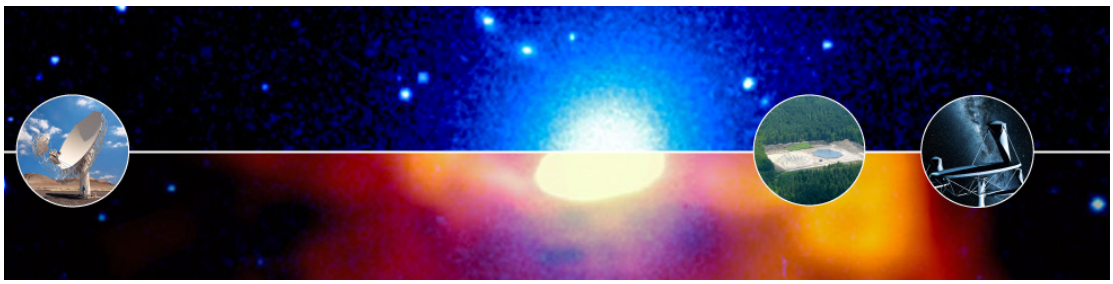


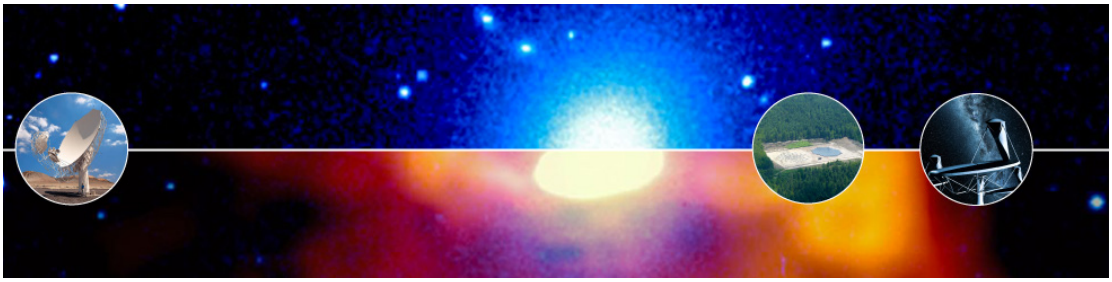
SKA-LOFAR Radio Days

February 11-13 2014

Paris (IAP)

Organised by :

Action Spécifique
SKA-LOFAR



SKA-LOFAR Radio Days
February 11-13 2014
Paris

Tuesday, February 11 2014

Chair = S. Corbel

13:55 - 14:00 Opening - Stéphane Corbel
14:00 - 14:30 Science with the SKA - Robert Braun
14:30 - 14:50 HI and Galaxy evolution - Matt Lehnert
14:50 - 15:10 Continuum surveys with LOFAR, SKA and its pathfinders - Chiara Ferrari
15:10 - 15:30 The large inverse problem of modern radio interferometry - Cyril Tasse
15:30 - 15:50 Synergies SKA / Athena - Gabriel Pratt

15:50 - 16:15 Coffee-break

Chair = C. Ferrari

16:15 - 16:35 LOFAR observations of Jupiter and Saturn - Julien Girard
16:35 - 16:55 Cosmic Magnetism - Katia Ferrière
16:55 - 17:15 Forecasts of radio emission from the cosmic web - Franco Vazza
17:15 - 17:35 Synergies LOFAR/SKA/Planck - Mathieu Langer
17:35 - 17:55 EMBRACE@Nancay: An Ultra Wide Field of View Prototype for SKA – Steve Torchinsky
17:55 - 18:15 High energy sources and HI tomography during the dark ages - Felix Mirabel

Wednesday, February 12 2014

Chair = S. Bontemps

09:30 - 09:50 21 cm signal from the Epoch of Reionization: from models to observations - Benoit Semelin
09:50 - 10:10 Synergies between SKA and future large instruments (Euclid, JWST, E-ELT) - Françoise Combes
10:10 - 10:30 Slow (incoherent) Radio transients - Stéphane Corbel
10:30 - 10:50 Synergies between radio and gravitational wave observations - Michal Was

10:50 - 11:15 Coffee-break

Chair = F. Combes

11:15 - 11:45 Towards the SKA: using its Precursors, ASKAP and MeerKAT (and APERTIF) - Wim van Driel
11:45 - 12:05 Sun and Space weather - Alain Kerdraon
12:05 - 12:25 Stellar Physics with SKA - Sylvain Bontemps

12:25 - 14:00 Lunch

Chair = S. Torchinski

14:00 - 14:30 Science with LOFAR - Michael Wise
14:30 - 14:50 Fast (coherent) Radio transients and pulsars - Jason Hessels
14:50 - 15:10 Fundamental Physics with pulsars - Lucas Guillemot
15:10 - 15:30 LOFAR Sparse Image Reconstruction - Jean-Luc Starck
15:30 - 15:50 Protoplanetary disk with the SKA - Stéphane Guilloteau

15:50 - 16:15 Coffee-break

Chair = M.A. Miville-Deschenes

16:15 - 16:35 The NenuFAR project - Michel Tagger
16:35 - 16:55 Low frequency radio observations from space: now and tomorrow – Baptiste Cecconi
16:55 - 17:15 LOFAR observations of Saturn's atmosphere - Daniel Gautier
17:15 - 17:35 Star-forming regions - Philippe André

17:35 - 18:30 General Discussion (Amphithéatre Henri Mineur (IAP))

18:30 - 20:00 Cocktail (Cassini room @ historical site of Observatoire de Paris)

Thursday, February 13 2014

Chair = Wim van Driel

09:15 - 09:35 21-cm signal from cosmic dawn - Anastasia Fialkov
09:35 - 09:55 The low-frequency radio view of merging galaxy clusters – Mamta Pandey-Pommier
09:55 - 10:15 Exoplanet searches in Radio : theory & observations from UTR2 to LOFAR/SKA Philippe Zarka
10:15 - 10:35 VLBI and its complementary with SKA for long baseline science - Patrick Charlot

10:35 - 11:00 Coffee-break

Chair = R. Ansari

11:00 - 11:20 Pulsar interactions with planet - Fabrice Mottez
11:20 - 11:40 Molecular Spectroscopy with SKA : new diagnostics for the ISM and star and planet formation - Maryvonne Gérin
11:40 - 12:00 Cosmology with the SKA - Ben Wandelt
12:00 - 12:20 Cosmological Evolution of Neutral Gas Mass - Celine Peroux

