Background Information:
Examples for FP7 projects concerning Researcher Mobility and Training Programmes

<table>
<tr><td colspan="2">ASTROFIT – Astronomy Fellowships in Italy</td></tr>
<tr><td>Project period: 01.11.2011- 31.10.2015</td><td>Project status: Execution</td></tr>
<tr><td colspan="2">Objective</td></tr>
<tr><td colspan="2">Astrophysics research has typically an international dimension, since most of the projects require large collaborations. Many scientific projects are conducted by international teams. It is therefore essential that young researchers have the opportunity to work with teams in different countries. INAF the Italian Institute for Astrophysics- intends to launch a programme of incoming mobility for researchers non-resident in Italy. The AstroFIt programme here proposed will allow INAF to set up for the first time such a programme.
The fellowships will be carried out at INAF structures, that include 19 Institutes broadly distributed in Italy and the Telescopio Nazionale Galileo (TNG) in the Canary Island.
Two mobility types will be implemented: a) Incoming Mobility and b) Re-integration fellowships. Both types are of utmost importance for INAF, considering the so-called brain drain phenomenon, not counterbalanced by an adequate attractiveness of Italian research centres for foreign scientists. Both the proposed types of fellowship try to invert this tendency.
The limited number of fellowships foreseen is due to the fact that AstroFIt Programme is an integration of other international scientific collaborations, schemes and initiatives in which INAF is already involved. Nevertheless, Astrofit is important because unrelated to a single scientific programme but is devised to the strengthening of the fellows capabilities in working in an environment different from the environment where initial training was achieved.
The program will be 4-year long. Fourteen (14) fellowships will be offered, with two calls, each one including 3 Incoming mobility fellowships and 4 Re-integration fellowships. Every fellowship will last two years. All the fellowships will be easily completed within its 4-year duration, including a final meeting to present and discuss the programme results.</td></tr>
<tr><td colspan="2">Project Details</td></tr>
<tr><td>Project Reference: 267251</td><td>Project Cost: 1532454 EURO</td></tr>
<tr><td>Programme Type: FP7 People</td><td>Project Funding: 612981 EURO</td></tr>
<tr><td>Subprogramme Area: Marie-Curie Action: "Co-funding of regional, National and International Programmes"</td><td></td></tr>
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CAFEGROUPS - Cooling, AGN Feedback and Evolution in Groups	
Project period: 01.01.2012-31.12.2014	Project status: Execution
Objective	
This proposal aims to facilitate close collaboration between researchers in the UK, Italy, USA and India to study the nature and consequences of the energy transferred from supermassive black holes at the centres of galaxies to the surrounding intergalactic medium (IGM) in groups of galaxies. The research combines data from opposite ends of the electromagnetic spectrum: low-frequency radio observations track the history of outbursts from the black holes, while X-ray data allow us to determine their effects on the ten-million-Kelvin gas of the IGM. The partner institutions have long records of internationally-recognised research in these areas. The University of Birmingham is one of the top few teams worldwide in the study of groups with a solid track record in X-ray astronomy (particularly using ESA's XMM-Newton X-ray observatory), while the INAF-Instituto di Radioastronomia provide access to some of Europe's best experts in the low-frequency radio regime. The Smithsonian Astrophysical Observatory (US) is the home of NASA's Chandra X-ray observatory, and has a strong claim as the preeminent X-ray astronomy institution worldwide, while the National Centre for Radio Astrophysics (India) operates the Giant Meterwave Radio Telescope (GMRT), the first and currently the only radio observatory to achieve high spatial resolution and sensitivity at low frequencies. The collaboration will bring together experts with diverse skills to study closely one of the outstanding puzzles of modern astrophysics, providing direct benefits to the European institutions involved, the wider scientific community, and to the European Research Area as a whole, through increased scientific returns from current European facilities, increased access to international resources, and the scientific and theoretical tools for wide range of future studies with Europe-based facilities (e. g. , the European LOFAR radio observatory and ESA International X-ray Observatory).	
Project Details	
Project Reference: 247653	Project Cost: 133200 EURO
Programme Type: FP7 People	Project Funding: 133200 EURO
Subprogramme Area: Marie Curie International Research Staff Exchange Scheme (IRSES)	
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Project Coordinator: The University of Birmingham Robert Fekete (administrative contact) Edgbaston Birmingham B15 2TT United Kingdom r.fekete@bham.ac.uk Tel:+44-1214158202 Fax:+44-1214146056	Project partner: Istituto Nazionale di Astrofisica Dr. Luigina FERETTI Viale del Parco Mellini 84 00136 ROMA Italy lferetti@ira.inaf.it Tel:+39-0516399400 Fax:+39-0516399431

