particles as Dark Matter components. This will be pursued in collaboration with the FNAL researchers involved in the Axion Dark Matter Search (ADMX) project.

Muon Campus experiments at Fermilab. The goal of the Muon (g-2) is to measure the muon anomalous magnetic moment a_μ with an uncertainty of 0.14 ppm. This is an improvement of a factor of 4 with respect to the E-821 measurement. It requires a 20-fold increase in statistics and a 3-fold (or more) reduction of the systematics uncertainties. FNAL beam complex is fundamental to produce the necessary flux of muons, injected and stored in the original BNL storage ring relocated at FNAL. The experiment performs a precision measurement of the muon spin precession frequency ω_a, in the rotation around the ring, by detecting their decay positrons in 24 calorimeter stations positioned around the storage ring (Fig. #MC1 left). We expect to detect $1.8x10^{11}$ positrons in two years of data taking, between 2017 and 2019. The dominant sources of systematic errors in the BNL experiment were due to the photomultiplier gain stability and multi-positron pileup in the same calorimeter crystal. To reduce these systematic uncertainties, the calibration and gain stability of the calorimeter made of fast lead fluoride, with large area silicon photomultipliers (SiPM) readout, must be monitored at the per mil level. This is a one order of magnitude improvement with respect to any past or existing calibration system adopted for a calorimeter in HEP experiments. A state-of-the-art laser-based gain monitoring system has been designed by the INFN researchers. The innovative technique employs newly available pulsed diode lasers at 405 nm remotely controlled in intensity and rate on a microsecond timescale by custom electronics. Pileup events are identified by three straw-tracker detectors inside the storage ring vacuum chamber on the positron trajectory in front of three calorimeter stations ("tracking volume" in Fig. #MC1 left). NEWS researchers will setup calibration procedures for the calorimeter and measure the muon spin precession frequency ω_a. For the laser calibration system, the focus will be on the design of the rate of calibration pulses, rate and length of calibration runs, number of stored calibration parameters, all optimized in a automated procedure to give the exact quantities necessary to constrain the systematic errors on ω_a at the level of 0.02 ppm. NEWS researchers will also lead one of the blind analyses to measure the muon spin precession frequency ω_a in parallel with the US groups. The procedure of performing independent parallel analyses has proven very effective in the BNL experiment and will be adopted also in the Fermilab Muon (g-2) experiment. The goal of the Mu2e experiment is to improve the sensitivity on the neutrinoless, coherent muon to electron conversion by four orders of magnitude, from a branching fraction of $7x10^{-13}$ to $6x10^{-17}$, with respect to the Sindrum-II [21] experiment at PSI. This can be achieved with the FNAL Muon Campus pulsed-muon beam (10^{11} muons/s). To get rid of forward neutral background, a number of twisted solenoids transport the muons from the production target to the stopping target (Fig. #MC1 right). This unusual field configuration is created by three coupled solenoids in a row: the Production Solenoid (PS), the Transport Solenoid (TS) and the Detector Solenoid (DS). At the stopping aluminium target, the muon decay electrons are momentum analysed in the DS field from the target to the detector elements. 39 % of the stopped muons decay in orbit (DIO), while 61 % are captured in the aluminium nuclei. The CLFV signature is a single mono energetic electron (CE) with a momentum of 104,97 MeV. Low energy photons, neutrons and protons emitted in the nuclear capture process constitute an environmental background that produces a significant ionisation and neutron dose in the detection systems. A high-precision apparatus, made of a straw tube tracker, which uses the same technology as Muon (g-2), and an electromagnetic calorimeter based on Cesium Iodide crystals and placed inside the DS separates CE and DIO events. One of the detector operational challenges is the vacuum of 10^{-4} torr required to minimize the electron multiple scattering and bremsstrahlung. The calorimeter rejects background muons, provides a seed for tracking and a trigger signal. Mu2e data taking is expected to begin in the year 2020. INFN, UNIPI and Caltech are responsible of the construction of the Cesium Iodide (CsI) crystal calorimeter, HZDR of the neutron transport studies necessary to design the shielding of the Mu2e detectors and to perform radiation damage tests on the crystals and electronics components. INFN, HZDR and CALTECH will also develop the upgraded radiation hard calorimeter for Mu2e-II. CsI crystals are not adequate for the level of radiation expected for Mu2e-II. The plan is to use Barium Fluoride (BaF_2) scintillating crystals. BaF_2 has a fast light emission (1 ns) at a wavelength of 220 nm, but also a large slow component (600 ns) above 280 nm that is incompatible with operation in the Mu2e high event rate and has to be suppressed. A new kind of Avalanche PhotoDiode (APD), blind above 280 nm and highly efficient in the deep UV region, will be developed. INFN and CALTECH will design a solar-blind interference filter with an atomic layer deposition technique on silicon. The Mu2e Transport Solenoid is made of 52 coils arranged in 27 modules that form the S-shaped cold mass. Each coil is wound from Al-stabilized NbTi superconductor. Although FNAL and INFN have successfully designed and tested a prototype in 2015, technical challenges have to be overcome to develop an industrial process for the entire construction. FNAL, CERN and INFN are making great progress in the technology of Nb_3Sn which has superior superconducting properties than any alternative used in existing particle accelerators. This enables to use this innovative technology also for LHC upgrades. To this aim the development of 16 T Nb_3Sn magnets is required, which is still an exceptional challenge, since the Nb_3Sn is brittle and requires high temperature processing. With the stronger forces and higher stresses in the coil, mechanical design is crucial. In 2015 FNAL has fabricated and tested the first successful Nb_3Sn twin-aperture accelerator magnet, and has started the development of a 15 T Nb_3Sn dipole demonstrator for a 100 TeV scale hadron collider. We will provide a leading contribution to design a 16 T dipole for 2019. FNAL and POLIMI have developed a technique to deposit superconducting Nb_3Sn film on a niobium surface. Electro-deposition is scalable to any surface. This would allow using superconductors as surface coating as opposed to bulk wires and cables. Demonstration of deposition on an actual RF cavity surface would offer the potential of lower RF losses, operation at higher temperatures and RF critical fields than sheet niobium. We will study possible applications of the Nb_3Sn multi-layer film technology to this case. This effort will be complemented by the collaboration between UNIGE, FNAL and CALTECH to develop Transition Edge Detectors.

Inter-multidisciplinary aspects. The technological innovations developed by NEWS have many applications in other areas of basic and applied research and in non-academic and industrial fields. We give a only a few examples. The construction of flight GPDs for polarimetric missions will need hardware integration and test procedures to ensure qualification for space. In particular the GPD will require optimal sealing of the gas gaps, precision alignment of all mechanical components, chemical and physical stability of the integrated systems, application of space industry standards of quality assurance. The NEWS teams involved in this project, both at universities and industrial partners, will leverage on past experience in space hardware qualification and will develop a new set of skills to be applied to future space activities for science and commercial applications. The design and construction of the Mu2e CsI calorimeter and research for the upgraded BaF_2 calorimeter for Mu2e-II require a wide expertise in crystals, SiPM and associated front-end and fast digitization electronics, which have to be radiation resistant and magnetic field compatible. This technology can be applied to medical imaging, in the combination of PET and Magnetic Resonance Imaging (MRI), including ultra-high field MRI. Applications to HEP require silicon photosensors with improving performance, in terms of larger active areas and of quantum efficiency extended to higher frequency light. Mu2e is considering the rad-hard BaF_2 crystals for the calorimeter upgrade to exploit the BaF_2 fast light component which would provide time information. This time information may extend standard two-dimensional PET scanning to three dimensions. INFN, UNIPI and HZDR will develop a synergy for future developments in nuclear imaging with PET and PGI systems and for in-vivo dosimetry at proton and ion beams. The hostile Mu2e operational environment, in terms of magnetic field and radiation flux, limits the use of standard electronic devices. The presence of a 1 T field imposes to adopt coreless inductors or to develop alternatives to standard power supplies. The alternatives include air-wounded or printed circuit board inductors and commercial off-the-shelf DC-DC modules developed for applications outside HEP. The request of radiation resistant components reduces the available options. Preliminary studies show that commercial DC-DC modules, developed for medical instrumentation and compliant to strict EMC regulations, could be used. The European Community and US Government, through DOE agencies, are making huge investments in the next generation of High Performance Computing. HEP has historically not taken advantage of such resources and research is necessary to learn how to adapt our physics framework and codes to the environment of HPC. FNAL is leading this effort to provide adequate computing infrastructures for Muon (g-2) and Mu2e. Success in these areas would open up an enormous computing resource allowing for the next leap in facing complex physics analysis. The new technologies would be fundamental in many computation-intensive research areas, including basic research, engineering, earth and materials science, medical imaging, energy and security. KIPAC and the entire Fermi collaboration are defining the software tools for data archival and analysis to build the Fermi-LAT legacy archive. The distribution of public analysis tools for Fermi data created within NEWS will facilitate development of open source software culture and techniques for strengthening collaborations within the relevant communities of researchers, and dissemination of science and technology awareness in the society through outreach activities. The continuous sharing of methods and techniques between the astrophysicists and HEP communities involved in Fermi has proven to boost the scientific return of the mission as well as to create unanticipated partnerships. Several techniques used to separate the gravitational wave signals from the noise are computationally intensive and based on sophisticated data analysis techniques. These are expected to be applicable in several other fields: in particular noise cancellation techniques could have relevant application in geological prospection problems and data mining in general. A gravitational wave detector should reduce several kind of noises at the lowest level, and the techniques involved can be applied wherever a high sensitivity measurement, or a high level of isolation from environmental noise is needed. The advancements in Nb_3Sn technology, achieved through large long-term investments and collaborations between Europe and US, are opening the prospect of using this innovative technology for LHC upgrades and future circular machines. Nb_3Sn magnets with improved current carrying capacity reduce the cost and the accelerator energy, and open the possibility to a wider use of this technology, including applications to the energy sector, in accelerator-driven nuclear systems. The possible use of these magnets at non-cryogenic temperatures to generate lower intensity magnetic fields could allow applications in medical accelerators, including hadro-therapy, with no cryogenic infrastructure and a significant cost reduction.