12:20 - 14:00 Lunch

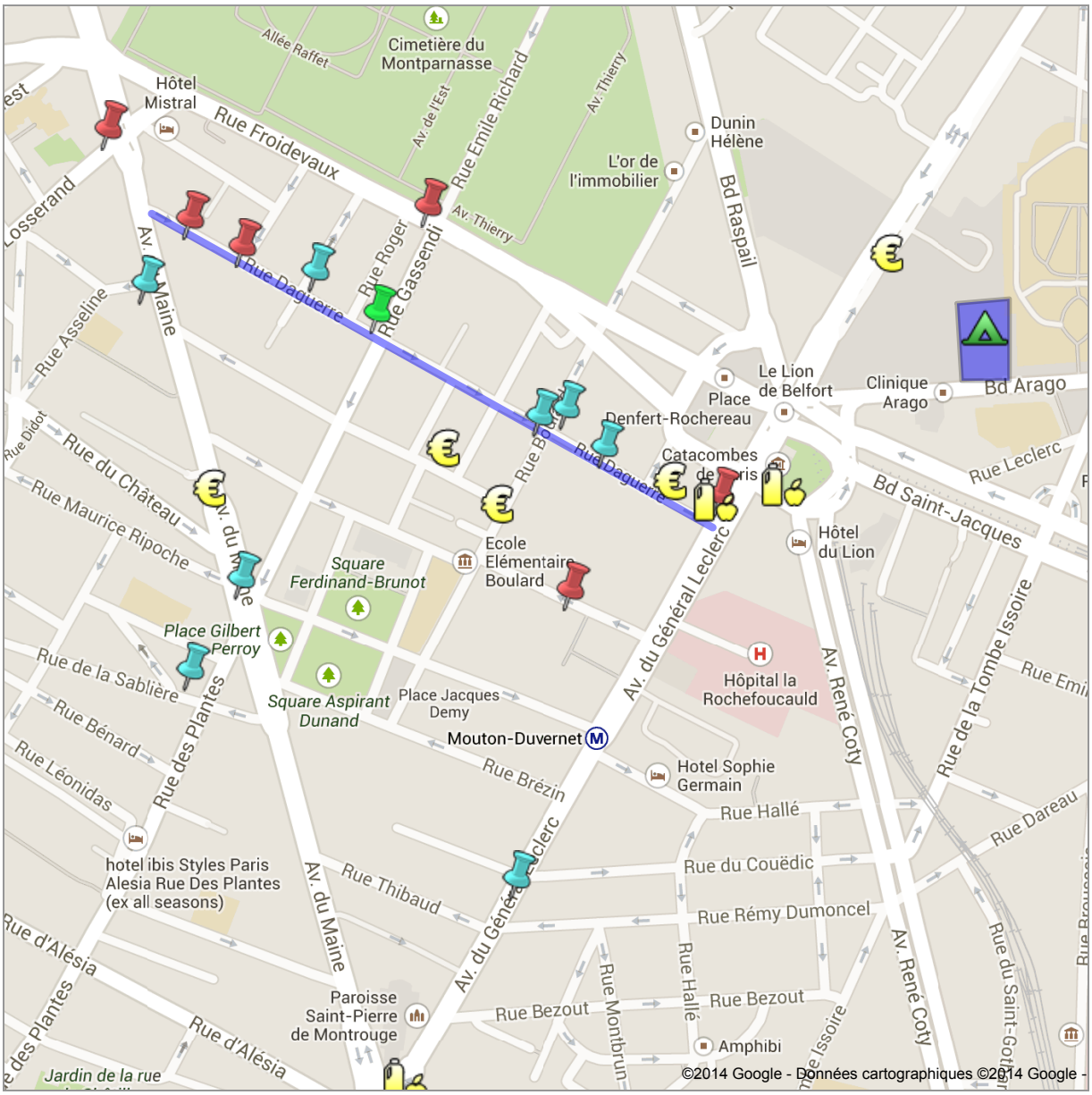
Chair = P. Charlot

14:00 - 14:20 Turbulence in the interstellar medium. Prospects with the SKA - François Lévrier

14:20 - 14:40 3D intensity mapping and 21 cm cosmology - Reza Ansari
14:40 - 15:00 Radio detection of cosmic rays - Richard Dallier / Lilian Martin
15:00 - 15:20 Restoration of radio astronomical images: an Analysis by Synthesis Approach Arwa Dabbech
15:20 - 15:40 Particle acceleration on the largest scales: radio emission in clusters of galaxies Annalisa Bonafede
15:40 - 16:00 Synergies radio and high energies - Helene Sol

16:00 - 16:30 Coffee-break

16:30 - 18:00 First part of NenuFAR workshop



Restos near the IAP

A list of scrupulously selected hand-picked restaurants near the IAP in the 14th arrondissement of Paris

Privée · Collaboration ouverte · 114 166 consultations
Créée le 2 oct. 2007 · Par Henry Joy M · Mise à jour le 17 jan.

Rue Daguerre

The IAP
That hallowed hall of learning (and coffee)

Institut d'Astrophysique de Paris

Dominique Saibron
Best croissants / viennoiserie in the 14th, a hike from the IAP but worth it. The 'petit rouleau' are the best. There is a small cafe area so you can take a cafe with your croissant.

Dominique saibron
14 avis
77 Avenue du Général Leclerc

75014 Paris
+33 1 43 35 01 07
dominique-saibron.com

Boulangerie Moisan Le Pain au Naturel
The baguettes are bit too crispy (or, if you like, burnt) for my liking, but the croissants are good (although a bit heavy on the butter). They sell sandwiches too.

Boulangerie Moisan Le Pain au Naturel
3 avis
4 Avenue du Général Leclerc
75014 Paris
+33 1 43 22 34 13
painmoisan.fr

Paul (Boulangerie)
Ok bakery. various sandwiches, pastries and cakes to take away.

Le Bouquet
Nothing gastronomique here, just entrecote+frites for 13 euros ! It's a real 'bistro du quartier'.

Café d'Enfer
Small and inexpensive restaurant, good for a midday meal.

Café d'Enfer
7 avis
22 Rue Daguerre
75014 Paris
+33 1 43 22 23 75

ENZO Aux Bonnes Gourmandises Italiennes
best pizza in the rue daguerre. But it's always full, and if you don't want to reserve, you need to arrive late in the evening.