ELIXIR - EarLy universe exploration with nirspec	
Project period: 01.12.2008 – 30.11.2012	Project status: Execution

Objective

This network proposes to develop European expertise in searches for primeval galaxies and in the extraction of key physical information from deep sky observations, to ensure the maximum scientific return of the European instrument NIRSpec on board the future James Webb Space Telescope that will be launched in 2013.

The accomplishment of this goal requires the combined expertise of four different communities:
- Observational astronomers with expertise in deep sky surveys and in spatially resolved studies of distant galaxies.
- Experts in spectral models of galaxies, to interpret the light emitted by distant galaxies in terms of physical parameters such as star formation rate, metallicity and dust content.
- Theoreticians with expertise in modelling galaxy formation in its proper cosmological context.
- Industrial engineers who are responsible for the performance and calibration of NIRSpec.

This network will bring together these communities to work on the interpretation of the physical properties of distant galaxies deduced from their spectra and images and to develop practical analysis tools of interest to the exploitation of NIRSpec.

Project Details

Project Reference: 214227	Project Cost: 2566809 EURO
Programme Type: FP7 People	Project Funding: 2566809 EURO
Subprogramme Area: Marie Curie Action: "Networks for Initial Training"	

Contact

Project Coordinator:	Project Partners:
Dr. Stephane Charlot IAP-CNRS 98 bis boulevard Arago 75014 Paris, France charlot@iap.fr Tel: +33 1 44 32 81 83 Fax: +33 1 44 32 80 01 http://www.iap.fr/elixir/index.html	CRAL – Observatoire de Lyon, France Centro de Astrobiologia (CSIC-INTA), Madrid, Spain Istituto Nazionale di Astrofisica, Rome, Italy Max-Planck-Institut für Astronomie, Heidelberg, Germany Leiden Observatory, The Netherlands University of Oxford, United Kingdoms For contact details see: http://www.iap.fr/elixir/Pages/Contact.html

