

Abstracts

Spanish SKA day

SKA overview

Phil Diamond (Director General of the SKA Organization)

The Square Kilometre Array is the next generation radio telescope; its detailed design phase is well underway, with the expectation that construction will begin in early 2018. I will provide a brief summary of the SKA science case, including the recent science prioritisation process. I will then provide an update on the project itself, its design process and a report on recent engagement with partner countries.

Spanish participation in the SKA

Lourdes Verdes-Montenegro (IAA-CSIC), Jose Carlos Guirado (U. de Valencia), Jesús Martín-Pintado (CAB-CSIC)

In this talk we will inform on the activities performed so far by the Spanish community within the framework of SKA Project in scientific, engineering and outreach areas, driven by the Spanish SKA Network and the VIA-SKA project “Feasibility study of the technological Spanish participation in the SKA” both funded by the former MICINN. Those activities lead to the formation of the Grupo Español del SKA (GE-SKA).

Dissemination activities undertaken as members of the SKA Communications and Outreach Network (SKACON) by the Outreach Units of Instituto de Astrofísica de Andalucía (CSIC) and Universidad de Valencia will be summarized. Finally, we will present the recommendation issued by the RIA Working Group “Radio Astronomy Infrastructures” (G1) in May 2013 and endorsed by the RIA Board on the interest of the scientific community and industry that Spain explore the possibility to join the SKA project as Full Member before the construction phase starts.

Industrial Activities in Large Scientific Facilities

Kauzar Saleh (CDTI)

CDTI (Center for the Development of Industrial Technologies) is a public organisation chaired by the Spanish Secretariat for Science, Technology and Innovation. Within its competences are the funding and support to companies in the preparation of R&D projects, both for national (CDTI), European (H2020, CDTI) and international (CDTI) programs. CDTI is also the delegate body representing Spain at the different ESA boards, and acts as Industrial Liaison Officer (ILO) for Large Scientific Facilities such as CERN, ESO, Fusion for Energy, etc.

This presentation is meant to make the CDTI activities in support of research infrastructures known to the SKA community, and to highlight the experience of Spanish companies in delivering added value services and products for the Large Scientific Facilities in which Spain participates.

Epoch of Reionisation/cosmology

Diego Herranz (IFCA/CSIC-UC), Jose Alberto Rubiño (IAC)

In this brief talk we will summarize the scientific potential of SKA for cosmology and Epoch of Reionisation (EoR) studies, placing an especial focus on the specific interests of the Spanish scientific community and the synergies between the SKA and Spanish-led experiments such as J-PAS, QUIJOTE, ALHAMBRA, etc. but also with some other surveys in which the Spanish community is involved.

Galactic spectroscopy with SKA pathfinders

José Francisco Gómez (IAA-CSIC)

SKA pathfinders will be powerful instruments of obtain scientific results over the next few years. Here we will present two complementary surveys that we plan to carry out: the Galactic ASKAP Survey (GASKAP), one of the key science surveys approved for the Australian SKA Pathfinder, and the Galactic and Magellanic Evolution Survey (GAMES), proposed for the APERTIF project at Westerbork.

With these surveys we will obtain a complete map of the Galactic Plane ($|b| < 10$ deg) and the Magellanic Clouds in the HI and OH lines at 18-21 cm, with unprecedented sensitivity and angular resolution.

Our data will provide information on different phases of the interstellar medium (the warm atomic gas traced by HI and the colder molecular gas traced by OH), as well as energetic processes in young and old stars via their OH maser emission. We will obtain an extraordinarily detailed view of galaxy evolution in our own backyard, studying the processes leading to star formation and the subsequent effects of mass loss from young and dying stars on the interstellar medium.

Spanish participation in the SKA Telescope Manager. The Telescope Manager

Eduard Díez (GTD), Josep-Miquel Girart (IEEC), Josep Colomé (IEEC)

The Telescope Manager Work Package tasks concern the management of all Telescope Hardware and Software, all Astronomical Observations, and Communication across Stakeholders and Other elements. The presentation is focused in the Telescope Manager (TM) Status, primary responsibilities, key challenges of the TM and the background of IEEC/GTD.

