

# Canada and the SKA

Kristine Spekkens

RMC / Queen's / 🍁 SKA Science Director

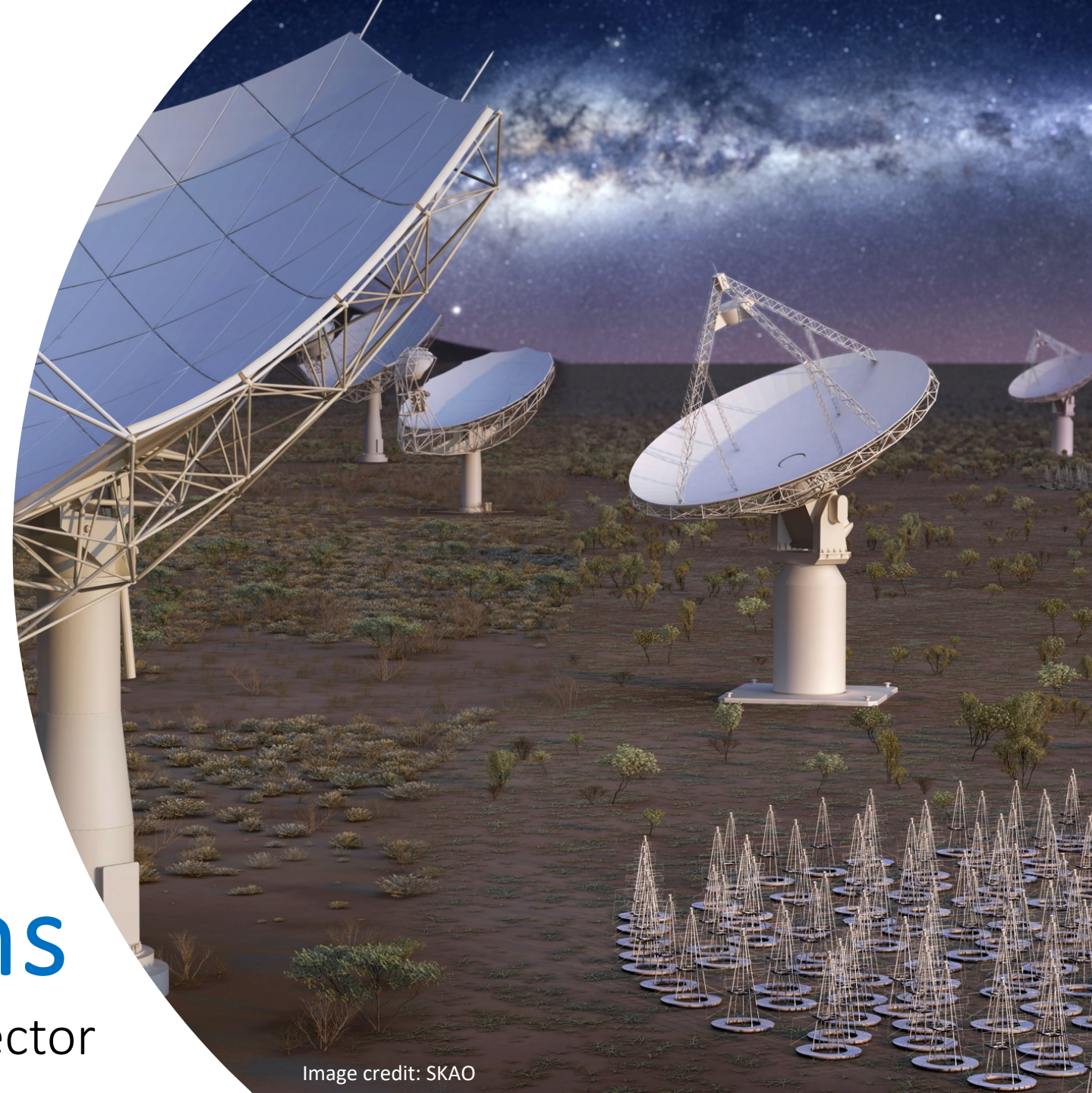


Image credit: SKAO

# Canada and the SKA

- The Square Kilometre Array
- SKA survey science, technology, broader impacts
- A Canadian SKA regional data centre