Gender aspects. We will balance the gender composition of the NEWS Management Board and Scientific Board. One member of the NEWS Management Board will be appointed as gender officer, to achieve balance within the workforce, to monitor working conditions, to increase gender awareness, to promote women in science. We plan to achieve family-friendly working conditions, female speakers at the project training events, workshops and conferences, specific invitations to female students to visit the NEWS laboratories. We will promote networks with the women organization of the US laboratories and universities.

2.2. Quality and appropriateness of knowledge sharing among the participating organisations in light of the research and innovation objectives

To maximize knowledge sharing NEWS will use as much as possible secondments, and will strongly encourage participation to workshops, trainings and conferences.

Secondments. NEWS will maximize the collaboration and knowledge sharing among participants which are highly experienced and have leading roles in the construction of the experiments, as well as in data analysis. Detectors design and collected data analysis will thus be the product of continuous interaction between EU, US and Japanese researchers. This will require a significant presence of the EU researchers and engineers in the US and Japanese laboratories. An effort will be made to have researchers seconded in coincidence with the LIGO, Kagra, Fermi-LAT, Muon (g-2) and Mu2e Collaboration Meetings to maximize knowledge sharing and encourage EU researchers to present their results. Secondments of Virgo researchers will be very important at CALTECH for exchanging knowledge and planning activities with LIGO partners. In this case also we will try to overlap part of the secondments with LIGO/Virgo collaboration meetings. Secondments with Kagra are mainly important for instrumental activities, and typically a fraction of time is dedicated to direct experimental activities on Kagra facilities, both cryogenic and optical. For the Fermi-LAT data analysis the secondments at KIPAC will be crucial for knowledge sharing about analysis techniques, analysis packages development, algorithms development and optimization and compilation of the LAT gamma-ray source catalog. Secondments at KIPAC and MARSHALL for X-ray polarimetry will be used to develop the observation-simulation framework which will used to perform optimization and sensitivity studies for possible future polarimetric missions. Secondments of OIA, Prisma and Clever researchers will be crucial to build a lab-grade prototype of the Gas Pixel Detector and to design the basic components of a space-grade data acquisition system. For the Muon Campus experiments at FNAL, the secondments will be crucial for the Muon (g-2) detectors commissioning and data taking, since this will allow to the EU researchers to acquire a leading role in data analysis and in the development of the computing infrastructure. Early Stage Researchers that will get an invaluable training during the Muon (g-2) experiment data taking. One of the challenges of the Mu2e experiment is understanding the level of damage of the detector components due to the high radiation levels and neutron fluxes. The design of the upgraded BaF_2 crystal calorimeter for Mu2e-II will greatly benefit from the close collaboration between INFN, FNAL and HZDR researchers. HZDR provides access to the nElbe photo-neutron source, that is a leading European irradiation infrastructure. This will allow irradiation studies of the BaF_2 crystals and of the front-end electronics components and of the data acquisition components. This complements the tests that INFN can perform in Italy at the ENEA Neutron Generator at Frascati, which provides neutron sources at higher fixed energy. The involved Prisma and Clever researchers and engineers will be trained in the field of tests and development of radiation hard components from this collaboration. INFN researchers responsible of the design of the Mu2e Transport Solenoid superconducting magnets will be seconded at FNAL to share their knowledge with the FNAL researchers and engineers for the installation and commissioning of the magnetic system. POLIMI researchers involved in the development of state-of-the-art electrochemical techniques for Nb_3Sn thin layer deposition on Nb and Cu will be seconded at IHCE and at FNAL to optimize these techniques on an industrial scale. UNIGE researchers will be seconded at FNAL and CALTECH to develop Transition Edge Sensors.

Workshops. 3-day NEWS Workshops will be organized once a year to have a general discussion and review of the NEWS research activity. Participation in person will be strongly encouraged although remote participation will be possible.

Trainings. Most NEWS Institutions organize training events and Schools for researchers at all levels. NEWS will promote the participation to these events. The "INFN-LNF Spring School in Nuclear, Subnuclear and Astroparticle Physics" is dedicated to the training of young researchers in the fields of accelerators, future detectors, trigger and data-acquisition, future colliers, dark matter and astro-particle experiments, neutrino theory, cosmological surveys, heavy flavor and heavy ions physics, Higgs properties measurements, Beyond Standard Model theory and searches, and top physics. The "FNAL High Energy Physics Software School" is intended for young researchers with programming experience but limited experience in developing software within the framework of large computing projects. The course is general and applies to programming problems in any large experimental particle physics project. It will be beneficial for Early Stage Researchers involved in g-2, Mu2e and LIGO/Virgo and Fermi-LAT software development. HZDR contributes to the organization of the "OncoRay Postgraduate School" which trains physicists, engineers, biologists and physicians on Medical Radiation Sciences. This will be an ideal opportunity for researchers involved in particle detectors development with plans for a career in medical physics. Early Stage Researchers will attend one between the "U.S. Particle Accelerator School, Education in Beam Physics and Accelerator Technology", and the "CERN Accelerator School". POLIMI will organize a specific "School on Electrochemical Synthesis of Metallic Coatings" to provide a basic knowledge of electro-deposition techniques. NEWS researchers involved in the development of superconducting techniques for accelerators will be encouraged to attend the school. The "SLAC Summer Institute" is an annual event held in Kavli Auditorium at the SLAC National Accelerator Laboratory in July/August. The Institute is a ten-day Summer School with lectures and a mix of topical talks, SLAC tours and discussion sessions. Topics range from gravity, cosmic accelerators, dark matter searches, particle physics, neutrino physics. The LIGO/Virgo collaboration organize each year the GWADW workshop, a unique occasion for discussion about R/D issues in the gravitational wave community. Another important event is the GWPAW, which address data analysis issues. Ligo and Fermi organize joint "Ligo-Fermi workshops" focussed on topics of joint interest to both collaborations, including science enabled from coincident GRB/GW events and the electromagnetic follow-up. NEWS researchers will participate to these events. For the year 2017 researchers will participate to the GraWIToN[1] Schools dedicated to the data analysis and design and operation of gravitational waves detectors. UNIPI organizes the annual "Phd+: Research Valorization, Innovation and Entrepreneurial Mindset" program which aims at fostering innovation and entrepreneurial mind-set in PhD students and Experienced Researchers. It consists of a series of interactive lectures combined with mentoring activities, given by top-level experts in innovation and technology transfer. It is an excellent practice of training in research valorization, innovation and entrepreneurship, which has received national and international awards. The non-academic Institutions will have a precious role in training through the numerous secondments. Most key persons at the non-academic Institutions have a PhD in Physics or Engineering and are fully committed

[1] GraWIToN is an Initial Training Network, funded by European Commission under FP7-Marie-Curie-Actions for four years, since the 1st of February 2014.

to their training role. Since the research activities planned for the secondments are extremely advanced and specialized, specific training will be provided on a case-by-case basis by the members of the host staff.

Conferences. NEWS will strongly encourage the participation to International Conferences in physics and technology to present scientific results and be informed of the progresses in NEWS research areas. Examples are: IEEE Nuclear Science Symposium and Medical Imaging Conference, the Frontier Detector for Frontier Physics Conference, the International Conference on Calorimetry and High Energy Physics, the Vienna Conference on Instrumentation, the International Conference on Charged Lepton Flavor Violation, the International Conference on High Energy Physics, the annual American Physical Society Meetings, the International Symposium on Lepton Photon Interactions at High Energies, the Astroparticle Physics Conference, the High Energy Astrophysics Division Meetings, the International Fermi Symposium, the International Cosmic Ray Conference, the annual American Astrophysical Society Meetings, the Texas Symposium on Relativistic Astrophysics. Important conferences for the gravitational waves community are the Edoardo Amaldi conferences and the Marcel Grossmann meetings.