AGN and Jet Studies with SKA

Ivan Agudo (JIVE)

Relativistic jets in active galactic nuclei (AGN) are among the most powerful astrophysical objects discovered to date. Indeed, jetted AGN studies have been considered a prominent science case for SKA so far. Most of the fundamental questions about the physics of relativistic jets still remain unanswered, and await high-sensitivity radio instruments such as SKA to solve them. These questions will be addressed especially through analysis of the massive data sets arising from the deep, all-sky surveys (both total and polarimetric flux) from SKA1. Wide-field very-long-baseline-interferometric survey observations involving SKA1 will serve as a unique tool for distinguishing between extragalactic relativistic jets and star forming galaxies via brightness temperature measurements. Subsequent SKA1 studies of relativistic jets at different resolutions will allow for unprecedented cosmological studies of AGN jets up

to the epoch of re-ionization, enabling detailed characterization of the jet composition, magnetic field, particle populations, and plasma properties on all scales. SKA will also enable us to study the dependence of jet power and star formation on other properties of the AGN system. SKA1 will enable such studies for large samples of jets, while VLBI observations involving SKA will provide the sensitivity for pc-scale imaging.

Cosmic Magnetism and SKA

Eduardo Battaner, E. Florido, A. Gujarro, B. Ruiz-Granados (U. de Granada)

Cosmic Magnetism is one of the main objectives of SKA. We will consider the main opportunities as identified by the Working Group on Cosmic Magnetism. The FR tomography of our own galaxy and other nearby galaxies will be observed with unprecedented insight. We can study the evolution, configuration and dynamical effects of galactic magnetism. Fields in clusters, filaments, Reionization and Recombination are also exciting objectives of SKA. Within these general topics some particular targets in our group will be commented, such as the study of the so called "fan" region, the rim regions of galaxies and the interplay of magnetic fields and TeV cosmic rays.

Spanish participation in the SKA Science Data Processor Consortium

Rosa Badia (on behalf of BSC, IAA-CSIC, FCSCCL)

This presentation will cover the Spanish participation, carried out by IAA-CSIC, FCSCCL and BSC-CNS, in the Science Data Processor (SDP) consortium, in charge of the development of the computing hardware platforms, software, and algorithms needed to process science data coming from the correlator.

The IAA-CSIC as part of the SDP consortium aims to reinforce the efficient distribution of the SKA data and metadata among the scientific community. To that end, the IAA team will collaborate to characterize the SKA processes and data and to design a federated access to them that exploits the computing resources minimizing the latency time and the energy consumption.

The FCSCCL will evaluate the suitability of specific hardware configurations and infrastructures. It will set up a heterogeneous testbed with distributed resources and a 10GB lambda network amongst remote data centres which will serve to analyse the performance of a distributed storage and computation federation over high bandwidth networks

BSC - CNS contributes to SDP consortium with expertise on operation of HPC systems, with experience on tuning HPC applications and with expertise in parallel programming models, both for fine grain (aiming to parallelize applications for multicores and GPUs) and for coarse grain (aiming to parallelize workflows). BSC will collaborate within the consortium to characterize the behaviour of the SKA processes in the HPC infrastructures.

Transient studies with the SKA

Miguel Pérez-Torres, Antxon Alberdi (IAA-CSIC)

I will give a short overview of the science that the SKA will be able to tackle within the field of the transient radio sky.

Radio transients are both the sites and signatures of the most extreme phenomena in our Universe, including exploding stars, compact object mergers, black holes and ultra-relativistic flows. All of the above show prominent non-thermal radio emission, yet strong variability can also be associated with thermal emission, e.g., novae. SKA will be able to observe large numbers of any of those objects, and down to unprecedented sensitivities, which will permit to make similarly unprecedented advances. In all cases, transient science benefits greatly from monitoring the sky frequently. As such, commensal observing alongside other SKA projects is a powerful strategy, and transient studies will highly benefit from such approach.

