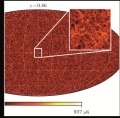




SQUARE KILOMETRE ARRAY

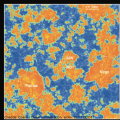
## Switzerland and the SKA

### Science



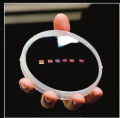
Swiss scientists are at the forefront of many fundamental science questions which will be addressed with the SKA

- cosmology
- cosmic reionisation
- galaxy evolution
- astrophysics



Swiss scientists are carrying out multi-wavelength and interferometric observations with the world's leading facilities and satellites and are involved in SKA precursor projects. Research groups in Switzerland are also among the world leaders in numerical simulations for astrophysics, a fundamental topic for future experiments such as the SKA.

### Technology



EPFL, ETHZ, Universities, and industry carry out important research and development on cutting-edge technology, which is crucial to meet the challenges of the SKA

- Development of large capacity memories
- Fast analog-digital converters
- Data compression and extraction
- Signal and image processing
- Machine learning
- Big Data developments

Participation in the upcoming SKA – the unique international radio facility – is of prime interest and importance for science, academia, and industry in Switzerland.

### The Swiss SKA consortium

Ecole Polytechnique Fédérale Lausanne (EPFL), University of Geneva (UniGE), Eidgenössische Technische Hochschule Zürich (ETHZ), University of Zürich (Unizh), Fachhochschule Nordwestschweiz (FHNW), Swiss National Supercomputing Centre Lugano (CSCS)



Fachhochschule Nordwestschweiz  
Hochschule für Technik



Swiss National Supercomputing Centre  
Lugano

Discover more, visit [www.skatelescope.org](http://www.skatelescope.org)

[ska.epfl.ch](http://ska.epfl.ch)

# SWITZERLAND AND THE SKA



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Universität Zürich

**ETH** zürich



**CSCS**

Centro Svizzero di Calcolo Scientifico  
Swiss National Supercomputing Centre



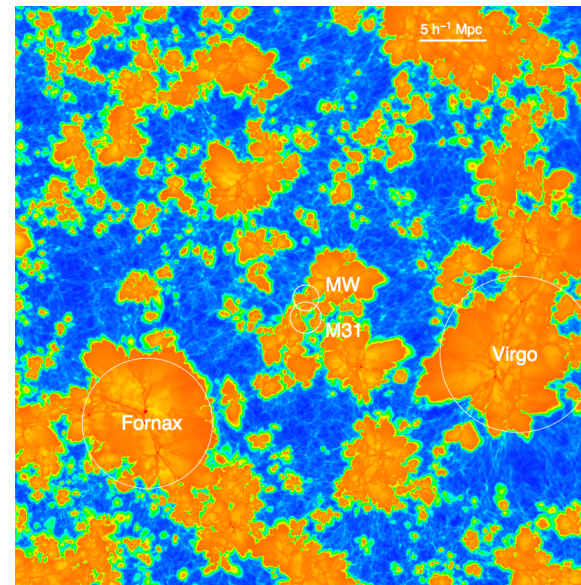
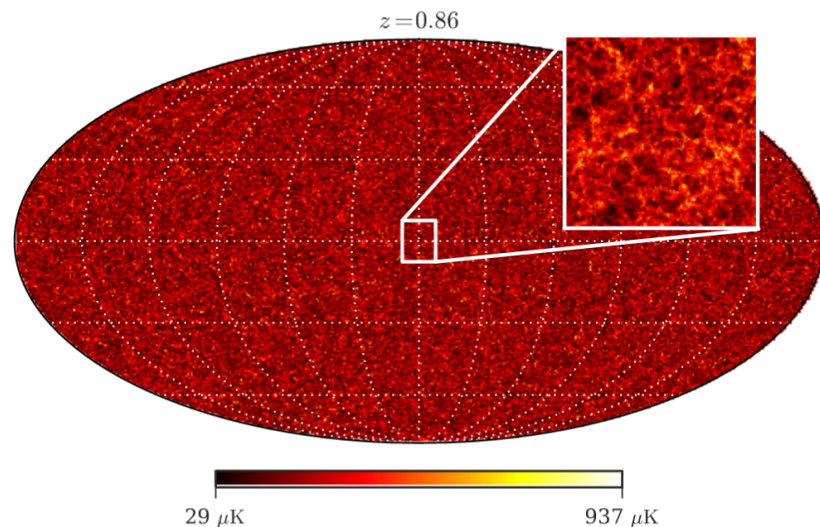
Fachhochschule  
Nordwestschweiz