ENZO Aux Bonnes Gourmandises Italiennes
26 avis
72 Rue Daguerre
75014 Paris
+33 1 43 21 66 66
pizzaenzo.com

Félicie
Brasserie / restaurant on the avenue du maine.

174, Avenue Maine
75014 Paris
01 45 41 05 75

plus d'infos »

La Medina

17 Rue Daguerre
75014 Paris

Excellent marocain restaurant. Probably
the best place to eat lunch if you are not going to the observatory canteen.

Les Jardins Contini
Pizzeria. Very thick pizzas, fine if you've not been to Italy too often ;-) Otherwise, better go to Enzo on rue daguerre (if you can find a spot)

Les jardins contini
16 avis

49 Avenue du Général Leclerc
75014 Paris
+33 1 43 20 25 34
jardins-contini.com

Le Royal Berbere
128, Avenue Maine
75014 Paris
01 43 21 69 74

plus d'infos »

Le Petit Baigneur
Excellent small restaurant on the other side of the avenue du maine.

Le Petit Baigneur
14 avis
10 Rue de la Sablière
75014 Paris
+33 1 45 45 47 12

Zango
58 rue Daguerre
African restaurant/ Fusion food.
offers good deals and a wide variety of dishes.
vegetarian options

Aquarius
40 rue de Gergovie.
Great vegetarian/vegan restaurant. reasonably expensive.

Cafe Daguerre
4, Avenue Gén Leclerc
75014 Paris
01 43 22 17 29

The most popular brasserie on the
rue daguerre. Dependable. I've only ever seen it closed once in my life -- on the 25th of December! Serves until late.

plus d'infos »

Le Bistrot des Pingouins
Large bistro, resasonably priced, one of the better bistros of the 14th. But you are probably better off going to the Plan B...

79, Rue Daguerre
75014 Paris
01 43 21 92 29

plus d'infos »

Le Plan B

EXCELLENT small bistro right at the end of the rue daguerre. Great 'plats du jour', friendly people. And not too expensive. One of my favourites.

Le Plan B
4 avis
89 Rue Daguerre
75014 Paris
+33 1 43 20 20 09
leplanb-resto.fr

Soura
Good and but slightly expensive Korean restaurant.

Soura
10 avis
7 Rue Ernest Cresson
75014 Paris
+33 1 45 41 71 55

Vin et Marée
108, Avenue Maine
75014 Paris
01 43 20 29 50

plus d'infos »

Chez Papa
6 rue Gassendi.
Cuisine Basque (Southern France)

rich and hearty meals for a very decent price!
Vegetarians... run away!

Cave Peret

6, Rue Daguerre
75014 Paris, France
01 43 22 08 64

wine bar. Has a nice selection
of salads if you would like to eat
something lighter.

more info »

La Maison Courtine
This is one of the restos in the quartier which is michelin starred. Expect to pay around 40+ euros for a full meal (without wine). It's an excellent resto.

La Maison Courtine
49 avis
157 Avenue du Maine
75014 Paris
+33 1 45 43 08 04
lamaisoncourtine.com

Restaurant Contre Allée
One of the best restos in the quartier. Excellent food, but expensive. It's about 35 euros entre + plat + dessert.

Restaurant Contre Allée
6 avis
83 Avenue Denfert-Rochereau
75014 Paris
+33 1 43 54 99 86
contre-allee.com

Les petites sorcières
12 rue Liancourt
excellent but expensive!

A Mi Chemin
quality French food. about 30 euros for a full meal.

Table of Contents

Results from EMBRACE@Nancay: An Ultra Wide Field of View Prototype for SKA

Torchinsky Stephen [1]

1 : Unité Scientifique de la Station de Nançay (USN)
CNRS : USR704Observatoire de ParisUniversité d'Orléans
18330 NANCAY
http://www.obs-nancay.fr/

A revolution in radio receiving technology is underway with the development of densely packed phased arrays for radio astronomy. This technology can provide an exceptionally large field of view, while at the same time sampling the sky with high angular resolution. Such an instrument, with a field of view of over 100 square degrees, is ideal for performing fast, all-sky, surveys, such as the "intensity mapping" experiment to measure the signature of Baryon Acoustic Oscillations in the HI mass distribution at cosmological redshifts. The SKA, built with this technology, will be able to do a billion galaxy survey.
The Nancay radio observatory is a major partner in the development of dense phased arrays for radio astronomy, working closely with The Netherlands Foundation for Radio Astronomy (ASTRON). The joint project is called EMBRACE (Electronic MultiBeam Radio Astronomy Concept). With significant funding from European Commission FP6 project SKADS, two EMBRACE prototypes have been built: One at Westerbork in The Netherlands, and one at Nancay. These prototypes are currently being characterized and tested at the two sites. Conclusions from the EMBRACE testing will directly feed into the SKA and will have a decisive impact on whether or not dense array technology is used for the SKA. I will present the current status and initial results from the Nancay EMBRACE station.

Particle acceleration on the largest scales: radio emission in clusters of galaxies

Annalisa Bonafede [1]

1 : Hamburg University

Galaxy clusters are the largest systems in our Universe, and unique laboratories to study particle acceleration and magnetic field amplification in an almost perfect plasma.
Mpc-size radio sources are observed in an increasing number of galaxy clusters. They are called "radio halos" and "radio relics" and and have been interpreted since the beginning as turbulent and shock acceleration sites
during cluster-cluster mergers.
In my talk, I will show the main pro and contra of the proposed models, and I will show new radio observations
recently obtained with LOFAR, the Very Large Array and Giant Metrewave Radio Telescope which challenge the commonly adopted scenario for radio relics.
I will show how LOFAR and SKA will shed light on the nature of the magnetic field amplification and particle accleleration in galaxy clusters.

Forecasts of radio emission from the cosmic web

Franco Vazza [1]

1 : Hamburg Observatory

I will present our latest results concerning the forecast of synchrotron radio emission from the cosmic web. Using a set of high-resolution cosmological simulations, we simulated the acceleration of cosmic rays at shocks and the related emission in radio, from primary and secondary accelerated electrons. The observable level of radio emission from such structures will tell us about the range of cosmic magnetic fields on large-scale (>10 Mpc) of the Universe. We simulated the visibiity of the cosmic web for the planned arrays of SKA1 (LOW, MID & SUR) as well as for the LOFAR HBA and LBA arrays, and we studied the possibility of detection as a function of the average magnetic field on such scales. Our study highlights the pivotal importance of having small enough baselines in order to sample the large angular scales, since most of the
detectable emission comes from scales of a few degrees on the sky, for the cosmic web at a low (zWork done in collaboration with C. Ferrari (OCA), A. Bonafede & M. Brueggen (Hamburg Observatory) and C. Gheller (CSCS).