Note: The material used for this talk is mostly taken from the presentation made by Rob Fender, coordinator of this SWG, at the SKA conference in Giardini Naxos.

Prebiotic Chemistry

Jesús Martín-Pintado (CAB-CSIC)

Carbonaceous meteorites provide us with a record of prebiotic chemistry in the early Solar System. Although complex organic molecules like alcohols, aldehydes, water, ammonia and methane has been detected in a wide range of environments in the Interstellar Medium (ISM), the detection of prebiotic molecules in the ISM has been, so far, unsuccessful. SKA offers unique capabilities to detect prebiotic molecules in the ISM. I will discuss the main difficulties of detecting prebiotic molecules with the present facilities and the potential of the SKA to detect them.

Spanish participation in the SKA Synchronization and data transport Consortium

Javier Díaz (Unv. Granada)

This talk presents the work under development at the Signal and Data Transport (SaDT) group of SKA. The top end requirements to transport a huge volume of data and the high accuracy/stability of the time and frequency distribution system requires the development of unprecedented technologies capable to fulfil SKA specifications.

This talk focus on the contribution being done by the Spanish partners, mainly in the framework of Synchronization and Timing task where different technologies for time transfer as well as for frequency dissemination has been evaluated according to SKA needs. Target architectures, future development plans and challenges are briefly summarized.

Spanish participation in the CSP consortium

Juan A. López (UPM)

This talk presents the work under development at the Central Signal Processor (CSP) group of SKA. The CSP receives the data from the SaDT, and performs the required high performance computations using specialized platforms to convert the digitised signals detected by the SKA receivers into the information needed by the SDP to make images of the astronomical targets.

Our main activities in this group are: (1) High level optimization of the DSP modules and the global architecture for its implementation in ROACH III or Power-MX boards. (2) Development of an advanced quantization tool for optimal wordlength selection of DSP specifications in FPGA-oriented designs, and (3) development of CAD tools for high-level analysis and fast design of modules associated to the CASPER toolflow (Collaboration for Astronomy Signal Processing and Electronics Research).

This work is performed by the UPM with the support of ISDEFE, in collaboration with SKA-SA, UC Berkeley, Univ. Oxford, Univ. Curtin, and others.

Jets and protoplanetary disks in young stars,

Guillem Anglada (IAA-CSIC)

Stars form as a consequence of the collapse of dense cores of molecular gas and dust, resulting from the fragmentation of interstellar (parsec-scale) molecular clouds. Because of the initial rotation of the core, matter does not fall directly onto the central (proto)star but through a circumstellar accretion disk. Eventually, as a result of the evolution of this disk, a planetary system will be formed. A fraction of the infalling matter is ejected in the polar direction as a collimated jet that removes the excess of mass and angular momentum, and allows the star to reach its final mass. Thus, the star formation process is intimately related to the development of disks and jets. One of the key problems in the study of jets is to determine how they are accelerated and collimated. High angular resolution observations at centimeter wavelengths are very useful to trace the base (at 100 AU scales) of the ionized component of the jets, close to the young central star and its accretion disk, where optical or near-infrared imaging is hampered by the high extinction. This kind of observations are also useful to trace the emission of dust grains that have grown up to large (centimeter-sized) scales in the process of planetary formation. I will review the main properties and recent results on jets and protoplanetary disks associated with young stars. Finally, I will discuss the main expected contributions to this topic from the very sensitive, high-angular resolution centimeter wavelength observations that will be feasible with SKA.

Atomic gas and galaxy evolution: SKA prospects

Lourdes Verdes-Montenegro (IAA-CSIC)

The atomic gas (HI) informs us about the process shaping galaxies, from their very formation to their internal evolution and the way they relate with their environments. However we suspect that a significant diffuse HI component is escaping detection. The star formation activity observed at different ages of the Universe seems to require a steady accretion of intergalactic gas, which might also explain some of the asymmetries observed in disc galaxies. On the other hand, in very dense environments high HI deficiencies are observed, reaching in some cases a 100% of missing gas.