Daniel Schaerer (UniGE), Swiss SKA board

# SWITZERLAND AND THE SKA

## SCIENCE

- Astrophysics, Theoretical Physics
- Cosmology
- Cosmic reionisation
- Cosmic magnetic fields
- Galaxy evolution
- Extrasolar planets, astrobiology
- ...



Ocvirk et al. 2015, Cosmic Dawn collaboration





HST (UV-IR)



VLT (visible-near-IR)



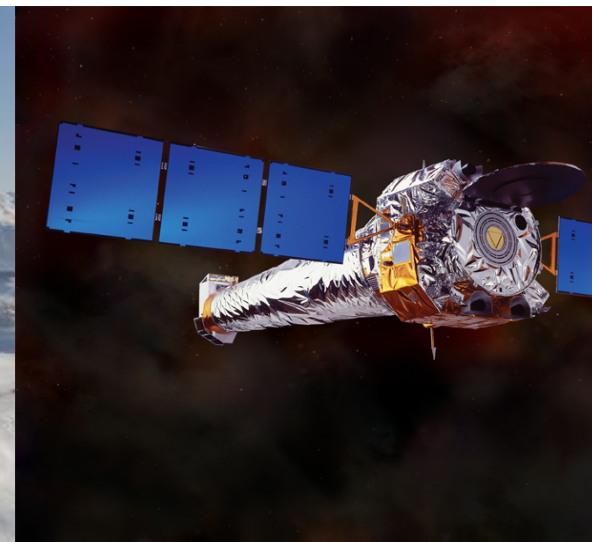
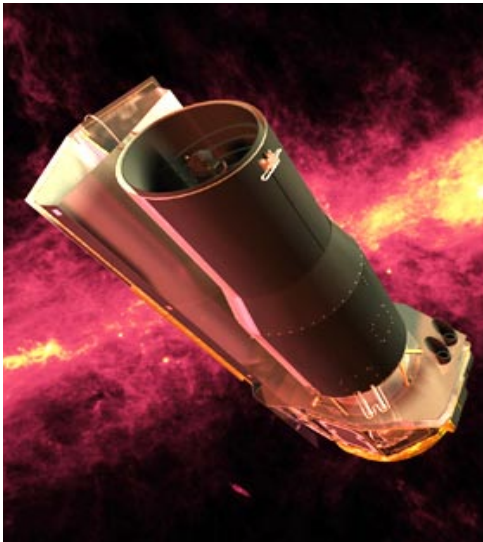
VLA (radio)

**Multi-wavelength observations**

Spitzer (near / mid-IR) Herschel (IR)

IRAM, ALMA (mm)

Chandra (X)