2.3. Quality of the proposed interaction between the participating organisations

Gravitational wave physics and detectors. In WP2, INFN, UNIPI and UNINA will collaborate on data analysis activities mainly together with CALTECH. INFN, UNIPI, UNIRO, UNINA, UNIPG and CNRS will be involved with CALTECH, NINS-NAOJ and ICRR in the discussion about third generation detectors. CNRS, INFN will collaborate mainly with CALTECH for the definition of a Virgo digital preservation structure. In WP3, the activities concerning the implementation of the optical structure for quantum noise reduction will be mainly of CNRS, UNINA, NINS-NAOJ and ICRR. There are several interactions between the partners of the project that will be needed for the activity about cryogeny. These will involve INFN, UNIRO, UNINA, UNIPG and Impex as an industrial partner. Some of these activities overlap with the activity about monolithic fiber suspension, which involve mainly INFN, UNIPG and Impex. The gravity gradient noise issue will need interaction mainly between INFN, UNINA, EGO and CALTECH. Finally advanced control techniques will involve mainly INFN, EGO and CALTECH.

Fermi data analysis and X-ray Polarimetry Explorers (XIPE). INFN, UNIPI, OKC, KTH, HOG, KIPAC and ICRR will collaborate on the Fermi-LAT data analysis. The team will develop the most complete catalog of stationary gamma ray emitters detected by Fermi. All analysis components will be updated. We will publish a new telescope event analysis package to extend analysis to ~1 TeV with increased angular and energy resolution. We will systematically revisit algorithms for finding source seeds and for cross-matching 4FGL with catalogs at other wavelengths to define source association. We will search for gamma-ray emission from targets in the sky known to host large concentration of Dark Matter. So far only upper limits on such emissions were found from LAT data, and converted to the most constraining limits on WIMP annihilation cross sections in the ~10 to ~100 GeV mass range. We will develop a common analysis framework to apply to all known and newly discovered targets, such as dwarf spheroidal galaxies expected to be found in the coming years from optical surveys. We have prospects for the next four years to exclude canonical WIMPs up to 400 GeV in case of no detection of gamma rays. We also extend real-time searches and alerts for gamma-ray transients to GW trigger. Localization of potential counterparts in gamma-rays will help constraining the position of the GW event and will be distributed rapidly through the Gamma-Ray bursts Coordination Network network. We will work on the definition of software tools for data archival and analysis to build the Fermi-LAT legacy archive. INFN, UNIPI, KTH, KIPAC and MARSHALL, with collaboration of Prisma, Clever and OIA, will build a fully functional laboratory prototype of a Gas Pixel Detector for the focal plane of an X-ray polarimetric mission. INFN and UNIPI have pioneered the development of efficient photoelectric X-ray polarimetry and have introduced a new detector concept which uses Gas Pixel Detectors to overcome the limitations of the traditional experimental techniques. OIA will provide a long-standing experience in producing components for space applications, to implement a space-grade system. UNIPI, INFN, KIPAC and MARSHALL will develop an observation-simulation framework which will be crucial to perform sensitivity studies for a possible future polarimetric mission and to develop the science analysis algorithms and tools.

Muon Campus experiments at FNAL. INFN will operate the Muon (g-2) laser-based calibration system. This is a crucial task, since the systematic uncertainty related to the calorimeter calibration stability was the dominant systematics on the BNL measurement and monitoring the gain stability at the per mil level is required. INFN will be responsible of the online and offline calibration procedures, including the choice of the rate of calibration pulses, rate and length of calibration runs, number of stored calibration parameters, all optimized in a automated procedure to give the exact quantities necessary to constrain the systematic errors on ω_a at the level of 0.02 ppm. INFN will collaborate with FNAL to develop the Muon (g-2) computing infrastructure, the GEANT4 detector simulation, and to foster the integration of the simulation production with the workflow management structure supported by the FNAL Scientific Computing Division. INFN will take leading roles in detectors operation, data taking, and in the data analysis to perform the measurement of the muon anomalous magnetic moment with the full statistics available in the year 2019 which will require a significant presence at Fermilab. INFN researchers will lead one of the blind analyses to measure the muon spin precession frequency ω_a in parallel with the US groups to publish the muon anomalous magnetic moment measurement with the same accuracy as the BNL experiment within the first year of NEWS, and with 4 times better accuracy within the NEWS completion. INFN is leading the project of the Mu2e CsI calorimeter and the R&D for the upgraded BaF_2 calorimeter for the Mu2e-II. Since a factor of 10 times higher muon intensity and radiation dose is expected for Mu2e-II in 2024, a design with the more radiation-hard BaF_2 crystal is under study. This crystal emits in two frequency bands: one is in the UV spectrum at 220 nm and is very fast, one is slower and in the near-visible region at 340 nm. To exploit the fast component, a solar-blind SiPM with photon detection efficiency extended to 200 nm has to be developed. The R&D plan is to achieve this performance by applying a solar-blind filter by atomic layer deposition over the photosensitive area of the silicon wafer. This will be developed by INFN and CALTECH. Prisma and Clever will develop the front-end electronics and data acquisition for the construction of a first BaF_2 matrix with complete readout for the test beam to measure prototype performance.

Advanced superconducting technologies for particle accelerators and detectors. FNAL and INFN have designed the coils wound from Al-stabilized NbTi superconductor for the Mu2e Transport Solenoid. The first prototype has been successfully tested at FNAL in 2015. INFN and FNAL will install the modules in the Mu2e beam-line within 2018. FNAL is also a world leader in the Nb_3Sn technology for high field magnets for future accelerators. FNAL and INFN are planning to design a 16 T prototype dipole with an aperture suitable for a future 100 TeV-scale hadron collider. POLIMI and FNAL are developing state-of-the-art electrochemical techniques for Nb_3Sn thin layer deposition on Nb and Cu. The goal is to apply this technology to superconducting Nb_3Sn wires, to improve critical current density and performance, and to superconducting Nb_3Sn radio-frequency cavities to increase accelerating gradient, reduce cooling requirements and decrease costs. FNAL Technical Division has a wide experience in Superconducting Radio Frequency (SRF) design, fabrication and testing. This experience will be merged with the long-standing POLIMI experience in electrochemical deposition techniques aiming at obtaining uniform superconducting deposit on curved surfaces and at improving scalability and reproducibility of the technique. POLIMI will study techniques to achieve the best uniformity and purity of the deposit. FRD and IHCE will collaborate with FNAL and POLIMI to optimize the electrochemical technique, and will provide the equipment to treat small radio-frequency cavities for the production of prototypes. UNIGE has a long standing-tradition in superconductivity applications to develop bolometers and microcalorimeters widely used in cosmology, astrophysics and particle physics. UNIGE will collaborate with CALTECH and FNAL to develop innovative Transition Edge Sensors, with possibly a data taking campaign in ground or balloon telescopes.

3. Impact

3.1. Enhancing the potential and future career perspectives of the staff members

NEWS will offer a unique opportunity to work in a world-class environment of academic research Institutions and non-academic Partners. All activities are at the frontier cutting-edge of technology in many areas, gravitational wave astronomy and detectors, particle radiation detectors for space and high-intensity accelerator beams, radiation hard and magnetic tolerant analog and digital electronics for space and medical applications, photosensors for high energy physics and medical applications, advanced laser calibration systems, simulations of radiation transport, high-speed computing infrastructures. This includes a strong participation to the international research programs in superconducting technologies to develop new advanced accelerators and detectors, and to the international effort to develop particle therapy in medical applications. This context will enhance the knowledge and develop the skills of the researchers and will open superior career prospects in academia and in industry. The secondments at CALTECH, KIPAC, FNAL, MARSHALL, NINS-NAOJ, ICRR and at the non-academic Partners in US and Europe will provide a world-class training with open access to a broad area of expertise. All the researchers will present their results at NEWS meetings and workshops and at international conferences. Secondments will favour future work opportunities with fellowships or contracts. NEWS will train a new generation of European scientists with a global approach through the exposition to the US research and industrial environment. NEWS research activities will create new collaborations and reinforce the existing ones between US and Europe. This will be beneficial to Europe innovation capacity, given US leadership in all the NEWS research and technological areas. The collaboration between US and Europe will continue after the end of the NEWS project, when LIGO/Virgo will have greatly contributed to gravitational wave astronomy and experimental techniques, g-2 will still be involved in data analysis and in possible plans for detector upgrades, and the Mu2e Collaboration will be at the beginning of data taking, and already deeply committed to Mu2e detector upgrades. The expected success of this collaboration between US, Japan and Europe has its roots in the extraordinary success of the collaboration on LIGO/Virgo, Fermi-LAT, and also on the Tevatron experiments, CDF and D0, which have trained generations of European researchers now at top-level positions in research Institutions and private companies. The merging of academic with non-academic partners will be beneficial to the training of the researchers and to reinforce the industrial innovation capacity. Secondments at these companies will be an opportunity for hands-on training.