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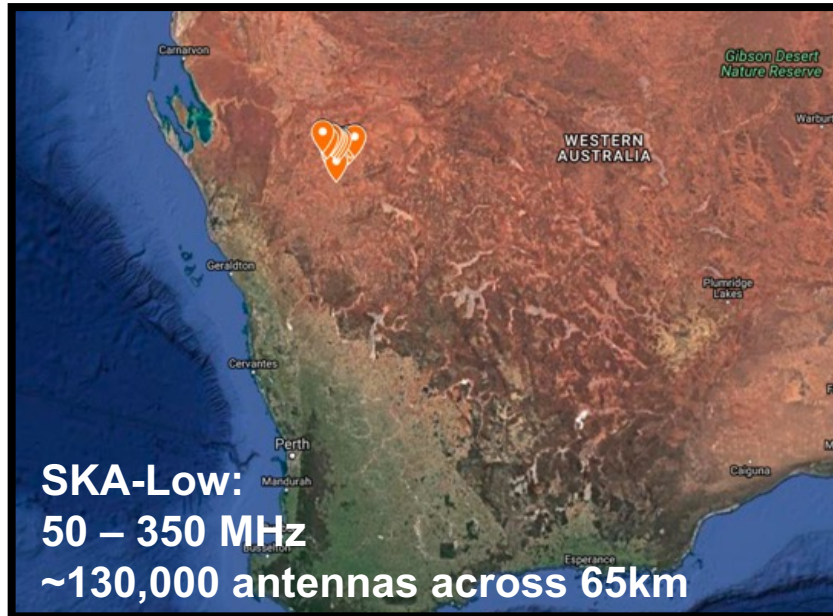
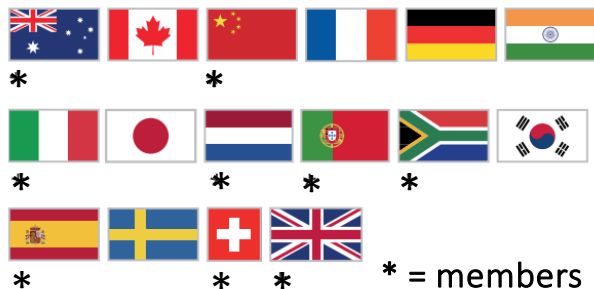
# The SKA

16 partners

2 telescopes

1 observatory

- ~1.3 Billion euro (2021) construction cost
- 50+ year design lifetime
- ~700 PB/year of science data