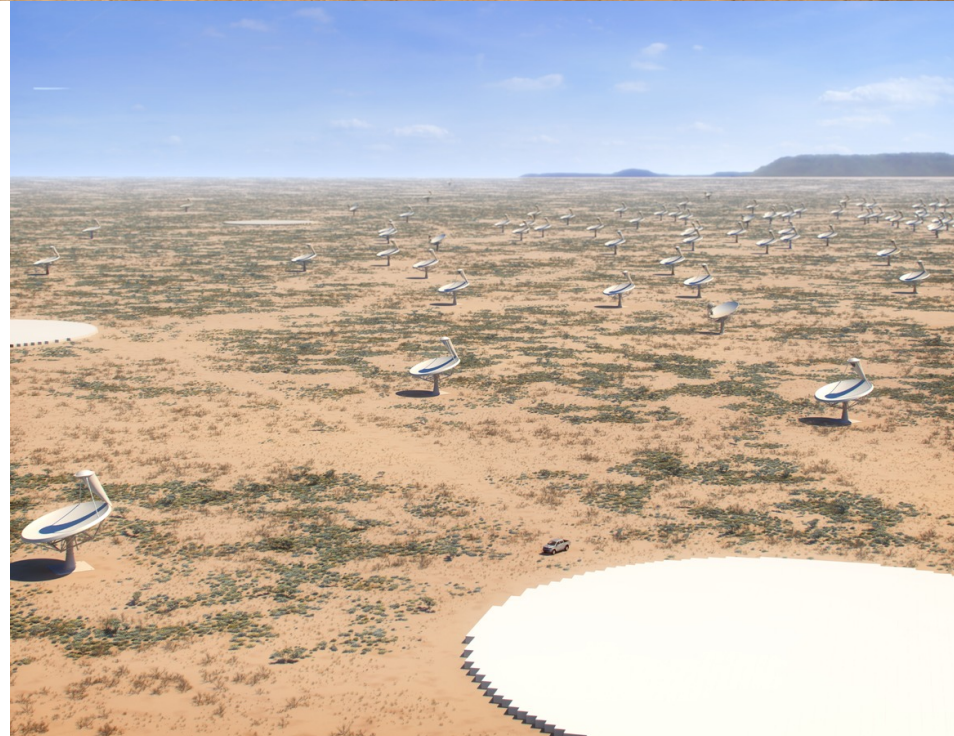
# SWITZERLAND AND THE SKA

**SCIENCE**

**Multi-wavelength observations**



***The next step!***





# SWITZERLAND AND THE SKA

**SCIENCE**

**Simulations**

CoDa from Teyssier ...

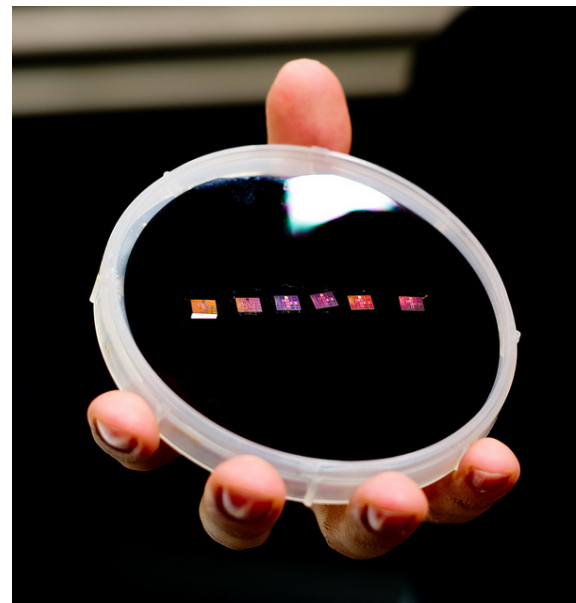


# SWITZERLAND AND THE SKA

## TECHNOLOGY

- Hardware:
  - Large capacity memories
  - Fast analog-digital converters
  - ...
- Data compression and extraction
- Signal and image processing
- Machine learning
- Big Data developments
- ...

DOMÉ project  
Credit: IBM Research, Zurich





# SWITZERLAND AND THE SKA

## *The current Swiss landscape*

Interest groups, competences :

- Astrophysics, Cosmology
- Theoretical Physics
- High Performance Computing, Signal processing
- Big data, data mining, ...
- Hardware (electronics, antennae...)

Active Universities/institutions:

- Geneva (UniGE)
- Lausanne (EPFL)
- Zurich (UniZH + ETH)
- National Supercomputing Centre (CSCS)
- University of Applied Sciences (FHNW)

Industry:

- IBM research



# SWITZERLAND AND THE SKA

## *The current Swiss landscape*

Involvement in SKA precursors, radio astronomy, interferometry:

- Users of IRAM, ALMA, SMA
- Users of (e)VLA, GMRT, ATCA
- Participation in ASKAP, MeerKat
- Involvement in BINGO
- Antenna in Bleien
- ...