3.2. Developing new and lasting research collaborations, achieving transfer of knowledge between participating organisations and contribution to improving research and innovation potential at the European and global levels

Development of new and lasting research collaborations. The European research Institutions leading the NEWS project already have crucial roles in the LIGO/Virgo, Fermi-LAT and in the Muon Campus experiments at FNAL. In terms of number of involved researchers, they are approximately 15% of the Virgo Collaboration, 45 % of the Fermi-LAT Collaboration and 15 % of the Muon (g-2) and Mu2e Collaborations. NEWS will significantly contribute to strengthen and develop these collaborations and increase the importance of the European contribution by giving a wide opportunity of secondments at the US laboratories. Intersectoral secondments will reinforce the collaboration between research Institutions and SMEs. This has already proven extremely effective for the collaboration between INFN and Prisma.
Self-sustainability of the partnership after the end of the project. The established collaboration will continue after the end of the NEWS project. The LIGO/Virgo, Fermi-LAT and the Muon Campus experiments at FNAL will be active and the European research Institutions will receive financial support from their national funding agencies well beyond the lifetime of the NEWS funding. In Europe the Virgo Collaboration receives funding from the Italian Institute of Nuclear Physics (INFN), the French Centre National de la Recherche Scientifique (CNRS), and the Netherlands Organization for Scientific Research. In Italy Fermi-LAT receives financial support from the Italian Space Agency (ASI), INFN, and the Italian Institute of Astrophysics (INAF), in Sweden from the K. A. Wallenberg Foundation, the Swedish Research Council, and the National Space Board. In Italy the Muon Campus experiments at FNAL receive funding from INFN.
Contribution of the project to the improvement of the research and innovation potential within Europe and/or worldwide. The research activities will create a new collaboration and reinforce the existing ones between US and Europe. This will be beneficial to European innovation capacity, given the leadership in accelerator technology and Intensity Frontier (FNAL), in the development of state-of-the-art detectors (INFN, UNIPI), integration of electronics and sensors (OIA, Prisma), high-speed computing (FNAL, KIPAC), as well as strong analysis skills for all the involved academic institutions. The collaboration between US, Japan and Europe will continue after the end of the NEWS project, when all experiments will be focusing on data analysis and, for some of them operating on ground, like g-2 , Mu2e, Virgo, upgrades will be planned. The long and successful experience of the scientific collaborations working on the Fermi observatory and on the Tevatron experiments at FNAL which has trained generations of European researchers who now occupy top-level positions in research Institutions and private companies, is an important asset of this project . The merging of academic with non-academic partners will be beneficial to the training of the researchers and to reinforce the industrial innovation capacity. Secondments at these companies will be an opportunity for hands-on training.

3.3. Quality of the proposed measures to exploit and disseminate the project results

Dissemination strategy. Maximum effort will be made to share the information, know-how and documents among the project participants. This “internal” dissemination will be achieved with the internal section of the NEWS web site, the web-based document repository, and the internal workshops and meetings. To maximize the visibility and the awareness of the project results in the scientific community we have a strong plan of “external” dissemination. The public NEWS web site will provide access to the project information, scientific publications, public deliverables and organized events. Results will be presented at international/national conferences/workshops, including conferences dedicated to technology, instrumentation, and electronics, in particle, astro-particle, space physics, accelerator technologies, where representatives from industries will be present. This facilitates contacts with industries working in the field and will disseminate project results to the wider community. Scientific and technological results will be published in peer-reviewed journals, also according to the guidelines for publication of the g-2, Mu2e Fermi-LAT and LIGO/Virgo Collaborations (if applicable). The most relevant journals will be Astronomy and Astrophysics, Astrophysical Journal, Astrophysical Journal Letter, Monthly Notices of the Royal Astronomical Society, Physical Review D, Physical Review Letters, Science, the Journal of Cosmology and Astroparticle Physics, Classical and Quantum Gravity, IEEE Transactions on Nuclear Science, Nuclear Instruments and Methods A, the Journal of Real-Time Image Processing, IEEE Transactions on Applied Superconductivity, Material Letters, Superconductor Science and Technology, Applied Physics Letters, Journal of Instrumentation, IEEE Transactions on Cloud Computing, and IEEE Transactions on Electron Devices. All publications will be available in open access repositories and an effort will be made to use widely accepted social networks, including Facebook, Twitter, LinkedIn. If a consortium partner should claim intellectual property rights which do not allow for a (early) dissemination of the results, the Management Board will discuss the issue and make a decision according to the Consortium Agreement. Maximum effort will be made to involve university students. The dissemination strategy among students will be supported by extremely effective initiatives as Summer Schools. UNIPI and FNAL organize the “Summer School at FNAL and other US Laboratories” for Master and first year PhD students. Although most students are hosted at FNAL, the School includes also opportunities at other US laboratories, including LIGO observatories, SLAC and other US space science laboratories. This is a 9-week internship accessible to students of all European Universities. Students are accepted in the research groups and perform an original research activity under the supervision of a scientist of the host laboratory. This is close to the idea of secondment. The School acknowledges 12 ECTS credits upon successful completion of the final exam with a UNIPI committee.

Expected impact. We are convinced our plan of “internal” dissemination will favour the communication of all our scientific results among all the NEWS participants, and the “external” dissemination plan will have a strong impact on the entire scientific community, as well as on the younger generations of European university students in scientific and technological disciplines.

Exploitation of results and intellectual property. Research Institutions will closely collaborate with the private sector for the success of the project, which will be mainly measured with the scientific achievements of the Muon Campus experiments. All results in this area will be published and made accessible to the scientific community with fast publication procedures. Maximum effort will be made to export the new developed detector technologies to future HEP experiments. The public and private sector partners will closely cooperate to develop industrial applications of the developed superconducting technologies for high field magnets, including electrochemical techniques. Rules for the protection of the Intellectual Property will be addressed in the Consortium Agreement, to establish a framework for the protection of applications also through patent application.

3.4. Quality of the proposed measures to communicate the project activities to different target audiences

Communication strategy. EGO has a communication office to promote events and activities to engage the public. EGO participates to the annual European Researchers’ Night with the organization of events, including guided tours of the Virgo laboratory. During the year EGO organizes seminars on gravitational waves followed by guided tours of Virgo for high school students and nights dedicated to the observation of the sky with optical telescopes. EGO researchers and experts of communication in science have organize special events to explain gravitational waves searchers to primary school kids. EGO has a public web site with a collection of multimedia files about Virgo, EGO and gravitational waves developed for an audience of science journalists, but adequate also for general public. The web site includes the list of physics conferences and events for public engagement. EGO publishes the online newspaper “h – The Gravitational Voice” twice per year. The publication reports the news from EGO and Virgo and the gravitational waves community but also from the scientific community around the world. Fermi-LAT Collaboration in US and Europe has a long-standing tradition in outreach and general public engagement, which is typical of NASA’s missions. A lot of material is available to the public, online web pages and brochures describing the science of NASA’s mission Fermi and gamma-ray astronomy, as well as providing information on what Fermi has seen in the almost eight years after launch. The Fermi-LAT Collaboration in US has an Education and Public Outreach team which has the mission to disseminate scientific and educational material based on NASA’s Astrophysics Division. Several online activities have been developed, including interactive applications with a all-sky maps that link to information about all the Fermi pulsars known so far, as well as videos and background information on Fermi and gamma-ray astronomy. NEWS researchers plan to adopt these initiatives to engage also the European public, with a special focus on high school students. In Europe KTH is extremely active in outreach, with an experimental program on cosmic-rays for high-school students, in collaboration with The Stockholm House of Science, a bi-annual public physics exhibition in a public park in collaboration with the Stockholm University, as long as various other media appearances and popular science publications. INFN is extremely active in outreach and NEWS researchers plan one annual “NEWS Open Day” at INFN. The INFN laboratories involved in NEWS will be open to the general public to show the detectors developed by the collaboration. This will be done in coincidence with the “European Researchers Night” initiatives which involve many Universities and Research Institutes in Europe and all Universities involved in NEWS. NEWS researchers will prepare posters describing the importance of research in the fields of gravitational waves, astroparticle and particle physics, with the many applications in applied technology. Special emphasis will be given to electronics, data acquisition, high-speed computing, optics. We also plan to open the INFN Laboratories at Frascati involved in Muon (g-2) and Mu2e research on crystal calorimeters to the participants of the annual event “Incontri di Fisica” (“Physics Meetings”). This is a refresher course for high school teachers with the aim of disseminating the latest physics advancements and promoting the teaching of modern physics in high schools. HZDR participates actively in the “Lange Nact der Wissenschaften” (“Night of Science”), organized by the network “Dresden - Stadt der Wissenschaften” (“Dresden - City of Science”) every year in the summer. HZDR researchers of the NEWS project will present their contributions with posters and presentations to the public. Every two years, the HZDR laboratories are opened to the public for an “Open Day”. HZDR press office will continuously advertise the HZDR involvement in the FNAL experiments and the related research in articles on the HZDR webpage and local newspapers. In coincidence with the annual NEWS Workshops, seminars and lectures will be given by the NEWS researchers to university students. NEWS laboratories will be open for demonstrations. The representatives of the non-academic Institutions will be available to discuss the prospects in research and development in industry. We also plan to develop a branch of the NEWS world web site dedicated to the description of the NEWS project research activity to the general public.

Expected impact. We are convinced the communication strategy is strong and the proposed actions will give an effective visibility to the NEWS project and will communicate to the general public the value and the potential impact of NEWS research activities. High-school and university students will get unique opportunities to be in contact with researchers from academic as well as non-academic Institutions.

