

Newsletter January 2014

RadioNet3 Newsletter

January 2014

Successful Mid Term Review for RadioNet3

The RadioNet3 Coordinator, Prof. Anton Zensus has recently received the official notification of the outcome of RadioNet3's Mid-Term Review (MTR) from the Project Officer Elena Righi-Steele. The European Commission found the RadioNet3 project in excellent shape and continuation without modification is recommended.

The MTR took place at the Max-Planck-Institut fuer Radioastronomie in Bonn on November 18th, 2013. Prof. Richard Schilizzi, University of Manchester, was the expert reporting to the European Commission, Directorate-General for Research & Innovation. The

Executive summary states that RadioNet3 delivers high quality products to the radio astronomy community, playing a major role in cohering the astronomy community through support of science and technical meetings, in training new members of the community through schools and workshops. RadioNet3 is providing a focus for highest priority engineering developments in European radio astronomy, and access to a wide range of world-leading radio astronomical facilities.



New Project Officer for RadioNet3

The RadioNet3 Project Officer Elena Righi-Steele has been promoted as of February 1, 2014 to be deputy head of a unit in the Energy Directorate. The RadioNet3 Coordinator Prof. Anton Zensus has congratulated and thanked Elena in the name of all RadioNet partners and wished her every success in her new capacity, which must be a well-deserved promotion into an exciting research area. "We have been working together for a long time, and we all always appreciated her commitment and determination to advance radio astronomy and to strengthen the European radio astronomy community" he said.

Dr. Sebastian Jester has been appointed as Project Officer of the RadioNet3 Project starting from February 1st, 2014, after working as Desk officer at the European Commission representing the German Federal Government. Prof. Anton Zensus, Coordinator of RadiNet3, gave a warmly welcome to Dr. Jester in his new role as Project Officer.

The European Research Council 'Synergy Grant' to image event horizon of black hole

The European Research Council (ERC) has awarded 14 Million Euros to a team of European astrophysicists to construct the first accurate image of a black hole. The team will test the predictions of current theories of gravity, including Einstein's theory of General Relativity. The funding is provided in the form of a 'Synergy Grant', the largest and most competitive type of grant of the ERC.

Was Einstein right? The European Research Council (ERC) has awarded 14 Million Euros to a team of European astrophysicists to construct the first accurate image of a black hole. The team will test the predictions of current theories of gravity, including Einstein's theory of General Relativity. The funding is provided in the form of a 'Synergy Grant', the largest and most competitive type of grant of the ERC.

The project seeks to measure the shadow cast by the event horizon of the black hole in the centre of the Milky Way, find new radio pulsars near this black hole, and combine these measurements with advanced computer simulations of the behaviour of light and matter around black holes as predicted by theories of gravity. To do so,

the team led by three principal investigators (Heino Falcke, Radboud University Nijmegen and ASTRON, Michael Kramer, Max-Planck-Institut für Radioastronomie, and Luciano Rezzolla, Goethe University in Frankfurt and Max-Planck-Institut für Gravitationsphysik) will combine several telescopes around the globe to peer into the heart of our own Galaxy, which hosts a mysterious radio source, called Sagittarius A*. It is considered to be the central super massive black hole.

Synergy grants are awarded by the ERC, on the basis of scientific excellence in an intricate and highly competitive selection procedure. The grants have a maximum limit of 15 Million Euros and require the collaboration of 2-4 principal investigators. In the current selection round the ERC honoured 13 out of 449 funding proposal, which corresponds to a success rate of less than 3%. Proposals were submitted from all areas of European science. This is the first time an astrophysics proposal has been awarded.

The project in depth

BlackHoleCam: Imaging the Event Horizon of Black Holes

Black holes

Black holes are notoriously elusive with a gravitational field so large that even light cannot escape their grip. The team plans to make an image of the event horizon - the border around a black hole which light can enter, but not leave. "While most astrophysicists believe black holes exists, nobody has actually ever seen one", says Heino Falcke, Professor in radio astronomy at Radboud University in Nijmegen and ASTRON, The Netherlands. "The technology is now advanced enough that we can actually image black holes and check if they truly exist as predicted: If there is no event horizon, there are no black holes".