Construction underway • First science data in 2026 • Full obs in 2029

# SKAO Science Working Groups



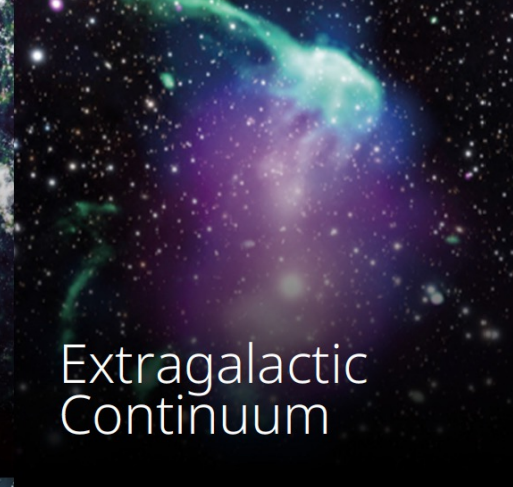
Cosmology



Cradle of Life



Epoch of Reionization



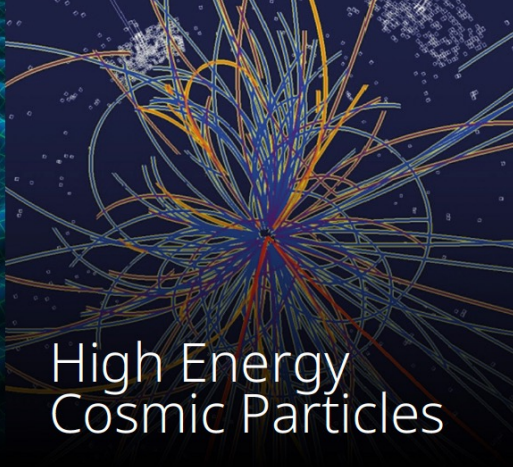
Extragalactic Continuum



Extragalactic Spectral Line



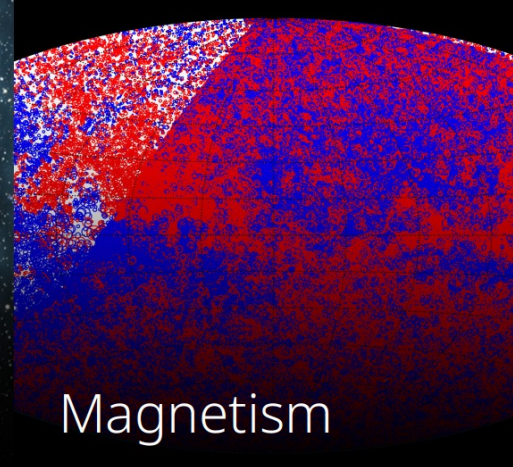
Gravitational Waves



High Energy Cosmic Particles

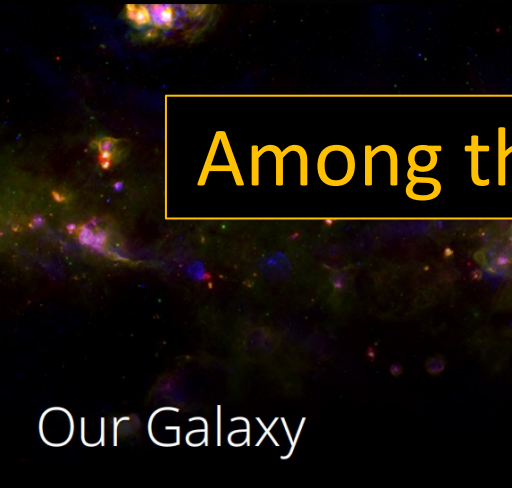


HI Galaxy Science

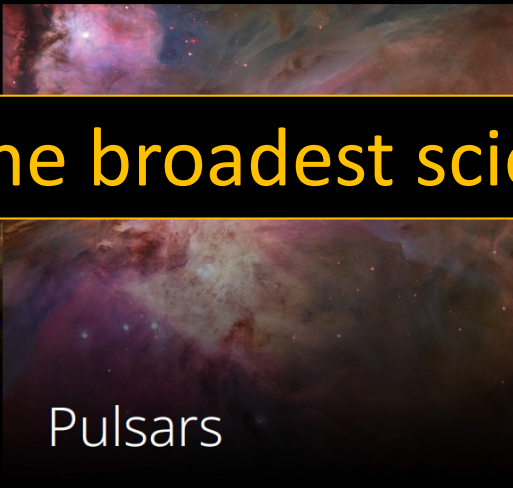


Magnetism

Among the broadest science cases for observatories worldwide



Our Galaxy



Pulsars



Solar, Heliospheric & Ionospheric Physics



Transients



VLBI

Slide from Phil Diamond / SKAO

# The SKA

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1 observatory

Jan 2023: Canada to  
join the SKA  
Observatory as a full  
member (!!)

Budget 2023:  
\$269.3M over next 8  
years + ongoing funds.



\* \* \* \* \*



\* \* \* \* \*



\* \* \* \* = members

From: [National Research Council Canada](#)

January 2023

[casca.ca/?p=18582](https://casca.ca/?p=18582)

## News release

### Canadian astronomers will have access to one of the world's leading facilities, further strengthening Canada's international reputation in astronomical discovery

January 24, 2023 – Ottawa, Ontario – National Research Council of Canada

The study of astronomy is critical to advance our understanding of our Universe, and Canada is a leader in this field of discovery and innovation. Through strong collaboration with industry, academia, government and international partners, the Government of Canada is committed to supporting its world-class astronomy and astrophysics community and laying the foundation for the next great discovery.

Today, the Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry, announced Canada's intention to proceed to full membership in the [Square Kilometre Array Observatory \(SKAO\)](#). The SKAO facility will enable discoveries that will revolutionize our understanding of the Universe, the fundamental laws of physics and the prospects for life on other planets.

Full membership is expected to provide Canadian astronomers a 6 per cent use-share of the observatory, access to a next-generation radio astronomy facility, and support the establishment of a domestic regional centre. This centre will provide direct connections to data collected with the telescope as well as science support to enable ground-breaking discoveries.

Canada's accession to the SKAO will happen very soon!

# The SKA

16 partners

2 telescopes

1 observatory

Jan 2023: Canada to join the SKA Observatory as a full member (!!)

Budget 2023: \$269.3M over next 8 years + ongoing funds.