The NenuFAR project

Tagger Michel [1,2], Zarka Philippe [3], Denis Laurent [2], Girard Julien [4], Collaboration And The Nenufar

1 : Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (LPC2E)
CNRS : UMR7328Université d'OrléansObservatoire de Paris
3A, Avenue de la Recherche Scientifique 45071 Orléans cedex 2
http://lpce.cnrs-orleans.fr/
2 : Unité Scientifique de la Station de Nançay (USN)
CNRS : USR704Observatoire de ParisUniversité d'Orléans
18330 NANCAY
http://www.obs-nancay.fr/
3 : Laboratoire d'études spatiales et d'instrumentation en astrophysique (LESIA)
Université Pierre et Marie Curie [UPMC] - Paris VIObservatoire de ParisINSUCNRS : UMR8109Université Paris VII - Paris DiderotUniversité Pierre et Marie Curie (UPMC) - Paris VI
5, place Jules Janssen 92190 MEUDON
http://lesia.obspm.fr/
4 : Astrophysique Interactions Multi-échelles (AIM)
CEAUniversité Paris VII - Paris DiderotINSUCNRS : UMR7158
Service d'astrophysique Orme des Merisiers F-91191 GIF SUR YVETTE CEDEX
http://irfu.cea.fr/Sap/

I will present NenuFAR (New Extension in Nançay upgrading LOFAR), launched as an extension to FR606, the french LOFAR station. Following a definition and prototyping study under a previous ANR contract, it will consist in a set of 15 (phase 1) to 96 (full project) mini-arrays (MA) of 19 antennae each. The MAs will be analog-phased, and optimized for the full 15-80 MHz band.
With the addition of a dedicated receiver, NenuFAR will be both and simultaneously
- an addition to LOFAR, the europe-wide Low-Frequency Array, of which it will significantly increase the capabilities as an alternative to the LBA of FR606;;
- and a stand-alone instrument, available for an original and autnonomous scientific program.

Synergies between SKA and future large instruments (Euclid, JWST, E-ELT)

Combes Francoise [1]

1 : Observatoire de Paris - Site de Paris (OP)
Observatoire de ParisINSUCNRS : UMR8112
61 Av de l'Observatoire 75014 PARIS
http://www.obspm.fr

At the end of the decade, many other large instruments will become operational, and complementary researches will be made with SKA. I will develop more in detail the main issues in cosmology: dark energy and its evolution, dark matter, neutrino mass, modified gravity, epoch of reionization, first galaxiesi, galaxy formation and evolution. All these will be accomplished through large-scale surveys, with different biases, according to wavelength, BAO, weak lensing, galaxy clustering. Some experiments will be proper to SKA, like precising the Hubble constant, with extragalactic masers.

La radioastronomie basses fréquence spatiales

Cecconi Baptiste [1], Zarka Philippe [,2], Hess Sébastien [,2], Klein-Wolt Marc [,3]

1 : Laboratoire d'études spatiales et d'instrumentation en astrophysique (LESIA)
Université Pierre et Marie Curie [UPMC] - Paris VIObservatoire de ParisINSUCNRS : UMR8109Université Paris VII - Paris DiderotUniversité Pierre et Marie Curie (UPMC) - Paris VI
5, place Jules Janssen 92190 MEUDON
http://lesia.obspm.fr/
2 : Laboratoire d'études spatiales et d'instrumentation en astrophysique (LESIA)
Université Pierre et Marie Curie [UPMC] - Paris VIObservatoire de ParisINSUCNRS : UMR8109Université Paris VII - Paris DiderotUniversité Pierre et Marie Curie (UPMC) - Paris VI
5, place Jules Janssen 92190 MEUDON
http://lesia.obspm.fr/
3 : Radboud University (RU)
Heyendaalseweg 135, 6525 AJ Nijmegen
https://www.astro.ru.nl/en

La gamme de fréquence en dessous de 10-20 MHz est encore complètement inexplorée avec des instruments radio interférométrique à grande échelle. L'endroit le plus proche de la Terre pour mettre en place ce type d'instrumentation est l'environnement lunaire, à la surface de la face cachée, ou bien en orbite. Même si un très grand radio télescope à la surface de la Lune semble encore hors de portée à moyen terme, des expérimentation pionnières doivent être lancée avec une instrumentation relativement simple. Nous présentons ici quelques uns de ces précurseurs qui peuvent être construits pour avancer dans cette voie. Ceux-ci sont basés sur un petit nombre d'antennes connectées à des récepteurs radio établissants des mesures spectrales et de forme d'onde. Nous montrons qu'il faut au moins un couple de dipôles croisés connecté à un récepteur à deux voies d'analyses pour mesurer la polarisation et le vecteur d'onde (la direction d'arrivée) des ondes radio incidentes, et donc obtenir une carte du ciel à l'ordre zéro, ou des mesures sur des sources brillantes et intermittentes avec une précision de quelques degrés. Il faut au moins un second point de mesure avec les mêmes caractéristiques instrumentales pour faire des mesures interférométriques, permettant ainsi de contraindre la taille angulaire et la localisation des sources radio les plus intenses, ainsi que des radio sources du système solaire, comme le Soleil ou les planètes externes. Dans un futur un peu plus lointain (mais pas si lointain, on parle de 2020), il est envisagé de construire des interféromètres radio très basse fréquence en orbite basse lunaire. Ces essaims d'antennes radio formeraient un interféromètre 3D composé d'au moins 50 nano-satellites répartis sur une distance de l'ordre de la centaine de kilomètres. Avec ce type d'instrument, on devrait pouvoir observer le rayonnement fossile de l'époque de recombinaison (formation des premiers atomes d'hydrogène), de mieux comprendre les émissions radio solaire (type II ou type III), en ajoutant la capacité de faire de la vraie imagerie. Les sources radio planétaires lointaines, comme Uranus, deviendraient aussi accessible depuis l'orbite terrestre. Ce type d'interféromètres pourrait aussi être placé autour des points de Lagrange L4 ou L5 de la Terre. Nous présenterons les différents actions en cours et les jalons prévus pour avancer dans cette direction.