TERAMIX - Study of Novel Low Noise Superconducting Mixers for Terahertz Radio Astronomy	
Project period: 01.10.2012 - 30.09.2017	Project status: Accepted
Objective	
Terahertz heterodyne receivers are valuable tools for molecular gas spectroscopy both for space (radio astronomy, planetary science) and terrestrial applications. They provide both high resolution spectral data, as well as broad bandwidth line survey data. Due to the progress in device physics, such receivers can now reach several THz. At such high radio frequencies, neither electronic nor photonic approaches for THz detectors work, but rather a combination of both is required. Superconducting devices have proven to provide sensitivity levels close to the quantum limit, hf/k. Superconducting Hot- Electron Bolometers (HEB) based on ultrathin NbN and NbTiN films are currently the only devices which are used as mixers for frequencies above 1.2THz (SIS mixer limit). However, their speed (i.e. the instantaneous bandwidth) is limited by the finite electron energy relaxation rate, of 40-100 ps. It corresponds to the bandwidth of maximum 4-5GHz. Such applications in radio astronomy as extragalactic spectroscopy, molecular line survey require this bandwidth to be doubled to say at least. In this project we will investigate response rate in ultra-thin MgB2 superconducting films. Preliminary investigation measured the electron-phonon interaction time as short as 1ps. Our recent data, point out on the response rate being limited by the phonon dynamic in the thick films. We will develop technology for ultrathin MgB2 film deposition, and processing THz nanobolometers. The response rate will be investigated with regards to the film parameters. In particularly, the phonon diffusion in superconducting nanobolometers will be studied in order to enhance the instantaneous bandwidth of MgB2 mixers. We estimate that the bandwidth of the novel THz detectors will be at least doubled compared to the existing once, providing completely new functionalities for THz radio astronomical receivers.	
Project Details	
Project Reference: 308130	Project Cost: 1497775 EURO
Programme Type: FP7 Ideas	Project Funding: 1497775 EURO
Subprogramme Area: ERC Starting Grant - Universe sciences	
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LOFAR-AUGER - From black holes to ultra-high energy cosmic rays: exploring the extremes of the universe with low-frequency radio interferometry	
Project period: 01.01.2009 – 31.12.2013	Project status: Execution
Objective	
Black holes (BHs) and ultra-high energy cosmic rays (UHECRs) are two extremes of the universe that link particle physics and astrophysics. BHs are the most efficient power generators in the universe while UHECRs are the most energetic particles ever detected. As we showed previously, a major fraction of the power of BHs is channeled into radio-emitting plasma jets, which are also efficient particle accelerators. Are BHs also responsible for UHECRs? This long-standing question could be answered soon, through the dawn of cosmic ray astronomy. The giant Auger observatory has now shown for the first time that the arrival directions of UHECRs are non-isotropic, potentially pointing back to their sources of origin. BHs turned out to be major suspects, but other sources could still also be responsible. To address this conclusively and to establish cosmic ray astronomy as a productive new field in the coming years, we need to increase statistics, expand current observatories, and have complementary all-sky radio surveys available to identify sources, since radio emission traces particle acceleration sites. Here, techniques pioneered by the Low-Frequency Array (LOFAR) promise major advances. First of all, working on LOFAR we uncovered a new technique to detect UHECRs with radio antennas and verified it experimentally. The technique promises to increase the number of high-quality events by almost an order of magnitude and provides much improved energy and direction resolution. We now want to implement this technique in Auger, combining LOFAR and AUGER know-how. Secondly, LOFAR and soon other SKA pathfinders will significantly improve all-sky radio surveys with high sensitivity, resolution, and image quality. Hence, we will use LOFAR to understand the astrophysics of UHECR source candidates and compile a radio-based catalog thereof. We start with jets from BHs and move later to other sources. Together this will allow us to identify UHECR sources and study them in detail.	
Project Details	
Project Reference: 227610	Project Cost: 3460000 EURO
Programme Type: Seventh Framework Programme	Project Funding: 3460000 EURO
Subprogramme Area: ERC Advanced Grant - Universe sciences	
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AARTFAAC - Amsterdam-ASTRON Radio Transient Facility And Analysis Centre: Probing the Extremes of Astrophysics	
Project period: 01.10.2010 – 30.09.2015	Project status: Execution
Objective	