4. Implementation

4.1. Coherence and effectiveness of the work plan, including appropriateness of the allocation of tasks and resources

Consistency and adequacy of the work plan and the activities proposed to reach the project objectives. The NEWS project is structured in 10 Work Packages, two are dedicated to gravitational wave physics and detectors, one to Fermi-LAT data analysis, one to X-ray polarimetry explorers, one to the FNAL Muon Campus experiments Muon (g-2) and Mu2e, two respectively to advanced superconducting techniques for particle accelerators and detectors, one to outreach and dissemination activities, one to transfer of knowledge activities, and the last one to management. This structure provides an adequate balance among all the relevant activities and an efficient organization of the work to reach the NEWS project objectives.

Credibility and feasibility of the project through the activities proposed. The activities proposed for the NEWS project are part of the research programs of well established and strong international collaborations, LIGO/Virgo, Fermi-LAT, Muon (g-2) and Mu2e, with well defined schedules already approved by European, US and Japanese financing agencies. NEWS proposed activities will reinforce these international collaborations.

Gender aspects. The NEWS project will promote the participation of women in all research and technological activities and at all responsibility levels. In particular, women will be included in the project management and will be encouraged to attend training courses, schools and workshops. The management will also ensure equal opportunity and working conditions for all participants, without any distinction on gender, ethnicity or religion. Moreover, since the project is mostly based on secondments in US, the presence of family services inside the laboratories (housing, kindergarten, summer camps for children, recreation services) allows all personnel the same opportunity for travelling.

4.2. Appropriateness of the management structures and procedures, including quality management and risk management

Network organisation and management structure. The project coordinator will take care of the financial management and of the submission to the EU officers of the periodic and final reports, as well as of the mid-term review meeting. The project coordinator will receive the funding from the European Commission and will be responsible for the appropriate distribution of the funds. The coordinator of each participant institution will provide the expenditure details to the project coordinator one month in advance of each financial report. The network management will consist of two boards: the Management Board (MB) and the Scientific Board (SB). Transfer of information among participants will be achieved with several tools. We will develop NEWS web site with public pages to maximize the outreach to the general public, and a private section to share documents and scientific information, including minutes of the MB and SB, internal reports, and papers submitted to journals but not published yet, only among the participants. We will create one mailing list for the MB members, one for the SB members, and one for all the participants to the project. The MB will organize General Meetings (GM) open to all the participants. The agenda will combine the common topics from different Work Packages (WP). Written proceedings, periodic reports on the WP activities and secondment/training progress will be available to all participants. Participant Institutions will observe and promote the principles of integrity in scientific research, including honesty in communication, objectivity, reliability in performing research, impartiality and independence, openness and accessibility, fairness in providing references and giving credit, and responsibility towards the scientists and researchers of the future. Adequate response, according to standard European procedures, to cases of scientific misconduct, including fabrication, falsification, or plagiarism, will be given.

Supervisory board. The Management Board (MB) is responsible of the financial and administrative management of the network and of approving the secondments planned by the Scientific Board. The MB is also responsible of the organization of the GM and of the dissemination issues, including network-wide workshops and schools. Each Institution will appoint one representative in the MB. MB members will be chosen to have a long-standing experience and international reputation in leading research teams and multi-institute projects, to guarantee the smooth network operation. One member of the MB will be appointed as gender officer. The MB will be chaired by the project coordinator that will appoint a deputy coordinator. The MB will meet every 3 months in person or through conference calls. The Scientific Board (SB) will ensure the implementation of the network's scientific and training program, monitor the progress of the research teams, ensure adequate communication and exchange of information among the teams, and plan the secondments and trainings. The SB members will be nominated at the first MB meeting. The SB will be composed of one representative of each participant institution and the coordinators of each Work Package, called WP managers. The WP managers will be appointed at the first MB meeting. They are responsible of appointing the WP Task Leaders. The SB will be chaired by one member of the MB and will meet every 3 months in person or through conference calls.

Progress monitoring. The progress of each WP activity will be monitored by a deliverable assessment procedure. The WP Leader and the corresponding Task Leader will be responsible of the preparation of each deliverable which will be reviewed by a committee selected among the participants to the project. The same procedure will be followed for the milestone assessment procedure. Training of the Early Stage Researchers will be closely monitored. Each ESR will have a supervisor, appointed by the SB and responsible of the ESR's research activity within the NEWS project. The supervisor will advise the ESR to present the important scientific results at international conferences and at the NEWS collaboration meetings.

Risk management at consortium level. Since the progress of a number of tasks depends on the completion of large systems, such as the LIGO/Virgo interferometers, or the FNAL accelerator complex, delays to the project may derive from changes of the US laboratories schedule. This risk will be mitigated monitoring the overall schedule progress and by revisiting the secondment plan accordingly. The European contributions will be separated from the US infrastructure as much as possible.

Intellectual Property Rights (IPR). IPR strategy will be in line with the Grant Agreement provisions. Agreements will be established to ensure IPR and National policies of all partners are respected. This concerns results which may have industrial or commercial application. In case a partner should claim intellectual property rights which do not allow for a (early) dissemination of results, the MB will discuss the issue and take a decision according to the strategy for industrial property protection at international level. Publication policy will follow the LIGO/Virgo, Fermi-LAT, Muon (g-2) and Mu2e rules: each publication on a piece of hardware or software will be signed only by the involved researchers. Publications which use the LIGO/Virgo, Fermi-LAT, Muon (g-2) or Mu2e data will be signed by all members of the collaborations.

Gender aspects. One member of the MB will be appointed as gender officer. Maximum effort will be made to achieve gender balance within the workforce, to monitor the working conditions, to increase gender awareness, to promote women in science. We plan to achieve family-friendly working conditions, female speakers at the project training events, workshops, and conferences, specific invitations to female students to visit the NEWS laboratories, network with FNAL women organization.

4.3. Appropriateness of the institutional environment (hosting arrangements, infrastructure)

Availability of the expertise and human resources to carry out the proposed research project.
All the NEWS Institutions are well-established research Institutions with highly qualified personnel with successful track-records over many years. NEWS will foster the collaboration between the Institutions to guarantee the necessary competences to carry out the research activities. NEWS researches have provided leading contributions to the design, operation and data analysis of the most important fundamental physics experiments, including the Virgo/LIGO interferometers, the Fermi-LAT, and are building and commissioning the Muon (g-2) and Mu2e experiments and the FNAL accelerator infrastructure. The industrial Institutions have provided products and services to the most important fundamental physics experiments in the world. All the NEWS Institutions have a long-standing expertise in outreach and communication, in some cases with dedicated personnel, and a lot of experience with European research with skilled administrative support.

Description of the necessary infrastructures and technical equipment.
INFN is the Italian public research institution dedicated to study the fundamental components of matter. INFN undertakes research in five different fields: theoretical physics, particle physics at accelerators, astro-particle physics, nuclear physics and detector development. It is composed of twenty departments and four national laboratories with mechanical and electrical shops, qualified technicians and engineers experienced in the detector design and construction. The Frascati National Laboratory has a beam test facility to test Mu2e-II calorimeter prototypes, and the synchrotron light radiation facility, DAFNE-Light, necessary to measure the transmittance of the Mu2e-II calorimeter scintillating crystals and the photon detection efficiency of the silicon photosensors. HZDR irradiation infrastructures will be available for the further irradiation campaigns. INFN facilities used for the design and construction of the LAT tracker will be used for the development of the XIPE detector prototypes. Flight hardware is handled in a class 10k cleanroom, equipped with gluing, bonding and probe stations, for ASIC assembly, and precision metrology equipment for detector alignment, and thermal chambers. UNIPI, UNIRO, UNIPG, UNINA, and UNIGE have independent infrastructures and also open and direct access to all INFN infrastructures. INFN and CNRS have built and operate the Virgo interferometer and provide financial support to the consortium EGO created to ensure the long term scientific exploitation of the Virgo interferometric antenna, as well as to foster European collaboration in this field. EGO pursues the main objectives to ensure the commissioning, the operation and the upgrades of the Virgos antenna, to create and run a computing center for data analysis, to ensure the maintenance of the Virgo site and its related infrastructures, and to promote R&D activities. CALTECH, together with the Massachusetts Institute of Technology (MIT), is one of the Institutions operating the LIGO observatories. Scientists at CALTECH had a key role in the design and construction of the LIGO interferometers, and are currently involved in the research and development aimed at further improving the capabilities of LIGO. CALTECH scientists are also deeply involved in the gravitational wave data analysis and in the theoretical modeling of the astrophysical sources responsible of emitting

gravitational waves. The National Astronomical Observatory of Japan (NINS-NAOJ) is the main center for astronomical research in Japan. NINS-NAOJ and ICRR are hosting a gravitational wave project office, which is responsible for the promotion, design and construction of KAGRA, a 3-km long gravitational wave interferometer installed in the Kamioka mine underground site. KAGRA, coordinated by ICRR and developed together with NINS-NAOJ, KEK and other Universities in Japan, will join the network of gravitational wave interferometers made by LIGO and Virgo and will participate in joint analysis of gravitational wave data. KIPAC is involved in the management of the operations of the Fermi-LAT experiment and hosts the Instrument Science Operation Center for the Fermi-LAT. KIPAC provides access to large parallel computing clusters, large memory machines, parallel file systems and visualization capabilities, with substantial allocations at the computing centers at Stanford and SLAC. MARSHALL has capabilities and projects supporting NASA's missions in three key areas: lifting from Earth, living and working in space, and understanding our world and beyond. FNAL Accelerator Division provides its expertise to produce particle beams for the Muon Campus intensity frontier experiments. The Technical Division supports all experiments and provides a versatile infrastructure acquired by the magnet scientists and engineers in superconducting materials, detectors and magnets. The Computing Division has world-class infrastructure with large mass storage systems, parallel computing systems, and wide area networking facilities that support data movement for large-scale collaborative science projects, such as CMS at LHC. FNAL has a strong coordination with US industry and universities. POLIMI is the leading Italian university in the field of Engineering and technology with world-level connections with the most qualified universities and industries. POLIMI has a well-equipped laboratory for applied electrochemistry research material, chemical characterization facilities, including analysis techniques, which complement FNAL infrastructures.