Measure the tiniest shadow

So, if black holes are black and are hard to catch on camera, where should one look? The scientists want to peer into the heart of our own Galaxy, which hosts a mysterious radio source, called Sagittarius A*. The object is known to have a mass of around 4 million times the mass of the Sun and is considered to be the central supermassive black hole of the Milky Way. As gaseous matter is attracted towards the event horizon by the black hole's gravitational attraction, strong radio emission is produced before the gas disappears. The event horizon should then cast a dark shadow on that bright emission. Given the huge distance to the centre of the Milky Way, the size of the shadow is equivalent to an apple on the moon seen from the earth. However, by combining high-frequency radio telescopes around the world, in a technique called very long baseline interferometry, or VLBI, even such a tiny feature is in principle detectable. Falcke first proposed this experiment 15 years ago and now an international effort is forming to build a global "Event Horizon Telescope" to realize it. Falcke is convinced: "With this grant from the ERC and the excellent expertise in Europe, we will be able to make it happen together with our international partners".

Find more radio pulsars

In addition, the group wants to use the same radio telescopes to find and measure pulsars around the very same black hole. Pulsars are rapidly spinning neutron stars, which can be used as highly accurate natural clocks in space. "A pulsar around a black hole would be extremely valuable", explains Michael Kramer, managing director of the Max-Planck-Institut für Radioastronomie in Bonn. "They allow us to determine the deformation of space and time caused by black holes and measure their properties with unprecedented precision". However, while radio pulsars are ubiquitous in our Milky Way, surprisingly none had been found in the centre of the Milky Way for decades. Only recently Kramer and his team found the very first radio pulsar around Sagittarius A*. "We suspect there are many more radio pulsars, and if they are there we will find them", says Kramer.

Behaviour of light and matter

But how will scientists be really sure that there is a black hole in our Milky Way and not something else that behaves in a very similar way? To answer this question, the scientists will combine the information from the black hole shadow and from the motion of pulsars and stars around Sagittarius A* with detailed computer simulations of the behaviour of light and matter around black holes as predicted by theory. We have made enormous progress in computational astrophysics in recent years", states Luciano Rezzolla, Professor of theoretical astrophysics at the Goethe University in Frankfurt and leader of the gravitational-wave modelling group at the Max-Planck-Institut für



Gravitationsphysik in Potsdam. "We can now calculate very precisely how space and time are warped by the immense gravitational fields of a black hole, and determine how light and matter propagate around black holes", he remarks. "Einstein's theory of General Relativity is the best theory of gravity we know, but it is not the only one. We will use these observations to find out if black holes, one of the most cherished astrophysical objects, exist or not. Finally, we have the opportunity to test gravity in a regime that until recently belonged to the realm of science fiction; it will be a turning point in modern science", says Rezzolla.

Partners in Europe

The principal investigators will closely collaborate with a number of groups throughout Europe. Team members in the ERC grant are:

- Robert Laing from the European Southern Observatory (ESO) in Garching, European project scientist of ALMA, a new high-frequency radio telescope, that the team seeks to use for their purpose,
- Frank Eisenhauer from the Max-Planck-Institut für extraterrestrische Physik in Garching, principal investigator of the upcoming GRAVITY instrument for the ESO Very Large Telescope Interferometer, to precisely measure the motion of stars and infrared flares around the Galactic Centre black hole.
- Huib van Langevelde, director of the Joint Institute for VLBI in Europe (JIVE) and Professor of Galactic radio astronomy at the University of Leiden.

The efforts of the Max-Planck-Institut für Radioastronomie will be conducted jointly with the VLBI group and the high-frequency radio astronomy groups at the institute and their directors Anton Zensus and Karl Menten. The scientists also want to make use of the two major European millimeter radio observatories (NOEMA and the IRAM 30m telescope) operated by IRAM, a joint German/French/Spanish radio astronomy institute. The BlackHoleCam team will closely collaborate with the Event Horizon Telescope project, led by S. Doeleman (MIT Haystack Observatory, Boston). <http://www.ru.nl/english/university/vm/news/@928308/synergy-news/>