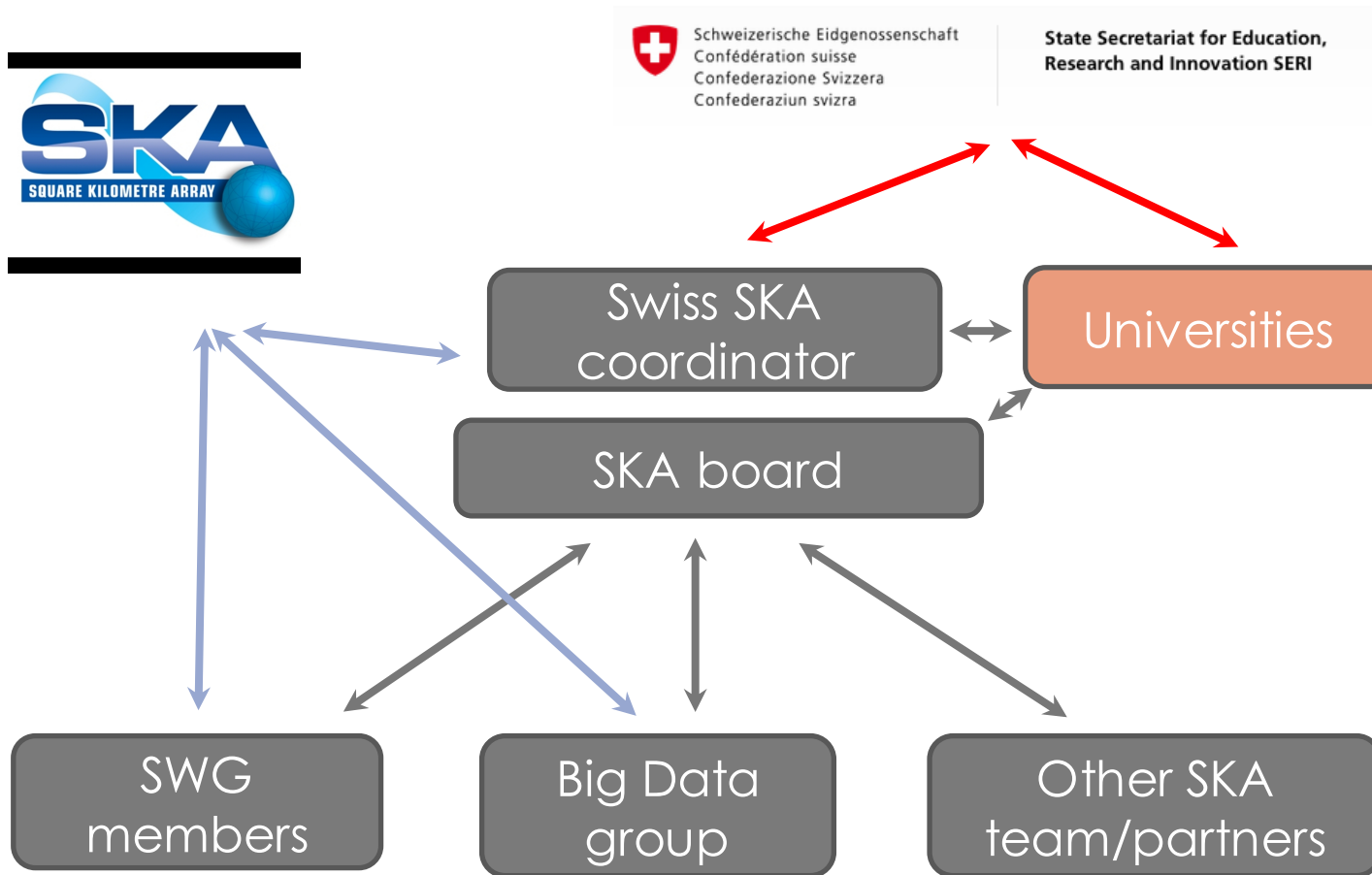
Involvement in SKA Science Working Groups:

- *Participants* in Cosmology, Astrobiology/Cradle of Life, Continuum Surveys, Extragalactic Spectral Line, Our Galaxy, Solar & Heliospheric Physics
- *Candidates* for H I and Galaxy Evolution, Epoch of Reionization & the Dark Ages, Cosmic Magnetism





# SWITZERLAND AND THE SKA

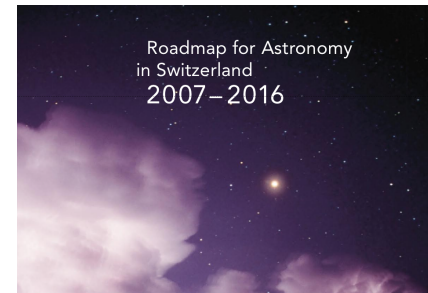


# SWITZERLAND AND THE SKA

**2014:** update of Swiss Roadmap for Astronomy 2007-2016 published by CHAPS committee

→ Recommends participation in future large projects

→ **SKA and LSST considered « scientifically most attractive at present »**



2014: Swiss Research Infrastructures Roadmap:  
*Federal Council Dispatch on the promotion of Education,  
Research and Innovation (ERI) for 2017-2020.*

→ **Proposal to join the SKA  
submitted:**

Schaerer (UniGE, Leading House),  
Meylan (EPFL), Teyssier (UniZH)



SWISS RESEARCH INFRASTRUCTURES ROADMAP

---

CALL FOR APPLICATIONS FOR NEW RESEARCH  
INFRASTRUCTURES OF NATIONAL RELEVANCE

---



# SWITZERLAND AND THE SKA



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

State Secretariat for Education,  
Research and Innovation SERI

## New research organisations

As part of the [2015 Swiss Research Infrastructure Roadmap](#), four international research organisations in the process of getting established have been identified, for which the question of Swiss participation merits serious consideration. The possibility of Swiss participation in these organisations will be decided by 2020. SERI is tasked with preparing the participations, establishing the financial framework up until the time when Switzerland signs an international agreement and, of course, ensuring an evaluation is made of the advantages of these participations for Switzerland. Representatives of the Swiss scientific communities concerned are in close contact with these efforts.

### CTA, Cherenkov Telescope Array (astronomy)

CTA is an international scientific cooperation project that aims to build a world leading research facility in the field of astroparticle physics. The infrastructure will involve a network of more than 100 Cherenkov-type telescopes, located in the southern hemisphere on a site in Chile (Paranal) and in the northern hemisphere on the island of Palma (Canary Islands, Spain). Fundamental breakthroughs are expected in the field of high-energy astroparticle physics and more generally in cosmology and fundamental physics. Construction of CTA is expected to start in 2017 or 2018 on the basis of an international agreement. In Switzerland, the universities of Zurich and Geneva and the ETH Zurich are actively involved in this project.



### ELI, Extreme Light Infrastructure (laser physics)

ELI is a research facility under construction located on three sites in the Czech Republic, Romania and Hungary. Currently, it is the only leading-edge research facility entirely based in the enlarged



→ Late 2015:  
4 new research  
organisations identified  
by SERI

### SKA, Square Kilometer Array (astronomy)

The Square Kilometre Array is a radio telescope under construction that will have a collection surface of approximately one square kilometre. The SKA is planned for work in the range of 0.10-25 GHz, eventually with the aim of reaching the 0.06-35 GHz frequency range. Its size will make it 50 times more sensitive than the instruments currently in use and provide the possibility to monitor several independent fields of vision, thus allowing different radio astronomers to observe at the same time or to observe different parts of the sky at the same time. The SKA radio telescope will make it possible to obtain distant radio images by using the interferometry technique.



