RadioNet support for scientific events
Application form for organisers

EVENT INFORMATION	
TITLE	European Pulsar Timing Array collaboration meeting
PLACE	Schloss Ringberg, Germany
ORGANISER'S INSTITUTE NAME	Max-Planck-Institute for Radioastronomy Kuo Liu, kliu@mpifr-bonn.mpg.de
DATE	March 29 – April 01, 2020
NO. OF PARTICIPANTS	40
TOTAL EVENT COST	15,000 €
RADIONET SUPPORT	7,600 €
OTHER SOURCES OF FUNDING	Indirect funds will be provided by MPG to cover the cost by MPG staff.

REQUEST *(max. 2 pages)*	
Short abstract of the event	We will host the first bi-annual collaboration meeting of the European Pulsar Timing Array (EPTA) in 2020, during March 29 – April 01 at Schloss Ringberg in Germany. The goal of the EPTA is to detect and study low-frequency gravitational waves (GWs) emitted by supermassive black hole binaries in distant merging galaxies, using precision timing of millisecond-period pulsars distributed over the sky (i.e. a pulsar timing array, or a PTA). The meeting will include the usual form of presentations, open discussions and breakout sessions. In total, we are expecting approximately 40 participants.
Relevance for RadioNet	Precision timing of a network of highly stable millisecond pulsars delivers a unique tool for directly detecting GWs at nanohertz frequencies generated by supermassive black hole (SMBH) binaries within merging galaxies in the distant Universe. This is currently the only way to observe and study SMBH binaries at cosmological distances, directly investigating the galaxy merger histories and hierarchical SMBH formation in the early Universe (Sesana 2013, MNRAS, 433, L1). PTA observation of GWs also offers a new window to test the prediction of general relativity in the radiative regime, under gravitational conditions such as curvature of space time and gravitational potential that are not primarily covered by other experiments (Kramer 2017, Astronomy & Geophysics, 58, 3.31). Our motivation for continuing the work has increased dramatically since the astonishing result in 2016 from the LIGO/Virgo consortium (and approximately ten events since then) that left very little doubt that gravitational waves exist, and are detectable. Though the PTA collaborations have so far only reported limits on the amplitude of GWs, this is likely due to the expected weak GW signal, and a detection is already within our reach. In fact, it has recently been predicted that we will be able to detect a stochastic GW background and at least one GW single source within a decade (Taylor et al. 2016, ApJL, 819, L6; Mingarelli et al. 2017, Nature Astronomy, 1, 886). For now, PTA data are already delivering promising results on constraining galaxy and SMBH formation histories, and are beginning to test several prominent models, only based on upper limits to the amplitude of the stochastic background (Shannon et al. 2013, Science, 342, 334; Lentati et al. 2015, MNRAS, 453, 2576; Arzoumanian et al. 2018, ApJ, 859, 47). Even the predicted-to-be-unlikely case of a non-detection would certainly lead to profound conclusions about the nature of galactic evolution, and will provide very stringent constraints on the population of

RadioNet has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 730562

	massive black holes. In addition, the overlap between neutron star (NS) and GW science has grown immensely in the past decade. One of the principle sources for the LIGO/VIRGO experiment is coalescing double-NS binary systems, and the first detection of such events has recently been achieved (Abottt et al 2017, PRL, 119, 161101). As acilliary science, the dataset collected for PTA experiment can also be used for test of gravity in the strong-field regime and the study of neutron star composition as well as the state of nuclear matter in ultra-high-density regime (Antoniadis et al. 2013, 340, 448; Zhu et al. 2018, 482, 3249). The LIGO/VIRGO and PTA results are complementary and can be combined to enhance the overall experimental precision (Shao et al. 2017, PRX, 7, 041025). Furthermore, the double-NS mergers are expected to have observable counterparts in the electromagnetic spectrum, and can be followed up by instruments that cover a large fields-of-view at radio wavelengths such as LOFAR (Abbott et al 2017, ApJ, 848, L12). In fact, many PTA astrophysicists are deeply involved with and connected to the LIGO/VIRGO consortium, as well as the upcoming eLISA space mission. The research activities in the EPTA, the European representative of the International PTA, use the largest RadioNet facilities and involves several RadioNet institutions (detailed in the next section). And in parcitular for this meeting, we will attempt to boom cross-field collaboration by inviting guest attendees specialized in e.g., GWs at other wavelengths (LIGO/VIRGO, LISA), NS theorires and test of gravity theories. This will create a great opportunity for networking, sparking collaborative discussions and ideas for synergies between researchers. It is also especially valuable for students and postdoctoral researchers, many of which will be in attendance at the meeting.
Impact on RadioNet	The EPTA is a tight collaboration of PTA scientists using the five major European radio telescopes: the Effelsberg telescope in Germany, the Lovell Telescope in the UK, the Westerbork Telescope in the Netherlands, the Nançay telescope in France, and the Sardinia telescope in Italy. Combined, these telescopes acquire over 3000 hours of pulsar timing observations per year for the EPTA. EPTA member institutions are also centrally involved in work to upgrade and improve their respective telescope instrumentation and pulsar backends. In addition to operations of individual telescopes, the EPTA has developed the ERC-funded Large European Array for Pulsars (LEAP). Here, the signals from the five above telescopes are coherently combined to deliver a collecting area similar to that of the Arecibo telescope, but able to view a much larger portion of the sky, providing unparalleled sensitivity for pulsar timing array observations (Bassa et al. 2016, MNRAS 456, 2196). The bi-annual collaboration meeting has been ongoing for tens years and been demonstrated to be high effective to maintain the strong ties among all EPTA institutions and advance the overall work progress. The EPTA also supports many students and early-career scientists. The datasets created from EPTA observations have formed the basis of a number of PhD theses, and continue to provide a series of exciting projects for postdoctoral researchers. These data and significant theoretical work also regularly result in high-profile publications, and these are typically led by young scientists within the collaboration. This includes both gravitational wave-related research – the central “raison d’être” of the EPTA – along with ancillary science which includes compact binary systems, tests of general relativity, dense nuclear matter, and studies of our solar system (e.g., Bassa et al. 2016, MNRAS, 460, 2207; Shaifullah, G et al. 2016, MNRAS, 462, 1029; McKee et al. 2016, MNRAS 2016, 461, 3; Perera et al. 2018, MNRAS, 478, 218; Caballero et al. 2018, MNRAS, 481, 5501; Tiburzi et al. 2019, MNRAS, 487, 394).
Use of the RadioNet contribution	The requested funding will be used to cover the full board rate at the conference site for approximately 20 participants, which includes lodging, three meals per day, coffee breaks, etc. The expense will be prioritized for junior researchers such as PhD students and postdoctoral researchers. Any remaining funds will be used to reimburse their travel to the conference site.
Ethics	Within the EPTA, we have a very active and experienced diversity and an inclusive culture, and plan to have an information and question-and-answer session on this topic during the meeting. In addition, we intend to enforce gender and cultural balance on the Scientific Organising Committee, representation of selected speakers and session

RadioNet has received funding from the EU’s Horizon 2020 research and innovation programme under grant agreement No 730562

	chairs. We also intend to create a Code of Conduct for our meetings, in the effort to combat harassment of any kind, and cultivate a respectful, professional environment in which all participants can feel safe, comfortable, and welcomed.

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:
Bonn, 01/07/2019	KUO LIU

RadioNet has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 730562