German SKA Science Meeting

The SKA project is moving fast and the upcoming year 2014 will be the most influential one in the SKA design process. The German Community will discuss the early science opportunities with the SKA and how to work out strategies for science funding in the "German SKA Science Meeting" organized in Bielefeld on February 12-13, 2014. The SKA will be built in two phases and during that year the scientific community will have the biggest impact on the layout and the capabilities of the SKA phase 1. After that, a final evaluation process by the SKA office will freeze the blueprint by the end of 2014. By 2020 the first data are expected to produce early science. The data quality promised by the SKA phase 1 will be up to 10 times more sensitive than the JVA or LOFAR and SKA phase 1 will have survey capabilities that are hundred times faster than current facilities. With this outlook we invite everybody of the scientific community to investigate the perspectives of SKA for their own science interests and to contribute talks. The envisaged science areas that will be discussed are: Cosmology, galaxy evolution, AGN and compact objects, star formation, interstellar medium, The Milky Way and Galactic science, radio transients, fundamental and astroparticle physics, extreme physics and associated theory. In order to provide an overview on the SKA phase 1 we have invited Robert Braun (SKA science director), and Leon Koopmans (epoch of reionisation) and Michael Kramer (fundamental forces with pulsars) to discuss their current view and technical requirements of the SKA.

Registration is open at <http://www2.physik.uni-bielefeld.de/geska14.html>

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3rd AERAP Workshop on the Implementation of the AERAP Framework Programme for Cooperation and Conference call on proposal for European Development Fund

On 4 and 5 November 2013, more than 40 researchers, engineers and industry representatives from Africa and Europe came together for the 3rd Workshop on the Implementation of the AERAP Framework Programme for Cooperation. The meeting started with a short report by Declan Kirrane on AERAP's activities since the last meeting in Brussels in June 2013, including a workshop in Cape Town in July and the participation of AERAP in an URSI event in Mauritius in September. Declan emphasised especially the successful engagement with MEPs and African diplomats during a networking dinner on 1 October: Italian MEP Vittorio Prodi suggested establishing radio astronomy for science capacity in Africa as a topic for the Greek and Italian Council presidency in 2013/2014. MEPs Michael Gahler and Gay Mitchell offered their support for AERAP in securing funding for the projects proposed in the AERAP Framework Programme for Cooperation.



Daan du Toit, science counsellor at the South African Mission to the EU, spoke about the latest developments on funding instruments accessible to AERAP. The preparations for the EU research and innovation programme Horizon 2020 are nearly finalised and the first calls will be published on 11 December 2013. According to draft work programmes for Horizon 2020 which are already circulating unofficially (some of them are accessible here), specific funding for the SKA will become available during the second phase of the Horizon 2020 programme cycle. In the work programme on research infrastructures, an Africa related call is foreseen which could allow the continuation of PAERIP (Promoting African - European Research Infrastructure Partnerships). It is conceivable that AERAP would be built into this continuation of PAERIP. The AERAP secretariat will analyse the work programmes in view of suitable calls for key actions in the AERAP Framework Programme for Cooperation as soon as reliable information is available. Information on the new Marie Curie Actions, now called Marie Skłodowska Curie Actions, has been presented by Veselina Angelova from DG Education and Culture, her presentation is available here.

In the framework of the EU development cooperation programmes, a funding opportunity worth €15 to €20 million (over 3-4 years) that could be suitable for AERAP's project ideas will become available. To seize this opportunity, a project proposal needs to be submitted before the 2nd week of December. Several volunteers expressed their interest in becoming part of a working group which will prepare such a proposal. The first conference call to plan the proposal writing will be organised in the week of 16 December 2013.

The First AERAP Implementation Plan could be the basis for such a proposal. During the workshop, the draft version of the Implementation Plan has been discussed and various modifications have been suggested. Taking these suggestions into account, the AERAP secretariat will update the Implementation Plan and make the next version available by 16 December 2013.

Workshop participants also suggested the organisation of the following meetings for 2014:

- Workshop on the co-location of scientific instruments at radio astronomy sites
- Joint RadioNet-AVN event
- Major AERAP meeting in Africa (e.g. Kenya or Ghana)

Conference call on proposal for European Development Fund

During the Conference call on Wednesday, 18 December 2013, Daan du Toit provided more information about the proposal for a 20 million development funding opportunity. He specified that the proposal will aim at securing funding from the European Development Fund (EDF). The focus areas on which the EDF budget will be spent are decided by the EU and the respective authority in the African, Caribbean and Pacific Group of States (ACP). This authority can be the African Union, a regional association of states (e.g. Southern African Development Community) or a national government. All EU countries and all ACP states are eligible for this funding. The proposal, which is to be submitted by the South African government, will be fed into the discussion of the EU and relevant African authorities in order to establish a focus area in which AERAP could be funded.