4.4. Competences, experience and complementarity of the participating organisations and their commitment to the project

NEWS Institutions have an extremely wide range of competences and a long-standing experience in fundamental physics research. US and Japanese Institutions are world leaders in the research and technological developments in the fields of gravitational wave astronomy and detectors, astroparticle and particle physics experiments at the intensity frontier. CALTECH is part of the collaboration operating the LIGO interferometer in US and has played a major role in the first observation of gravitational wave in the year 2016. This discovery has only been possible with the major contribution, in terms of technological advancements and data analysis, from the European INFN, CNRS, UNIPI, EGO, UNIRO, UNIPG, UNINA, which are also working on the commissioning of the Virgo interferometer. In the next few years the LIGO/Virgo Collaboration, with the LIGO and Virgo interferometers operating simultaneously, will make fundamental advancements in the field of gravitational wave astronomy. NINS-NAOJ and ICRR are developing the Japanese gravitational wave interferometer KAGRA and already have a tight collaboration with the European Institutions involved in NEWS. In collaboration with KIPAC and other international Institutions, the European INFN, UNIPI, KTH, OKC have designed and built and are currently operating the Fermi-LAT. Fermi is now the reference all-sky gamma-ray monitor in the network of multi-messenger observatories of extreme transient events where strong gamma-ray emission is expected. KIPAC is fundamental in the Fermi-LAT operation, the European Institutions have a leading role in data analysis. KIPAC, MARSHALL, INFN, UNIPI, KTH and OKC are also extremely active in the development of innovative X-ray polarization detectors for a new generation of satellite X-ray telescopes. Given the experience matured with Fermi-LAT, KIPAC and MARSHALL will implement an observation-simulation framework, INFN, UNIPI, KTH and OKC, will develop the detector. FNAL is world leader in accelerator infrastructures development and operation, in detector development and construction, in the management of large projects, which involve many detector subsystems operating in one single experiment, and will provide the Muon Campus infrastructures. INFN, UNIPI, HZDR are developing part of the accelerator infrastructure and Muon (g-2) and Mu2e detectors. INFN, UNIPI and HZDR will provide their long-standing expertise in calorimetry, photo-sensors, electronics, computing infrastructures, and will lead the data analysis effort. All the European industrial Institutions will provide highly qualified expertise and personnel that will be deeply involved in all technological aspects of the NEWS project.

5. Ethics Aspects

Research activities related to the NEWS project do not involve ethics issues, except the involvement of non-EU countries and the exportation of materials from EU to non-EU countries. This exportation involves just the detector components and the electronic and mechanical equipment needed for the construction and commissioning of the detectors. No personal data or any other ethically sensitive item will be exported. Ethical standard and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research is carried out. The research performed outside EU is compatible with the Union, National and International legislation and could have been legally conducted in one of the EU Member States.

6. Letters of Commitment of partner organisations

The letters of commitment are from the following Partners:
Nasa George C. Marshall Space Flight Center, signed by Nasser Barghouty, Manager;
Fermi Research Alliance, signed by Nigel S. Lockyer, Director of Fermilab;
KIPAC, Kavli Institute for Particle Astrophysics & Cosmology at Stanford University and the SLAC National Accelerator Laboratory, signed by Tom Abel Director of Kavli Institute for Particle Astrophysics & Cosmology;
Faraday Technology Inc., signed by E. Jennings Taylor, Vice President;
California Institute of Technology, LIGO Laboratory, signed by Dave H. Reitze Executive Director;
National Institutes of Natural Sciences of Japan, signed by Akio Komori, President;
Institute for Cosmic Ray Research (ICRR) University of Tokyo, signed by Masatake Ohashi, Director, KAGRA Observatory, ICRR;
Department of Physics, Missouri University, signed by Thomas Vojta, Chair of the Department of Physics;
Massachusetts Institute of Technology, Kavli Institute of Astrophysics, signed by Peter Fritschel, Director of the Kavli Institute of Astrophysics;
School of Science Hiroshima University, signed by Prof. Shinichi Take, Dean of the School of Science;
Tomsk Polytechnic University, signed by Valery P. Krivobokov, Head of the B.P. Weinberg Science and Education Centre of the Tomks Polytechnic University;
Ames Laboratory Iowa State University, signed by Prof. Vitalij K.Pecharsky;
Mitchell Institute for Fundamental Physics & Astronomy, Texas A&M University, signed by Prof. Louis E. Stringari;
The University of Hong Kong, Faculty of Science, signed by Prof. Quentin Parker, Associated Dean (Global), Faculty of Science, Director of the Laboratory for Space Science at the University of Hong Kong;
Jefferson Science Associates – Thomas Jefferson National Accelerator Facility, signed by Stuart Hendeson, Director.

Jefferson Science Associates
Thomas Jefferson National Accelerator Facility

April 15, 2019

To Whom It May Concern,

Thomas Jefferson National Accelerator Facility (TJNAF), managed and operated by Jefferson Science Associates (JSA), is pleased to extend this letter of support to the members of our user community submitting the proposal "NEWS" in their pursuit of the Marie Sktodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) program.

We are eager to continue the collaboration within the full suite of Jefferson Lab's scientific programs in fundamental hadron physics, QCD, particle physics and accelerator physics. In particular, the programs centered on the use of the world-leading polarized electron beam for experiments of light dark-matter search, ultra-dense matter equation of state, nucleon 3D imaging (partonic tomography in space and momentum) and superconducting radio-frequency applications offer exciting opportunities for discovery.

Should this effort be successful, a properly executed user agreement is required before accessing the TJNAF facility. More information on this process is found at https://science.energy.gov/userfacilities/userresources/useragreements/ or through the Jefferson Lab User Liaison Office. We look forward to continuing this important work.

Sincerely,

Stuart Henderson
Director

CC: A-M Valente, A. Seryi

TOMSK POLYTECHNIC UNIVERSITY
ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

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To whom it may concern

17 April 2019

The Tomsk Polytechnic University will be pleased to participate in the Marie Skłodowska - Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS".

The Department of Experimental Physics of Tomsk Polytechnic University is hosting several activities mainly in the following fields:

a) High temperature magnetron sputtering thin films deposition
b) Modelling of interaction of electrons, ions, and electromagnetic radiation with matter.

We collaborate with international partners and would warmly welcome scientific colleagues included in this proposal.

Specifically, the Tomsk Polytechnic University will:

a) act as a host institution for secondments from the NEWS participants;
b) provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives;
c) contribute to the knowledge exchange between Tomsk Polytechnic University and the NEWS participants.

These commitments are conditioned on Tomsk Polytechnic University priorities. Please note that all seconding personnel will require an appropriate visa to work in the Russian Federation and the home institutions for seconding personnel may be asked to sign a Non-Proprietary User Facility Agreement.

Sincerely,

Valery P. Krivobokov, DSc,

Head of the B.P. Weinberg Science and Education Centre of

Tomsk Polytechnic University

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Prof. Quentin A Parker
Associate Dean (Global)
Faculty of Science
The University of Hong Kong
Pokfulam Road, Hong Kong

To Whom It May Concern:

The University of Hong Kong's Laboratory for Space Research (www.lsr.hku.hk) is an interdisciplinary research grouping of about 40 academics, postdoctoral fellows and research postgraduate students that strives to play an important role in strategically positioning astrophysics, space and planetary science of both HKU and Hong Kong SAR to a higher level.

The LSR is well situated in a dynamic region of Asia to foster links with the space science community in China and globally as is already occurring. The LSR's interdisciplinary research launches various bids to exploit and access the emerging Mainland funding and research environment. We plan to develop multilateral and strategic partnerships with world-leading space science institutes, and participate in large, international, high-impact space missions. We see this as an effective means to better position the LSR, the Departments of Physics and Earth Sciences, the newly established Research Divisions of the Faculty of Science and so HKU, as a serious node of knowledge, expertise and capacity in space science and related disciplines.

As such we see this Horizon 2020 H2020-MSCA-RISE-2016 call project "NEWS" opportunity as perfectly filling our vision and mission and would warmly welcome colleagues on this proposal.

In particular, the LSR would be prepared to:
1. Host researchers and academics at HKU for collaborative visits
2. Provide a work environment for project visitors that supports collaboration and ensures the efficient undertaking of the project aims and directives while at HKU.
3. Contribute to the knowledge exchange between HKU-LSR and the lead institution including exchange visits among teams and institutes

We are looking forward to participating with you and moving forward on this key initiative.