Fundamental physics with pulsars

Guillemot Lucas [1]

1 : Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (LPC2E)
CNRS : UMR7328
3A, Avenue de la Recherche Scientifique 45071 Orléans cedex 2
http://lpce.cnrs-orleans.fr/

Pulsars, rapidly-rotating and highly-magnetized neutron stars born in supernova explosions of massive stars, are useful probes for a wide range of physical studies. For instance, radio pulsar timing measurements allow unique tests of relativistic gravity, or constraints on the equation of state of superdense matter. Pulsar surveys such as those conducted by Square-Kilometre-Array (SKA) pathfinders or by the SKA in the future provide us with an array of new clocks at large distances, acting as the arms of a cosmic gravitational wave detector. In this presentation I review some of the main applications of pulsar studies to fundamental physics, as well as the prospects for the SKA.

Cosmic magnetism

Ferrière Katia [1]

1 : Institut de recherche en astrophysique et planétologie (IRAP)
CNRS : UMR5277Observatoire Midi-PyrénéesUniversité Paul Sabatier (UPS) - Toulouse III
http://www.irap.omp.eu/

I will review the main observational methods used to detect and measure cosmic magnetic fields in galaxies and in the intergalactic medium.
I will explain what the different methods have already told us about the strength, direction and spatial distribution of these magnetic fields, and I will discuss the new results that can be expected from LOFAR and SKA.

21 cm signal from the Epoch of Reionization: from models to observations

Semelin Benoit [1]

1 : Laboratoire d'Etude du Rayonnement et de la Matière en Astrophysique (LERMA)
École normale supérieure [ENS] - ParisINSUCNRS : UMR8112Université Pierre et Marie Curie (UPMC) - Paris VIUniversité de Cergy PontoiseObservatoire de ParisUniversité Pierre et Marie Curie [UPMC] - Paris VI
61, avenue de l'Observatoire - 75014 PARIS
http://lerma.obspm.fr/

The process of Reionization progresses through the growth of ionized bubbles around the primordial galaxies. In the low density IGM, patches of still-neutral hydrogen emit 21 cm radiations that should be observable with radiotelescope such as LOFAR or the SKA. What features of the signal can be detected with what kind of instrument can be evaluated using numerical simulations. I will review the predicted general properties of the signal and what can be expected from LOFAR and SKA observations. I will also present examples of specific features only observable with the SKA, and explain what they will teach us about the underlying astrophysical processes.

The low-frequency radio view of merging galaxy clusters

Pandey-Pommier Mamta [1*], Combes Francoise

1 : Centre de Recherche Astrophysique de Lyon (CRAL)
INSUCNRS : UMR5574École Normale Supérieure [ENS] - LyonUniversité Claude Bernard - Lyon IÉcole Normale Supérieure (ENS) - Lyon
9 Avenue Charles André 69561 ST GENIS LAVAL CEDEX
http://www-obs.univ-lyon1.fr/
* : Corresponding author

Non-thermal radio emission are generated in dynamically disturbed galaxy clusters during their mergers events. In such events sudden increase in bulk motion of ICM produces Mpc-scale shock fronts and stirs the ICM creating large-scale turbulent eddies, with size up to several hundred kilo-parsecs. The non-thermal emission takes the form of cluster-wide radio halos, mini-halos and relics, further implying the presence of relativistic particles and magnetic fields within the intracluster medium. These sources reveal a population of ultra-relativistic electrons coexisting with the intracluster thermal gas. The origin of these relativistic electrons is one of the most intriguing problems of cluster astrophysics. Low-frequency radio observations play a crucial role in the study of these diffuse sources. In this presentation I will discuss about the low frequency nature of a number of well-studied sources selected from our low-frequency survey of massive clusters with the GMRT and compare results available from LOFAR, MWA.

Continuum Surveys with LOFAR, SKA and its pathfinders

Ferrari Chiara [1]

1 : Laboratoire Lagrange
Observatoire de la Cote d'AzurCNRS : UMR7293Université Nice Sophia Antipolis (UNS)
Boulevard de l'Observatoire CD 34229 F-06304 NICE Cedex 4
https://lagrange.oca.eu/

Radio continuum surveys are being planned on the SKA and on its main scientific and technological precursors and pathfinders located all over the world. I will give an overview of these projects and of their primary scientific objectives.

Synergies between radio and gravitational wave observations

Was Michal [1]

1 : LAPP
CNRS : UMR5814

The advanced Virgo and LIGO gravitational wave detectors will start to collect data in 2015, and their sensitivity will improve over the following years. At that time the different SKA precursors will start their radio observations. I will discuss the synergies between these two types of observatories, and cover two aspects: transient astrophysical events, such as produced by the coalescence of two neutron stars, and pulsars.

The Tianlai project: a 21cm intensity mapping experiment

Chen Xuelei [1]

1 : National Astronomical Observatory of China (NAOC)

I introduce the Tianlai project, which is a 21cm intensity mapping experiment designed to probe the dark energy by measure the BAO peaks.

LOFAR observations of Jupiter and Saturn

Girard Julien [1]

1 : Université Paris VII, Labex UnivEarthS, Service d'Astrophysique (IRFU/SAp/LEPCHE & LCS)
CEAUniversité Paris VII - Paris DiderotLabex UnivEarthS
Service d'Astrophysique, CEA-Saclay, DSM/IRFU/SAp, Bât. 709, L'Orme des Merisiers, F-91 191 Gif-sur-Yvette Cedex, France
http://irfu.cea.fr/Sap/

to fill

Restoration of radio astronomical images: an Analysis by Synthesis Approach

Dabbech Arwa [1], Ferrari Chiara [,2], Mary David [,3], Slezak Eric [,4]

1 : Laboratoire Lagrange
CNRS : UMR7293Observatoire de la Cote d'AzurUniversité Nice Sophia Antipolis (UNS)
CS 34229 06304 Nice Cedex 4
https://lagrange.oca.eu/
2 : Laboratoire Lagrange
Observatoire de la Cote d'AzurCNRS : UMR7293Université Nice Sophia Antipolis (UNS)
Boulevard de l'Observatoire CD 34229 F-06304 NICE Cedex 4
https://lagrange.oca.eu/
3 : Laboratoire J.-L. Lagrange, UMR7293
Université de Nice Sophia Antipolis - CNRS - OCA
Campus Valrose, 06108 Nice Cedex 02
4 : Laboratoire Lagrange
UNS / CNRS / OCA

The SKA with its bandwidth and its instantaneous field of view will be able to survey the sky at unprecedented sensitivity and resolution in a wide region of the radio band, thanks to the exploitation of massive computing, dedicated signal processing and innovative antenna design. Yet it will give rise to new challenges in data processing, in particular the ability of image restoration algorithms to recover faint and diffuse radio sources. In radio interferometric images, such sources are buried in the PSF sidelobes of surrounding bright compact sources, and the noise . We propose a sparsity promoting restoration model which is based on highly redundant, shift invariant dictionaries, and hybrid in its sparsity priors.