The SKA will be the most sensitive instrument of observation in radio astronomy ever designed, capable of detecting all the active galactic nuclei up to a redshift of 6, when the universe was not more than a billion years old. It will have the power to detect the signature of planets similar to Earth at distances of several hundreds of thousands of light years away. The SKA network is expected to have up to 3,000 dish antennas installed in South Africa and Australia. The SKA headquarters will be based in the United Kingdom. To date, 15 Asian, European and African states have joined SKA. The scope of SKA makes it a major long-term project for astrophysics at the global level, and Switzerland is closely monitoring its development, in particular in the universities of Geneva and Zurich, as well as the Federal Institutes of Technology in Zurich and Lausanne.



### LBNF, Long-Baseline Neutrino Facility and DUNE, Deep Underground Neutrino Experiment (particle physics)

The world scientific community in the field of neutrino physics is currently developing a project of unprecedented scope to carry out research in this field: DUNE, which is expected to be conducted in the purpose-built facility. LBNF. An international collaboration will be



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# SWITZERLAND AND THE SKA

The screenshot shows the SKA Telescope website homepage. At the top, the SKA logo is on the left, and navigation links (Home, Contact Us, Site Map, Job Vacancies, SKA Science Site) are on the right. Below the logo, the text 'SQUARE KILOMETRE ARRAY' is displayed, followed by 'Exploring the Universe with the world's largest radio telescope'. A row of flags represents the member states. A search bar and social media icons (Twitter, Facebook, RSS) are also present. A horizontal menu lists various sections: Project, Location, Design, Technology, Science, Industry, Outreach & Education, News, Media & Events, Technical Publications, Recruitment, and Contacts. The main content area features a 'Featured News' section with a large image of SKA dishes and a headline 'SKA selects the final design of the SKA dish'. Below this, three smaller news items are listed. To the right, an 'Explore the SKA' sidebar contains links to 'SKA Project', 'SKA Location', and 'Shared Sky'. A 'Did You Know?' section highlights the SKA super computer's processing power, comparing it to 100,000,000 personal computers. At the bottom, a row of four links provides access to 'Frequently Asked Questions', 'Project Timeline', 'Upcoming Meetings and Events', and 'Media coverage'. A 'The SKA Media Gallery' section is also visible, along with logos for 'GO-SKA' and 'PREP-SKA'. The footer contains copyright information for SKA 2016 and credits for the web design by Carbon Creative.

SKA TELESCOPE  
SQUARE KILOMETRE ARRAY  
Exploring the Universe with the world's largest radio telescope

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Search the SKA website

Project Location Design Technology Science Industry Outreach & Education News, Media & Events Technical Publications Recruitment Contacts

Featured News

SKA selects the final design of the SKA dish

The Square Kilometre Array (SKA) Project has selected the design for its dish, opening up the way for the eventual production of hundreds of dishes that will make up the world's largest radio telescope.

SKA selects the final design of the SKA dish

3rd round of SKA IGO negotiations successfully concludes in Rome

European Commission identifies SKA as a landmark project

Explore the SKA

SKA Project

SKA Location

Shared Sky

Did You Know?

The SKA central computer will have the processing power of about one hundred million PCs.

View All The Amazing Facts

SKA super computer

x 100,000,000 Personal Computers

Frequently Asked Questions Learn More

Project Timeline Learn More

Upcoming Meetings and Events Learn More

Media coverage Learn More

The SKA Media Gallery

View The Gallery

GO-SKA

PREP-SKA


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# SWITZERLAND AND THE SKA



**SKA SWITZERLAND**  
**SQUARE KILOMETRE ARRAY**  
Exploring the Universe with the world's largest radio telescope

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## THE SQUARE KILOMETRE ARRAY SKA

Swiss SKA Day Swiss Participation to SKA Pre-SKA projects

Share:

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**What is SKA ?**  
The Square Kilometre Array (SKA) is a large multi radio telescope project aimed to be built in Australia and South Africa.  
SKA will operate over a wide range of frequencies and its collecting area of approximately one square kilometre will make it 50 times more sensitive than any other radio telescope.  
It will require very high performance computing engines and long-haul links with a capacity greater than the current global Internet traffic.  
SKA will be able to survey the sky more than ten thousand times faster than ever before, opening a new window in radio to study transient phenomenon in the universe.  
With receiving stations extending out to distance of at least 3,000 kilometres from a concentrated central core, it will exploit radio astronomy's ability to provide the highest resolution images in all astronomy.  
The SKA will be built in the southern hemisphere, with cores in South Africa and Australia, where the view of the Milky Way Galaxy is best and radio interference least.  
Construction of the SKA is scheduled to begin in 2018 for initial observations by 2020. The SKA will be built in two phases, with Phase 1 (2018-2023) representing about 10% of the capability of the whole telescope. Phase 1 of the SKA was cost-capped at 650 million euros in 2013, while Phase 2's cost has not yet been established.  
The headquarters of the project are located at the Jodrell Bank Observatory, in the UK.

**SKA project key information:**

- History of the SKA project
- Participating countries
- SKA project timeline

ENTER SITE



# SWITZERLAND AND THE SKA

## THE SQUARE KILOMETRE ARRAY SKA

[Home](#) [Swiss SKA Day](#) [Swiss Participation to SKA](#) [Pre-SKA projects](#)

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### Swiss SKA Day

With the visit of Phil Diamond the Director General of the SKA project and Bernie Fanaroff the former head of SKA in South Africa, we are organising this exciting day event around this ambitious radio-astronomy projects at the edges of advanced technology and computing.

**On 18 May 2016 !**

This Swiss SKA day 2016 will take place on **Wednesday May 18 from 09:45 to 18:00 at EPFL, Lausanne.**

The venue of the meeting will be on the conference [room BC410](#)

If you are interested to participate to the meeting please register here: [Online registration](#)

### Agenda

**09:45 - 10:15 -- Welcome Coffee**

**Session 1: SKA an ambitious project for the 21st century**

10:15 – 10:30 Welcome SKA Days - Karl Aberer (EPFL, Vice Presidency for Information Systems)

10:30 – 11:00 SKA – The Project - Phil Diamond (SKA Director General)

11:00 – 11:20 SKA – Policy - Simon Berry (SKA Director of Policy Development)

11:20 – 11:50 SKA – Science - Robert Braun (SKA Director of Science)

11:50 – 12:10 SKA – Engineering and plans for construction - Alistair McPherson (SKA Deputy D-G and Head of Project)

12:10 – 12:30 SKA – Computing and Software - Nick Rees (Head of SKA Computing and Software)

**12:30 - 13:30 Lunch**

**Session 2: Forefront science with SKA**

13:30 - 13:40 Overview of the Swiss SKA Consortium - Daniel Schaerer (UniGE)

13:40 - 13:55 Cosmology with the SKA - Martin Kunz (UniGE)

13:55 - 14:10 HI Intensity Mapping with BINGO - Alexandre Refregier (ETHZ)

14:10 - 14:25 The epoch re-ionization simulated in a box - Romain Teyssier (UniZH)

14:25 - 14:40 View through the visibilities - Yves Wiaux (Heriot-Watt University/EPFL)

**14:40 - 15:10 Coffee Break**

**Session 3: Technological challenges with SKA**

15:10 - 15:30 The DOME project - Ton Engbersen (IBM Zurich)

15:30 - 15:45 Analogic to Digital Converter for SKA - Yusuf Leblebici (EPFL)

15:45 - 16:00 The Future of Data-Centric Computing - Babak Falsafi (EPFL)

16:00 - 16:15 A holistic perspective on algorithms for the SKA pipeline - Paul Hurley (IBM Zurich)

16:15 - 16:30 SKA machine learning perspectives for imaging, processing and analysis - Slava Voloshynovskiy (UniGe)

**Open Conference (CM3):**

17:15 - 18:00 The Square Kilometre Array & Radio Astronomy in Africa - Bernie Fanaroff (SKA South Africa)

### Contact

Swiss SKA Board

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