Best regards,

19th March 2019
Quentin Parker, BSc, PhD, FRAS, FASA
Associate Dean (Global) - Faculty of Science
Director, Laboratory for Space Research
Member Academic Senate
The University of Hong Kong

MITCHELL INSTITUTE FOR FUNDAMENTAL PHYSICS & ASTRONOMY

TEXAS A&M UNIVERSITY

To Whom It May Concern:

The Department of Physics and Astronomy at Texas A&M University and the Mitchell Institute (MI) will be pleased to participate in the Marie Skłodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS". We have a long history of collaboration with international partners and would warmly welcome our scientific colleagues included in this proposal.

Specifically, MI will

1. Act as a host institution for secondments from the NEWS participants
2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives
3. Contribute to the knowledge exchange between MI and the NEWS participants.

Louis E. Strigari (strigari@tamu.edu)
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THE Ames Laboratory
Creating Materials & Energy Solutions
U.S. DEPARTMENT OF ENERGY

February 15, 2019

To whom it may concern

My group at Ames Laboratry, Iowa State University (AMES/ISU) will be pleased to participate in the Marie Skłodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS". The group a long and successful history of performing world-class research on rare earth-based intermetallic materials and collaborating with international partners, and would warmly welcome our scientific colleagues included in the NEWS.

Specifically, we will

- Act as a host for visiting scientists, professors and scholars from the NEWS participants.
- Provide a work environment for the visiting personnel (including office space and access to equipment to perform experiments) that encourages collaboration and ensures the efficient fulfillment of the project objectives.
- Support and contribute to the knowledge exchange between AMES/ISU and the NEWS participants.

These commitments are contingent on Field Work Project (FWP) priorities, receiving all DOE approvals including Contracting Officer approvals, and availability of FWP funding for such endeavors at AMES/ISU. Please note that all seconding personnel will require an appropriate visa to work in the United States and the home institutions for seconding personnel may be asked to sign relevant non-disclosure agreements.

Yours sincerely

Vitalij K. Pecharsky

Faculty Scientist and Field Work Project Leader
Ames Laboratory of the U.S. Department of Energy, and
Distinguished Professor
Department of Materials Science and Engineering, Iowa State University

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Ames Laboratory is operated by Iowa State University for the U.S. Department of Energy. Ames, Iowa 50011-3020

March 6, 2019

To Whom It May Concern:

Hiroshima University will be pleased to participate in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS". Hiroshima University has a history of collaborations with international partners and would warmly welcome our scientific colleagues included in this proposal.

Specifically, Hiroshima University will

1. Act as a host institution for secondment from NEWS participants.
2. Provide a work environment for the seconding personnel that encourages collaboration and ensure the efficient fulfillment of the project objectives.
3. Contribute to the knowledge exchange between Hiroshima University and NEWS participants.

These commitments are conditioned upon institutional and laboratory priorities. Please note that all seconding personnel will require an appropriate visa to work in Japan.

Sincerely,

Prof. Shinichi Take
Dean of the School of Science
Hiroshima University

Peter Fritschel
PHONE 617.253.8153
FAX 617.253.7014
pf@ligo.mit.edu

Massachusetts Institute of Technology
Kavli Institute for Astrophysics and Space Research
LIGO Laboratory
185 Albany Street, Building NW22-Room 295
Cambridge, Massachusetts 02139-4307

March 2, 2019

To whom it may concern,

The LIGO Laboratory at MIT will be pleased to participate in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2017) call proposal "NEWS", and to welcome and collaborate with our international colleagues included in this proposal.

In particular the LIGO Laboratory will:

- Act as a host for secondment from NEWS participants.
- Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project goals.
- Contribute to the exchange of knowledge between the LIGO Laboratory and the NEWS participants.

These commitments are conditioned upon project and Laboratory priorities.

Regards,

Peter Fritschel

Dr Peter Fritschel
Director, MIT LIGO group
Kavli Institute of Astrophysics

MISSOURI S&T

An equal opportunity institution

Physics Department

1315 N. Pine Street | Rolla, Missouri 65409-0640
Phone: 573-341-4781 | Email: physics@mst.edu | Web: physics.mst.edu

February 16, 2019

To whom it may concern:

The Physics Department at the Missouri University of Science and Technology (S&T), USA, would like to request to participate as a partner organization in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS"

Our department has a diverse portfolio of research which overlaps considerably with the topic of NEWS, encompassing gravitational physics, multi-messenger astrophysics and cosmology. Key department faculty members in these areas are: Prof. Marco Cavaglia, PI of the LIGO Scientific Collaboration (LSC) group at S&T, with expertise in gravitational-wave detection, astrophysics, data analysis, and machine learning as well as Prof. Shun Saito, with expertise in observational cosmology, large-scale structure, and data analysis. The group also includes several postdocs and graduate students.

As a partner organization, the Missouri S&T Physics Department will (contingent upon department resources and priorities):

1. Act as a host for secondments of NEWS participants.
2. Provide a collaborative work environment for the seconding researchers to ensure the efficient fulfillment of the project objectives.
3. Contribute to the exchange of knowledge between NEWS participants and Missouri S&T researchers.

We foresee many mutually beneficial interactions between the S&T Physics Department and NEWS.

Sincerely,

Thomas Vojta

Thomas Vojta
Curators' Distinguished Professor and Department Chair

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

March 31, 2017

Reply to Attn of: ST12

Dr. Luca Baldini
Istituto Nazionale di Fisica Nucleare –Sezione di Pisa
Largo Bruno Pontecorvo 3
I-56127
Pisa, ITALY

Dear Dr. Baldini,

The Astrophysics Branch at the NASA Marshall Space Flight Center (MSFC) will be pleased to participate in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) "NEWS" proposal. MSFC has a long history of collaboration with international partners and would welcome our scientific colleagues included in this proposal. Specifically, the NASA MSFC Astrophysics Branch will:

1. Act as a host institution for secondment from the NEWS participants.
2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives.
3. Contribute to the knowledge exchange between the NASA MSFC Astrophysics Branch and the NEWS participants.

Please note that all seconding personnel will require an appropriate visa to work in the United States. In addition, a NASA Visiting Researcher Agreement will be required to support this activity and must be in force before travel commences for the NEWS participants. The NASA Headquarters' Office of International and Interagency Relations will prepare the Visiting Research Agreement for signature by INFN.

Sincerely,

Nasser Barghouty, Ph.D.
Manager
Astrophysics Branch, Code ST12
NASA Marshall Space Flight Center

Fermilab

Fermi National Accelerator Laboratory

Nigel S Lockyer
Director

P.O. Box 500, MS 200
Kirk Road and Pine Street
Batavia, Illinois 60510-5011 USA
Office: 630.840.6723
lockyer@fnal.gov

8 April 2016

To Whom It May Concern:

Fermi National Accelerator Laboratory (Fermilab) will be pleased to participate in the Marie Skłodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS". Fermilab is constructing a Muon Campus to host two world-class experiments exploiting muons to perform discovery science. We have a long history of collaboration with international partners and would warmly welcome our scientific colleagues included in this proposal.

Specifically, Fermilab will

1. Act as a host institution for secondments from the NEWS participants
2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives
3. Contribute to the knowledge exchange between Fermilab and the NEWS participants.

These commitments are conditioned on laboratory priorities, receiving all DOE approvals including Contracting Officer approvals, and availability of funding for such endeavors at Fermilab. Please note that all seconding personnel will require an appropriate visa to work in the United States and the home institutions for seconding personnel may be asked to sign a Non-Proprietary User Facility Agreement.

Sincerely,

Dr. Nigel Lockyer
Director, Fermi National Accelerator Laboratory

cc: E. Barzi
S. Donati

Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science   www.fnal.gov

KIPAC KAVLI INSTITUTE FOR PARTICLE ASTROPHYSICS & COSMOLOGY

at Stanford University and the SLAC National Accelerator Laboratory
P.O. Box 20450 - MS 29 - Stanford, CA 94309, http://kipac.stanford.edu/

April 7, 2016

To Whom It May Concern

The Kavli Institute for Particle Astrophysics and Cosmology will be pleased to participate in the Marie Skłodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS". KIPAC has a long history of collaboration with international partners and would warmly welcome our scientific colleagues included in this proposal.

Specifically, KIPAC will:

1. Act as a host Institution for secondment from the NEWS participants.

2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives.

3. Contribute to the knowledge exchange between KIPAC and the NEWS participants.

Please note that all seconding personnel will require an appropriate visa to work in the United States.

Sincerely,

Tom Abel
Director
Kavli Institute for Particle Astrophysics and Cosmology

FARADAY TECHNOLOGY, INC.

11 April 2016

To Whom It May Concern:

Faraday Technology, Inc. will be pleased to participate in the Marie Sklodowska- Curie Research and Innovative Training Networks (H2020-MSCA-RISE-2016) call proposal "NEWS". Faraday has developed a patented electropolishing technology for surface finishing of niobium, without the use of hydrofluoric acid, termed FARADAYIC® HF-FREE EP for niobium SRF cavities.

Specifically, Faraday Technology will:

1. Act as a host institution for secondments from the NEWS participants

2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives, specifically as it applies to the design of research activities focused on the application of FARADAYIC® HF-FREE EP as applied to the project.