As already explained during the workshop in November, the proposal should consist of activities which are mature and which could be implemented with 20 million Euros over a period of 4 years. The proposal should include a description of these activities, the objectives, the expected impact, the added value and a time frame for the implementation (not a detailed project proposal as in the case of FP7). This should be completed by the beginning of February. The objectives and the expected impact of the proposal should align with the objectives of the EDF in the respective region. The AERAP Secretariat will provide the political document which describes the objectives,

the so called Regional/National Strategy Paper, together with the set of criteria pertaining to development funding, as well as examples of similar proposals. The ultimate goal of contributing to Africa's development objectives will be the driver of the whole process, and radio astronomy as a specific topic area will be incorporated at a later stage.

The First AERAP Implementation Plan will serve as a basis for the proposal but needs to be updated in order to become more substantial and realistic. The AERAP Secretariat will set up proposal writing meetings in January to coordinate the proposal preparation. The participants of the telephone conference agreed that the proposal should include all four topics mentioned in the Implementation Plan (AVN, Network of centres for radio astronomy education and training, Big Data Africa-EU Programmes and the mid-frequency aperture array).

Since the development of a mid-frequency aperture array will be very important in the long term, but is not yet mature for immediate implementation, a small part of the budget in this proposal will be dedicated to this project (the figure of 5% of the total budget was proposed during the call). This will underline the importance of the mid-frequency aperture array and facilitate further funding proposals. It was also proposed in the conference call that the participants would all indicate how much money approximately would be needed for each of the four topics to be successful. Regarding the size of the proposal, it was agreed that drafting five pages for each of the four topics, should be sufficient.

It was also discussed if Big Data should be included in the proposal, given that the budget available for this topic will be relatively small. Many participants agreed that even a smaller project, mainly focusing on education and training, could make a big difference and could help to prepare future Big Data projects in Africa.

Timeline for the preparation of the proposal

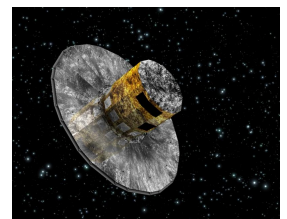
- 6-9 January 2014: Formation of virtual working groups for each topic (e-mails will be sent out followed by a conference call)
- 9 January 2014: Deadline for submission of ideas for the allocation of a specific budget for each of the four topics to toaerap@aerap.org
- 31 January 2014: Deadline for working groups to submit the parts of the proposal for their respective topic areas (cca. 5 pages per topic) to aerap@aerap.org. The AERAP Secretariat will combine these parts and compose a coherent proposal.
- cca. 10 February: Proposal Submission

GAIA

Gaia is an ambitious mission to chart a three-dimensional map of our Galaxy, the Milky Way, in the process revealing the composition, formation and evolution of the Galaxy. Gaia will provide unprecedented positional and radial velocity measurements with the accuracies needed to produce a stereoscopic and kinematic census of about one billion stars in our Galaxy and throughout the Local Group. This amounts to about 1 per cent of the Galactic stellar population.

ESA's Gaia mission blasted off last 19 December 2013 on a Soyuz rocket from Europe's Spaceport in Kourou, French Guiana, on its exciting mission to study a billion suns.

For more information:
<http://sci.esa.int/gaia/>



RadioNet3 ERATec Special Session at the IEEE-AP/URSI Symposium

The 3rd RadioNet3 European Radio Astronomy Technical Forum Workshop will be organized as a Special Session of the 2014 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting. This event will take place on July, 6th - 12th 2014 at the Memphis Convention Center in Memphis, Tennessee, USA.

The 3rd ERATec meeting is a continuation of a series of technical workshops combining several aspects of engineering and operational issues at European radio observatories. It provides the unique opportunity to cross borders between the different communities and to learn what 'the other half' is doing while improving communication between engineers, scientists and operators.

The first announcement is available here: <http://www.ira.inaf.it/eratec/memphis/>