?High energy sources and HI tomography during the dark ages

Mirabel Felix [1]

1 : CEA (CEA-Saclay)
CEA

The re-ionization of the universe that took place during the first billon years after the Big Bang is one of the major frontiers in cosmology. Until recently, most models of the re-ionization had considered only the ultraviolet radiation from the first generations of massive stars as the only factor in the process of re-ionization of the intergalactic medium. I will show that besides the UV radiation of massive stars, feedback from the fossils of those massive stars (X-rays and relativistic jets from i.e. accreting stellar black holes), played an important role determining the early thermal history of the universe and partially ionizing the intergalactic medium over large volumes of space. Feedback from accreting black holes had a direct impact on the tomography of HI to be observed with SKA, as well as on the properties of the faintest galaxies at high redshifts, the smallest dwarf galaxies in the local universe, and on the cold dark matter model of the universe.

Star-forming regions

André Philippe [1]

1 : Laboratoire d'Astrophysique de Paris-Saclay (CEA - AIM/SAp)
CEA
Orme des Merisiers - Bât. 709 - 91191 Gif-sur-Yvette

I intend to discuss three sub-topics:
Magnetically-active young stars, census and multiplicity of young protostars, and filamentary structure of HI clouds.

Synergies LOFAR/SKA/Planck

Langer Mathieu [1]

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TBD

The large inverse problem of modern radio interferometry

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The data produced by the new generation of interferometers are affected by a large variety of partially unknown complex effects such as pointing errors, phased array beams, ionosphere, troposphere, Faraday rotation, or clock drifts. Existing algorithms solve for the effective Jones matrices, and none of them use any of the structural properties of the Radio Interferometry Measurement Equation (RIME) nor can constrain its underlying physical quantities. Another related difficulty is that they lack robustness in the presence of low signal-to-noise ratios, and when solving for moderate to large number of parameters they can be subject to ill-conditioning. Those effects can have dramatic consequences in the image plane such as source or even thermal noise suppression. I will review the existing algorithms as well as those under development, and discuss the impact of this numerical instrumentation on the future science with the SKA.

Pulsar interactions with planets

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The pulsars PSR B1257+12 and PSR B1620-26 are expected to hold planets, and other pulsars have suspected asteroids or comets. We investigate the electromagnetic interaction of a relativistic and magnetized pulsar wind with a planet or a smaller body in orbit. Many models predict that, albeit highly relativistic, pulsar winds are slower than Alfven waves. In that case, a pair of stationary Alfven waves, called Alfven wings (AW), is expected to form on the sides of the body. They are a magnetic wake into the plasma flow, and they carry a strong electric current. The theory of Alfven wings was initially developed in the context of the Io-Jupiter interaction. We have extended it to relativistic winds, and we have studied the possible consequences that could be relevant for observations : possible radio emissions from planets of pulsars, and a magnetic force configuration with a strong influence on the orbit of asteroids, comets, planetesimals.
Electromagnetic effects effects of planets around pulsar may have been already observed. The extremly intermittent behaviour of pulsars PSR B1931+24 and PSR J1841-0500 may result from asteroids at close distance to the star. The Lorimer pulse and fast radio burst may be extremely colimated radio signals emited in the magnetic wake of pulsar planets from remote galaxies.

Radio détection des rayons cosmiques

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Synthèse des résultats récents et de problèmes ouverts dans le domaine des rayons cosmiques d'ultra haute énergie.
Progrès récents dans la radio détection des gerbes atmosphériques induites par ces rayons cosmiques et notamment obtenus par l'expérience CODALEMA et les autres réseaux de radio détection.
Perspectives pour la technique de radio détection et leur articulation autour des instruments LOFAR et SKA.

Cosmological Evolution of Neutral Gas Mass

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The cosmological evolution of neutral gas mass, Omega_HI, provide information on the gas reservoir for star formation and accretion phenomena on global scales. Measurements at z>2 based on large surveys of quasar absorbers observed at optical wavelengths now provide reliable estimates of this quantity. Observations at z~0 of HI emission of galaxies at radio wavelength also offer a strong constraint on Omega_HI, with a value considerably lower than measured at high-redshifts. ASKAP, MeerKAT (and ultimately SKA) offer prospects to derive this quantity at z>0 with direct emission detections, stacking and blind absorption techniques, thus providing important clues on the evolution of Omega_HI in a so-far little-probed time range.

LOFAR Sparse Image Reconstruction

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Recent papers have established a clear link between the discrete nature of radio interferometry measurement and ``compressed sensing" theory, which supports sparse recovery methods to reconstruct an image from the measured visibilities. We have implemented a sparse recovery method in the standard LOFAR imaging tools, allowing us to compare the reconstructed images from both simulation and real data to results obtained with classical methods such as CLEAN or MS-CLEAN. We show that i) sparse recovery performs as well as CLEAN in recovering the flux of point sources, ii) performs much better on extended objects , and iii) provides a solution with an effective angular resolution at least twice times better than the LOFAR CLEAN map.

RETRAM : A network of passive radars to detect and track local meteors - first results

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A meteor entering the higher layers of the atmosphere changes the surrounding media to a plasma reflecting electromagnetic waves. This phenomenon is well known for radars where the plasma creates a moving target reflecting back the transmitted pulses. This reflection mechanism is also the key for point to point communications where specific wireless systems are designed to use these opportunistic reflectors to open obstructed channels. Most of the meteors vanish during their friction through the atmosphere, and most of the time only dust reaches the ground. For dense or heavier objects, it is of high interest for scientists and astronomers to collect the stone on the ground before it is too contaminated by earth atmosphere. It is also important to know where the object comes from, for a better characterization of the known meteor swarms.
Meteor detection and tracking is the core research work done in the RETRAM group. Conversely to most systems using active radars or passive detection with multiple antennas, the RETRAM project tries to use multiple simple receiving stations and passive radar techniques to detect falling objects and estimating their trajectory in the vicinity of Paris, France. The group works on the design of a low-cost network of sensors and relevant algorithms, using the Internet to interconnect the radar stations and processing systems.
This presentation describes the underlying processing and the architecture of the system, the different illuminators of opportunity used and gives some results for the main showers during 2012 and 2013, showing - when available - the comparison with optical observations.