3. Contribute to the knowledge exchange between Faraday Technology and the NEWS participants.

These commitments are conditioned on company priorities as they are aligned with project scope and activities, and conditioned upon ongoing funded activities in this technical area at Faraday throughout the course of the program. Faraday will not pay for any of the costs associated with the seconding personnel while working either on-site at Faraday or at another institution within the group. Please note that all seconding personnel will require an appropriate visa to work in the United States and Faraday will not contribute to the cost of obtaining this visa. Furthermore, the home institutions and/or seconding personnel may be asked to sign Non-Disclosure and Intellectual Property Agreements, contingent upon project scope.

We wish you luck with your proposal, and look forward to working with you on this activity.

Sincerely,

E. Jennings Taylor
Vice President

Faraday Technology, Inc. • 315 Huls Drive • Englewood, OH 45315
Phone: (937) 836-7749 • Fax (937) 836-9498
http://www.faradaytechnology.com

LIGO LABORATORY
MC 100-36
PASADENA CA 91125

TEL: 626.395.2129
FAX: 626.304.9834

Date: April 23, 2016
Refer to: LIGO – L1600067-v2

To Whom It May Concern,

The LIGO Laboratory, California Institute of Technology will be pleased to participate in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal NEWS. LIGO has a long history of collaboration with Virgo and would warmly welcome our scientific colleagues included in this proposal.

Specifically, LIGO Laboratory/Caltech will:

1. Act as a host Institution for secondment from the NEWS participants.
2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives.
3. Contribute to the knowledge exchange between LIGO Laboratory and the NEWS participants.

Please note that all seconding personnel will require an appropriate visa to work in the United States.

Sincerely,

Dave H. Reitze
Executive Director, LIGO Laboratory

CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Page 1 of 1

NINS

INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
NATIONAL INSTITUTES OF NATURAL SCIENCES
4-3-13-2F Toranomon, Minato-ku, Tokyo 105-0001, Japan
Phone: +81-3-5425-1300 Fax: +81-3-5425-2049
http://www.nins.jp

April 3, 2017

To Whom It May Concern,

The National Institutes of Natural Sciences, National Astronomical Observatory of Japan ("NINS, NAOJ") will be pleased to participate in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2016) call proposal "NEWS". NINS, NAOJ has a long history of collaboration with international partners and would warmly welcome our scientific colleagues included in this proposal.

Specifically, NINS, NAOJ will:

1. Act as a host institution for secondment from NEWS participants.

2. Provide a work environment for the seconding personnel that encourages collaboration and ensures the efficient fulfillment of the project objectives.

3. Contribute to the knowledge exchange between NINS, NAOJ and the NEWS participants.

These commitments are conditioned upon institutional and laboratory priorities. Please note that all seconding personnel will require an appropriate visa to work in Japan.

Sincerely,

Akio KOMORI
President
National Institutes of Natural Sciences

November 9, 2017

To whom it may concern,

KAGRA is a large-scale gravitational wave project that has unique features of underground site and cryogenic mirrors. It is hosted by the KAGRA Observatory of the Institute for Cosmic Ray Research (ICRR) of the University of Tokyo. The KAGRA project will be pleased to participate in the Marie Sklodowska-Curie Research and Innovation Staff Exchange (H2020-MSCA-RISE-2017) call proposal "NEWS". KAGRA is an international collaboration and would warmly welcome our scientific colleagues included in this proposal.

In particular, KAGRA will:

1. Act as a host for secondment from NEWS participants.
2. Provide a work environment for the seconding personnel that encourages collaboration and ensure the efficient fulfillment of the project objectives.
3. Contribute to the knowledge exchange between KAGRA and NEWS participants.

These commitments are conditioned upon project and observatory priorities.

Sincerely yours,

Takaaki Kajita
PI, The KAGRA project,

Masatake Ohashi
Director, KAGRA Observatory, ICRR

INSTITUTE FOR COSMIC RAY RESEARCH
THE UNIVERSITY OF TOKYO
5-1-5 KASHIWANOHA, KASHIWA-SHI, CHIBA-KEN, 277-8582, JAPAN Telephone: 04- 7136- Fax: 04- 7136-

Marie Skłodowska-Curie Actions (MSCA)
Research and Innovation Staff Exchange (RISE)
H2020-MSCA-RISE-2016

Project Acronym: NEWS – Project Number: 734303
Annex 1 to the Grant Agreement
(Description of the Action)
Part B

ESTIMATED BUDGET FOR THE ACTION

	Number of units (person-months)
1. INFN	160.00
2. HZDR	6.00
3. Prisma	9.00
4. POLIMI	10.00
5. CLEVER	20.00
6. UNIGE	27.00
7. UNIPI	18.00
8. OCK	16.00
9. KTH	13.00
10. CNRS	14.00
11. UNIPG	30.00
12. UNIRO	3.00
13. Impex	1.00
14. EGO	11.00
15. UNINA	8.00
23. HOG	2.00
Total consortium	348.00

	Estimated eligible[1] costs (per budget category)							EU contribution		
	A. Costs for seconded staff members		B. Institutional costs				Total costs	Reimbursement rate %	Maximum EU contribution[2]	Maximum grant amount[3]
			B.1. Research, training and networking costs		B2. Management and indirect[4] costs					
Form of costs[5]	Unit		Unit		Unit					
	Costs per unit[6]	Total a[7]	Costs per unit[6]	Total b[7]	Costs per unit[6]	Total c[7]	d = a+b+c	e	f	g
1. INFN	2 000.00	320 000.00	1 800.00	288 000.00	700.00	112 000.00	720 000.00	100.00	720 000.00	720 000.00
2. HZDR	2 000.00	12 000.00	1 800.00	10 800.00	700.00	4 200.00	27 000.00	100.00	27 000.00	27 000.00
3. Prisma	2 000.00	18 000.00	1 800.00	16 200.00	700.00	6 300.00	40 500.00	100.00	40 500.00	40 500.00
4. POLIMI	2 000.00	20 000.00	1 800.00	18 000.00	700.00	7 000.00	45 000.00	100.00	45 000.00	45 000.00
5. CLEVER	2 000.00	40 000.00	1 800.00	36 000.00	700.00	14 000.00	90 000.00	100.00	90 000.00	90 000.00
6. UNIGE	2 000.00	54 000.00	1 800.00	48 600.00	700.00	18 900.00	121 500.00	100.00	121 500.00	121 500.00
7. UNIPI	2 000.00	36 000.00	1 800.00	32 400.00	700.00	12 600.00	81 000.00	100.00	81 000.00	81 000.00
8. OCK	2 000.00	32 000.00	1 800.00	28 800.00	700.00	11 200.00	72 000.00	100.00	72 000.00	72 000.00
9. KTH	2 000.00	26 000.00	1 800.00	23 400.00	700.00	9 100.00	58 500.00	100.00	58 500.00	58 500.00
10. CNRS	2 000.00	28 000.00	1 800.00	25 200.00	700.00	9 800.00	63 000.00	100.00	63 000.00	63 000.00
11. UNIPG	2 000.00	60 000.00	1 800.00	54 000.00	700.00	21 000.00	135 000.00	100.00	135 000.00	135 000.00
12. UNIRO	2 000.00	6 000.00	1 800.00	5 400.00	700.00	2 100.00	13 500.00	100.00	13 500.00	13 500.00
13. Impex	2 000.00	2 000.00	1 800.00	1 800.00	700.00	700.00	4 500.00	100.00	4 500.00	4 500.00
14. EGO	2 000.00	22 000.00	1 800.00	19 800.00	700.00	7 700.00	49 500.00	100.00	49 500.00	49 500.00
15. UNINA	2 000.00	16 000.00	1 800.00	14 400.00	700.00	5 600.00	36 000.00	100.00	36 000.00	36 000.00
23. HOG	2 000.00	4 000.00	1 800.00	3 600.00	700.00	1 400.00	9 000.00	100.00	9 000.00	9 000.00
Total consortium	n/a	696 000.00	n/a	626 400.00	n/a	243 600.00	1 566 000.00	100.00	1 566 000.00	1 566 000.00

1 See Article 6 for the eligibility conditions.
2 This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the Commission/Agency decided to grant for the action) (see Article 5.1).
3 The 'maximum grant amount' is the maximum grant amount decided by the Commission/Agency. It normally corresponds to the requested grant, but may be lower.

ESTIMATED BUDGET FOR THE ACTION

[4] The indirect costs covered by the operating grant (received under any EU or Euratom funding programme; see Article 6.3(b)) are ineligible under the GA. Therefore, a beneficiary that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant (i.e. the unit cost for management and indirect costs will be halved for person-months that are incurred during the period covered by the operating grant), unless it can demonstrate that the operating grant does not cover any costs of the action.

[5] See Article 5 for forms of costs.

[6] See Annex 2a 'Additional information on the estimated budget' for the details on the costs per unit.

[7] Total = costs per unit x number of units (person - months)

European Commission

FUNDING & TENDERS PORTAL DIGITAL SEAL

Digitally sealed by the European Commission
Date: 2019.04.19 17:10:16 CEST