RadioNet support for scientific events

Application form for organisers

Event Information	
Title	IPTA Hack Week 2019
Place	*Paris Observatory (Meudon site), France*
Organiser's Institute Name	***Gilles Theureau**, Paris Observatory*
Date	*December 9th-13th or December 16th-20th, 2019*
No. of participants	*20*
Total event cost	*8 k€*
RadioNet support	*5 k€*
Other sources of funding	*Paris Observatory*

REQUEST *(max. 2 pages)*

Short abstract of the event	*The International Pulsar Timing Array (IPTA) is a world wide collaboration, made of the contributions of three continental consortia: EPTA in Europe, PPTA in Australia and NanoGRAV in the US. Its primary goal is to detect gravitational waves (GW) in the Nanohertz regime using radio pulsar timing observations. At the European level, the EPTA program gathers scientific teams associated with the five 100-m class radio telescopes of the continent (Jodrell Bank, UK, Westerbork, NL, Effelsberg, Ger, Cagliari, It, Nançay, Fr). Several European groups are also contributing on the gravitational wave analysis and theory, in particular in Birmingham University, MPI für Gravitationsphysik in Postdam, Milano University.* *We propose to gather the main contributors to the IPTA data combination and gravitational wave analysis for an operational workshop, held in Meudon Observatory (France). The IPTA Hack Weeks give the opportunity to confront new algorithms and state of the art detection strategies.The goals of our 2019 busy week will be to explore various noise and gravitational wave models using available combined pulsar timing data coming from the various radio telescopes, while at the same time allow a leap in the data combination of new millisecond pulsars observed using the last generation of pulsar backends.*
Relevance for RadioNet	*Pulsar timing observations represent a large fraction of European radio telescope time at all these facilities, with a total amount of more than 3000 hours dedicated per year, since the start of the project in 2006.* *The timing of an array of stable millisecond pulsars (PTA) works as a Galactic sensor for gravitational wave direct detection in the frequency regime from Nanohertz to Microhertz. It is complementary to ground based (LIGO-Virgo, Herzt-Kilohertz) and future spatial (eLISA, milliHertz) interferometers. This technique is the unique one probing the emission of the supermassive binary black hole binary population that was formed in the hierarchical large scale structure and galaxy building scenario. Virgo-LIGO observations since 2016 enabled the first direct detections of gravitational wave signals. Even though PTAs have yet only produced upper limits on the nHz background or individual sources gravitational radiation, the recent results start to constrain models*

	of structure formation, the growth of the galaxy central black hole and the migration rate of the black hole binaries formed in mergers towards the gravitational wave emission regime. With improving radio telescopes detectors and data analysis techniques, a detection is expected within the coming 5-10 years with the current generation of instruments, while we will have to wait for SKA1 to fully confirm preliminary detections, identify and characterise the sources and their spectrum.
Impact on RadioNet	*The Timing data gathered at each telescope are combined at the world wide level to produce successive data releases and new constraints on the gravitational stochastic background and possible single sources. The main targeted population is the super massive binary black hole population, supposed to form in the process of galaxy hierarchical formation and evolution. So far a first IPTA data release (DR1) was published in 2016 by Verbiest et al, a second one (DR2) is currently in its publication process (Perera et al 2019, submitted to MNRAS). One of the goals of the 2019 Hack Week will be to start building the third one (DR3), with a strong and up-to-date contribution from Europe. Another one will be to finalise the three on-going publications concerning: 1) a new GW stochastic background limit from IPTA DR2; 2) an analysis for searching GW burst with memory events; 3) an analysis of the GW stochastic background based on the figure of merit of individual pulsars observed at single telescopes. Eventually, we will also start to explore the future DR3 data, in particular for searching for continuous wave single or multiple sources.* *Our goal in particular is to include in the DR3 some of the data produced in the last eight years by the last generation of European pulsar backends : ASTERIX on Effelsberg, PUMA-II on WSRT, NUPPI-512 on NRT, DFB at Jodrell Bank and Roach-2 system at SRT.*
Use of the RadioNet contribution	*We propose that this workshop be held in the meeting rooms provided by the CIAS (Centre International d'Atelier Scientifique) in Meudon Observatory, next to Paris. This site gives in addition access to a fast network infrastructure, a local powerfull supercomputer, plus some financial support for coffee breaks and meals, as well as some travel funding to invite international experts. Through the CIAS, Paris Observatory offers also the salary for one/two months for respectively two/one foreign visitor(s). Radionet funding will be used in particular for providing accomodation in Paris for young (PhD and post-docs) participants all during the Hack Week.*
Ethics	*Ethics have been for long an important concern of the IPTA consortium. A Diversity committee was created already four years ago, to take care of harassment of any kind, regarding gender or ethnic issues.*

Privacy Policy: *With signing this template and applying for RadioNet funding, I accept the* Privacy Policy of RadioNet*, which is based on the EU General Data Protection Regulation (GDPR).*

Place & Date: Signature of the applicant: Gilles Theureau

Nançay Radio Observatory, June 28th, 2019