Both extremes of the HI lifecycle, crucial for a complete picture of galaxy evolution exist at very low column densities unreachable by current interferometers. Detecting this faint gas has become one of the main drivers of one of the 5 Key Science Projects of SKA: "Galaxy Evolution, Cosmology and Dark Energy".

Studies of low-redshift galaxies can reach with SKA1-MID HI column densities 10 times better than current observations, with SKA1-SUR strength relying on its ability to characterize the environment with its large instantaneous field-of-view (FOV~18deg²). The SKA HI and Galaxy evolution Science Working Group (HISWG) has prepared a revision of SKA and SKA1 capabilities in the study of the history of HI at $z= 0-1.5$, to be published early 2015 as the updated Key Science Projects, and I will present a summary of them in this talk.

Roadmap to Exascale Computing. Building a Human Centric Intelligent Society

Adriano Galano (Director HPC & Big Data, Fujitsu)

Demand for supercomputing capabilities is rising the world over, driven primarily by the need for effective, reliable solutions to increasingly complex social, environmental and business challenges. This is also pushing high-end computational modelling and simulation capabilities beyond the R&D labs and into the commercial and manufacturing world. A game-changing generation of petascale supercomputers is delivering the horsepower to perform the most sophisticated, compute-intensive simulations. We are positioned at the forefront of the supercomputing space with 30 years' experience in the successful development of high-performance systems.

Cooperating with leading research bodies, we believe that supercomputing has the potential to solve the world's most pressing dilemmas.

Fujitsu's Technology and Service Vision in the journey to create a Human Centric Intelligent Society and the role of Fujitsu in Japan's FLAGSHIP 2020 Exascale project will be relevant topics to be share with the audience."

Spanish activity in the development of cryogenic LNAs for the bands 4 and 5 of the SKA-mid telescopes

Alberto Barcia (on behalf of SKA Dishes Consortium, IFCA/UC & IGN)

The Spanish groups participating in the activity will be introduced, together with the collaboration arrangements that make it possible.

The guidelines and status of the work, on the use of MMIC cryogenic LNAs developed in collaboration with the Fraunhofer Institute for Applied Solid State Physics will be briefly described.

On the (Portuguese) road to SKA: The ENGAGE SKA Consortium (Enabling Green E-Science for the SKA)

Domingos Barbosa (IT, Portugal)

As part of the National Roadmap on Strategic Research Infrastructures, the approved ENGAGE SKA RI implements an action plan for scientific excellence and technological leadership of the Portuguese industry, promoting the participation of Portugal in the Square Kilometer Array, the largest radio telescope of the XXI century, to be installed in Southern Africa and Australia. This platform will stimulate radioastronomy formation and technological leadership by coupling the advanced training with ICT, Renewable Energy and Space innovation, including the testing of prototypes on national soil.

ENGAGE-SKA main scientific objectives are closely coupled to the SKA project. On the national level, ENGAGE-SKA aims to promote and capacitate national research on front-line scientific and technological problems faced by the academic and industrial community via the use and development of both current radio-astronomy infrastructures, in terms of Big Data (astronomy software development and E.Science: Cloud Computing) and Energy solutions and the new related sensor technology prototypes like the Aperture Arrays (AA).

The path from PDR to CDR

Juan de Dios Santander (System Engineer SDP/TM, SKA Organization)

In a project of the complexity of the SKA, it is very important to be very observant of the different requirements for the SKA telescopes, and how they are implemented by the different sub-systems. And because the design of the SKA is evolving, the need to assess the impact of design changes, and potential trade-offs, is more relevant than ever. In this talk I will present how the SKA Organisation is leading the Systems Engineering work of the different consortia, and how we are using Model Based Systems Engineering (MBSE) to integrate the design inputs from the sub-systems, and be able to keep a Systems view that ensures that the element designs are sound, and really comply with the stringent requirements posed by the SKA.