Turbulence in the interstellar medium. Prospects with the SKA.

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Magnetized turbulence is now recognized as a major player in the dynamics and evolution of the interstellar medium. Power-law power spectra are a signature of a turbulent cascade of kinetic energy from the large injection scales to dissipation scales. Yet, the latter are not well constrained : Current observations provide kinematical and chemical clues of this dissipation occurring at the milliparsec scale, in structures which may be vortices or low-velocity shocks. On the other hand, Herschel observations have uncovered a typical width (0.1 pc) of self-gravitating filaments, a size which may be connected to the dissipation of energy via ion-neutral friction (ambipolar diffusion). I will present some of the questions pertaining to the dissipation of interstellar turbulence and how the SKA may help us answer them.

21-cm signal from cosmic dawn

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In this talk I will discuss the neutral hydrogen signal from pre-reionization epoch, including the dark ages and the era when the first bright objects were formed. The signal from dark ages depends only on atomic physics and cosmology and therefore is relatively easy to predict. On the other hand, neutral hydrogen emission from the era of primordial star formation depends on (1) emission spectrum of first stars, (2) the relative motion between the dark matter halos and the in-falling gas, (3) the feedback of the starlight on star formation, etc. Most of these high-redshift effects are poorly constrained due to the lack of direct observations. I will point out how these physical phenomena affect the expected neutral hydrogen emission from high redshifts.

LOFAR observations of Saturn's atmosphere

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The LOFAR interferometer permits us to measure the brightness temperature emitted by Saturn at meter wavelenghts. We show that they will provide us with the temperature profile of the deep troposphere of the planet in a region where the opacity is mainly due to water vapor. As a result, it will be possible to infer the O/H ratio, an information necessary to fit the gravitational moments measured by the Cassini spacecraft and then to infer the structure of the interior of the planet.

Synergies SKA-Athena

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The Advanced Telescope for High-energy Astrophysics (Athena) is an X-ray observatory proposal to be submitted to the ESA call for mission concepts for the science theme "The Hot and Energetic Universe". To be launched in 2028, Athena will provide transformational capabilities in terms of angular resolution, effective area, spectral resolution, and grasp, that will make it the most powerful X-ray observatory ever flown. I will discuss various synergies between the Athena mission and the SKA telescope.

Exoplanet searches in Radio : theory & observations from UTR2 to LOFAR & SKA

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We will review the various proposed scenarios that may lead to nonthermal radio emissions from exoplanetary systems (planetary magnetospheres, star-planet interactions, magnetosphere-ionosphere coupling), and the physical information that can be drawn from their detection. Then we will summarize the strategies and results of past and recent radio searches between ~10 MHz and ?1 GHz (with UTR-2, the VLA, the GMRT, and LOFAR), that led up to now to hints of possible radio detection of some known exoplanets, but not yet to a non-ambiguous detection. Much remains to be done with the above instruments, and even more is expected from powerful next-generation instruments such as SKA and FAST. I will summarize the status of future exoplanet searches with SKA, as discussed in its "Cradle of Life" science group. Interest and possible strategies of coordinated observations with non-radio instruments (Corot & Kepler, Espadons/Narval, Spirou, HST, XMM-Newto...) will be mentioned.

Towards the SKA: using its Precursors, ASKAP and MeerKAT (and APERTIF)

Van Driel Wim [1]

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The full SKA will be an instrument of truly astounding potential for discoveries. Although getting it built is a long-term project, it has the advantage of being a giant interferometer consisting of a myriad antennas, which can be built out over time, with exciting science goals that evolve as construction progresses. An important step towards building the SKA already started some time ago: the construction of its so-called Pathfinder instruments, ASKAP (Australia) and MeerKAT (South Africa), which will be complemented in the Northern hemisphere by APERTIF (Netherlands), and which will be fully operational just a few years from now. An overview will be given of these instruments and the science planned with them for their first years of operation - with particular focus on their interests for the French astronomical community.

Extremely-low-frequency studies of radio emissions from space at UTR-2 and GURT

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We will present recent results of observations of various astronomical objects with the radio telescopes UTR-2 below 32 MHz, and prospects for GURT below 70 MHz.
UTR-2 (Ukrainian T-shape Radiotelescope, v2) is operational since about 40 years but the recent implementation of digital receivers enhanced its capabilities. We will present results on sporadic solar radio emission (Type III, Type II, Type IV bursts, S-bursts, drift pairs, spikes), recombination radio lines, Jupiter radio emission (with 15 nanosecond time resolution), Saturn's lightning, the sounding of pulsar magnetosphere, a transient survey of the Northern sky, a survey of decametric sources and background, interplanetary and ionospheric scintillations, and flare stars.
Recently, the first sections of GURT (the Giant Ukrainian Radio Telescope) became operational. We will present first test observations and prospects.

Sun and Space weather

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Solar radio emissions come from accelerated electrons or from the thermal emission of the hot corona. They give a unique diagnostic of accelerated particles in the corona, and can help alone, or most often with observations at other wavelengths, to solve problems like particles acceleration in flares and propagation of particles toward the interplanetary medium. Large magnetic disturbances (i.e. coronal mass ejections) may be observed by the radio emission of the particles which are accelerated when the magnetic field of the moving disturbance reconnects with the coronal magnetic field. Acceleration of electrons may also occur in shocks, and the radio emission allows us to observe shocks propagation in the corona.
The thermal emission of the corona gives good models of the corona density and temperature, and shows a lot of structures which are related to the mostly unknown coronal magnetic field. These structures are probably connected to the solar wind.
Radio observations of the sun require specific capabilities for the radio telescopes, like a very good snapshot imaging, and accurate brightness measurements on a rather large object. Both need a dense uv coverage.
We will present some results and difficulties of Lofar, and what we can hope from other present (MWA) or future instruments.

HI and Galaxy evolution

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HI is one of the most significant, if not the most significant contributor of mass to the interstellar medium of galaxies. I discuss what is known both theoretically and observationally about the distribution and characteristics of HI in both local and distant
galaxies from absorption and emission lines. The general theme of my talk is a discussion of the important role that HI plays in the growth of galaxies and what interesting questions that a full SKA will be able to address.

Molecular Spectroscopy with SKA : new diagnostics for the ISM and star and planet formation

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Molecular and atomic lines have been used for tracing the dynamics, physical conditions and magnetic field in the
neutral ISM. With the huge increase in sensitivity, resolution and mapping speed provided by SKA, these diagnostic capabilities will provide interesting information to better understand the complex structure of the ISM and the process of star and planet formation.