Some of the most extreme tests of physical law come from its manifestations in the behaviour of black holes and neutron stars, and as such these objects should be used as fundamental physics labs. Due to advances in both theoretical work and observational techniques, I have a major opportunity now to significantly push this agenda forward and get better answers to questions like: How are black holes born? How can energy be extracted from black holes? What is the origin of magnetic fields and cosmic rays in jets and shocks? Is their primary energy stream hadronic or magnetic? I propose to do this by exploiting the advent of wide-field radio astronomy: extreme objects are very rare and usually transient, so not only must one survey large areas of sky, but also must one do this often. I propose to form and shape a group that will use the LOFAR wide-field radio telescope to hunt for these extreme transients and systematically collect enough well-documented examples of the behaviour of each type of transient. Furthermore, I propose to expand LOFAR with a true 24/7 all-sky monitor to catch and study even the rarest of events. Next, I will use my experience in gamma-ray burst follow up to conduct a vigorous multi-wavelength programme of study of these objects, to constrain their physics from as many angles as possible. This will eventually include results from multi-messenger astrophysics, in which we use neutrinos, gravity waves, and other non-electromagnetic messengers as extra diagnostics of the physics of these sources. Finally, I will build on my experience in modelling accretion phenomena and relativistic explosions to develop a theoretical framework for these phenomena and constrain the resulting models with the rich data sets we obtain.	
Project Details	
Project Reference: 247295	Project Cost: 3499127 EURO
Programme Type: Seventh Framework Programme	Project Funding: 3499127 EURO
Subprogramme Area: ERC Advanced Grant - Universe sciences	
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TFPA - Study of Terahertz Focal Plain Arrays	
Project period: 01.11.2009 – 31.10.2014	Project status: Execution
Objective	
The Terahertz frequency band is largely unexplored both for astronomical and for ground based applications. Over the recent years significant progress has been made in developing coherent detection techniques applicable at these higher frequencies, which enabled the building of array-receivers. When located in a focal plane a telescope such novel systems allow for a manifold increase in performance. However, the development of coherent detector focal plane arrays is still lagging behind. For incoherent bolometric arrays, a novel kinetic inductor detector (KID) has been recently proposed. It makes it possible to multiplex focal plane arrays with many thousands of pixels in very efficient and cost effective way. Backend technologies for both coherent and KID focal plane array will be based on Fourier Transform Spectrometer digital technique, which has demonstrated impressive progress during last few years and ready for large scale arrays. We propose to develop an advanced side band separating mixer technology for focal plane arrays in combination with research directed to increase the operation frequency of superconductor-insulator-superconductor technology by studying new superconducting materials. This research will be combined with development of many kilo pixel KID array. This inter-disciplinary research will enable building large focal plane arrays for use in astronomy and other Terahertz applications.	
Project Details	
Project Reference: 240602	Project Cost: 900000 EURO
Programme Type: Seventh Framework Programme	Project Funding: 900000 EURO
Subprogramme Area: ERC Starting Grant - Universe sciences	
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BEACON - Beacons in the Dark	
Project period: 01.09.2011 – 31.08.2016	Project status: Execution
Objective	
BEACON aims at performing an ambitious multi-disciplinary (optical, radio astronomy and theoretical physics) study to enable a fundamentally improved understanding of gravitation and space-time. For almost a century Einstein's general relativity has been the last word on gravity. However, superstring theory predicts new gravitational phenomena beyond relativity. In this proposal I will attempt to detect these new phenomena, with sensitivity 20 times better than state-of-the-art attempts. A successful detection would take physics beyond its current understanding of the Universe. These new gravitational phenomena are emission of dipolar gravitational waves and the violation of the strong equivalence principle (SEP). I plan to look for them by timing newly discovered binary pulsars. I will improve upon the best current limits on dipolar gravitational wave emission by a factor of 20 within the time of this proposal. I also plan to develop a test of the Strong Equivalence Principle using a new pulsar/main-sequence star binary. The precision of this test is likely to surpass the current best limits within the time frame of this proposal and then keep improving indefinitely with time. This happens because this is the cleanest gravitational experiment ever carried out. In order to further these goals, I plan to build the ultimate pulsar observing system. By taking advantage of recent technological advances in microwave engineering (particularly sensitive ultra-wide band receivers) digital electronics (fast analogue-to-digital converters and digital spectrometers) and computing, my team and me will be able to greatly improve the sensitivity and precision for pulsar timing experiments and exploit the capabilities of modern radio telescopes to their limits. Pulsars are the beacons that will guide me in these new, uncharted seas.	
Project Details	
Project Reference: 279702	Project Cost: 1892376 EURO
Programme Type: Seventh Framework Programme	Project Funding: 1892376 EURO
Subprogramme Area: ERC Starting Grant - Universe sciences	
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