Fast (coherent) radio transients and pulsars

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Recent pulsar surveys have discovered what appears to be a population of millisecond-duration, non-repeating radio bursts of plausible extragalactic origin. If properly localized, a large sample of such bursts would provide a unique new cosmological probe of the matter between galaxies. The basic origin of these "fast radio bursts" is also a mystery and a hot topic of debate. I will review our current understanding of this phenomenon and, in a more general sense, discuss fast (coherent) radio transient and pulsar searches: how they are done, what is being found, and how SKA can transform the field through its ability to monitor large areas of sky at high time resolution.

Synergie radio (SKA, LOFAR) et observatoires aux hautes et très hautes énergies

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Il s'agira d'illustrer l'intérêt des synergies entre la radioastronomie et l'astronomie gamma pour l'étude de l'univers non-thermique et turbulent, en particulier entre SKA et LOFAR, les télescopes Cherenkov au sol et le projet CTA.

La radioastronomie spatiale basses fréquences, présent et futur

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La gamme de fréquence en dessous de 10-20 MHz est exploitée pour l'exploration du système solaire: émissions radio solaire et planétaires. Mais elle est encore complètement inexplorée avec des instruments radio interférométriques à grande échelle. L'endroit le plus proche de la Terre pour mettre en place ce type d'instrumentation est l'environnement lunaire, à la surface de la face cachée, ou bien en orbite. Même si un très grand radio télescope à la surface de la Lune semble encore hors de portée à moyen terme, des expérimentations pionnières doivent être lancées avec une instrumentation relativement simple.
Après avoir fait un état des lieux de la radioastronomie spatiale, nous présenterons quelques uns de ces précurseurs qui doivent être construits pour avancer dans cette voie. Ceux-ci seront basés sur un petit nombre d'antennes connectées à des récepteurs radio établissants des mesures spectrales et de forme d'onde. Nous pouvons, dans un premier temps, mesurer la polarisation et le vecteur d'onde (la direction d'arrivée) des ondes radio incidentes à l'aide de deux dipoles électriques croisés, et donc obtenir une carte du ciel à l'ordre zéro d'une précision de quelques degrés. Il faut au moins un second point de mesure avec les mêmes caractéristiques pour faire des mesures interférométriques, permettant ainsi de contraindre la taille angulaire et la localisation des sources radio les plus intenses, ainsi que des radio sources du système solaire, comme le Soleil ou les planètes externes.
Dans un futur un peu plus lointain (mais pas si lointain, on parle de 2020), il est envisagé de construire des interféromètres radio très basse fréquence en orbite basse lunaire. Ces essaims d'antennes radio formeraient un interféromètre 3D composé d'au moins 50 nano-satellites répartis sur une distance de l'ordre de la centaine de kilomètres. Avec ce type d'instrument, on devrait pouvoir mieux comprendre les émissions radio solaire (type II ou type III), en ajoutant la capacité de faire de la vraie imagerie. Les sources radio planétaires lointaines, comme Uranus, deviendraient aussi accessible depuis l'orbite terrestre. Ce type d'interféromètres pourrait aussi être placé autour des points de Lagrange L4 ou L5 de la Terre. Nous présenterons les différents actions en cours et les jalons prévus pour avancer dans cette direction.

3D intensity mapping and 21 cm cosmology

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Innovative and next generation radio instruments are opening new windows for observing the distant universe, promising significant advances in cosmology, structure formation and evolution. In recent years, intensity mapping has emerged as a promising technic for 3D mapping of matter distribution in the universe through the redshifted 21 cm radio emission of atomic hydrogen. This is a complementary approach to optical surveys for the study of the Large Scale Structures, in particular for measuring the BAO (Baryon Acoustic Oscillation) scale up to redshifts z

VLBI and its complementary with SKA for long baseline science

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The presentation will review the current capabilities of existing Very Long Baseline Interferometry (VLBI) networks with a focus on the European VLBI Network (EVN) and its real-time component (e-EVN). VLBI is addressing a wide variety of astronomical topics in stellar, galactic and extragalactic science, with also a number of interesting applications in astrometry and planetary science. A review of these will be given. The presentation will also draw prospects for future synergies and complementarity between VLBI and SKA in the next decade.

Pulsar Timing Array for observing gravitational waves sources

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The timing of an array of millisecond pulsars (PTA) not only makes it possible to understand pulsar astrophysics but also to observe sources emitting gravitational waves (GWs) in the nanoHertz frequency range. Few tens of millisecond pulsars are currently monitored by the PTA community for reaching now a sensitivity where the detection of realistic GW emission become possible. A PTA based on the Square Kilometer Array (SKA) makes it possible to have a real observatory for sources emitting GW in nano-Hertz regime. The French community organized around Nançay radio telescope is very active in the whole PTA activities from pulsars observations to GW data analysis. In this talk we will show how the PTA can detect GW, the expected gravitational wave sources, the current activities of PTA community in particular within the French collaboration and the potential on SKA for PTA.

Stellar Physics with SKA

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I will draw the main science driver of SKA in connection with french research on stellar physics.

High Frequency Radar Astronomy and Radio Astronomy with the Over-The-Horizon Radar NOSTRADAMUS.

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The NOSTRADAMUS radar system is a set of 288 antenna elements distributed over the arms of a three-branch star. It is operating in High Frequency waves (6 to 28 MHz) that bounce off the ionosphere, reaching areas far beyond the horizon. As an early warning radar system, its primary purpose was the detection of aircraft (and ship) at long ranges from 700 to 3000 km.
In the past years, research have been carried out on the ionosphere, on oceanography and on seismology. More recently, the radar has been used at trans-ionospheric frequencies to do radar astronomy by detecting meteorites and the Moon, and radio astronomy by observing Jovian and Solar radio emissions at long wavelenghts.
After a quick presentation of the OTH radar, we present some results of radar astronomy and radio astronomy. Finally, we discuss about possible other experiments that could be carried out in the future.

Slow (incoherent) Radio transients

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Radioastronomy is currently undergoing a major revolution with the construction of new radio facilities and the advent of the Square Kilometer Array (SKA). Radio variability probes a wide range of astrophysical phenomena and several key projects have been designed to study the dynamic radio sky. In this talk, I will also present these various programs and the opening of the new time domain window for accreting black holes and slow transients.

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