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## News release

Full membership

Science • Tech • Governance

6 per cent use-share

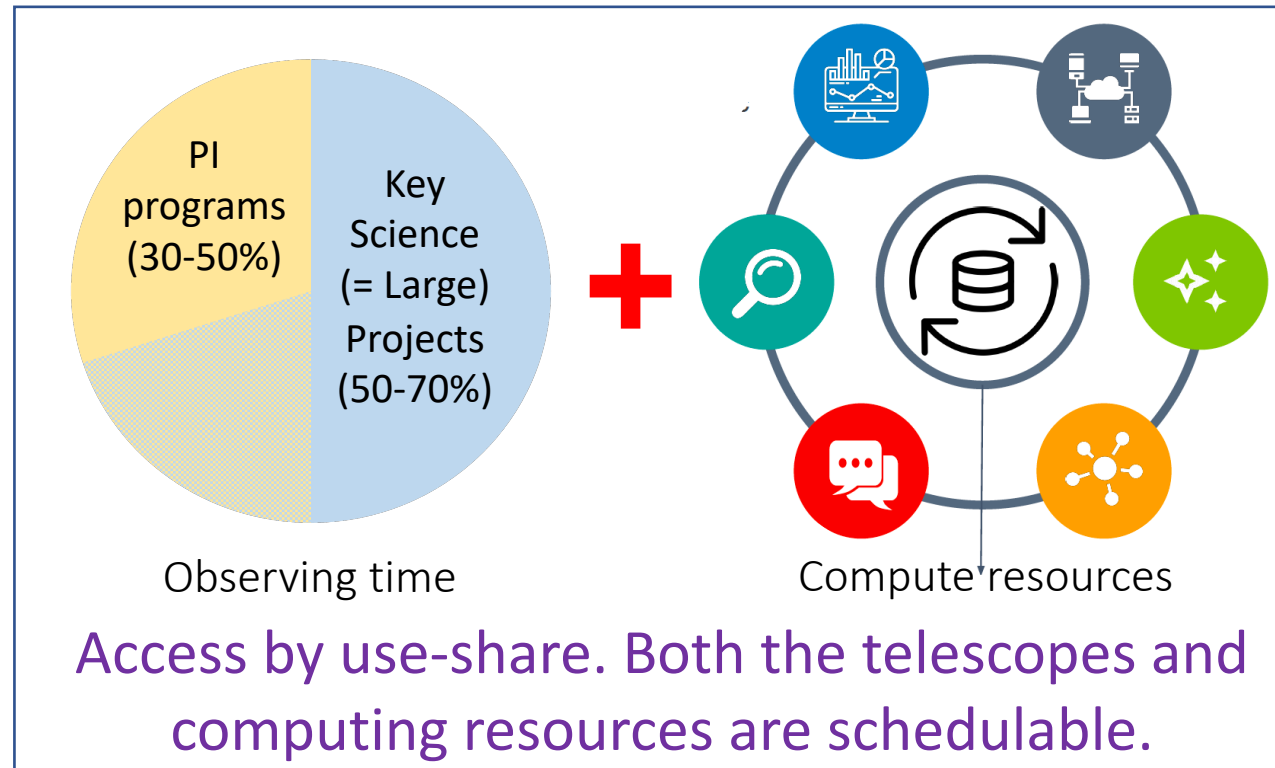
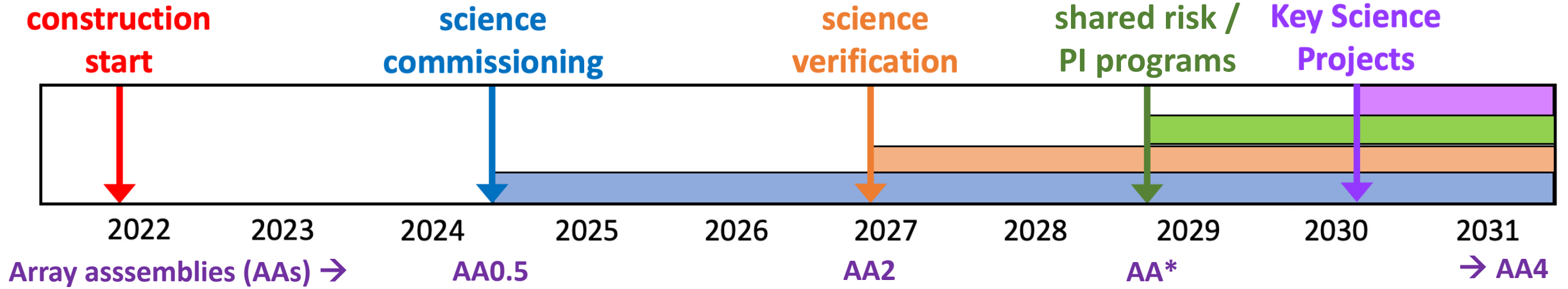
Generational investment

Domestic regional data centre

Legacy access • Digital innovation

Canada's accession to the SKAO will happen very soon!

# SKA timeline



# SKAO Science Working Groups



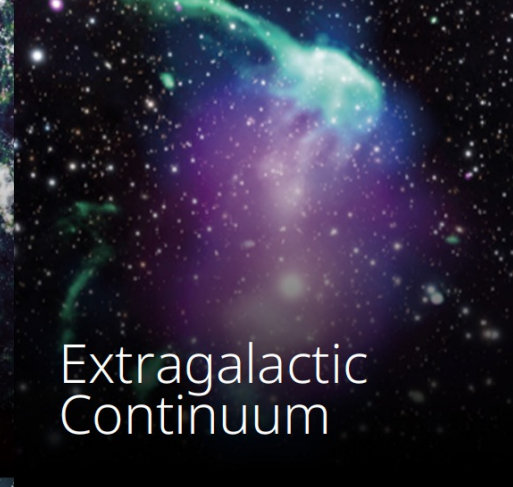
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Epoch of Reionization



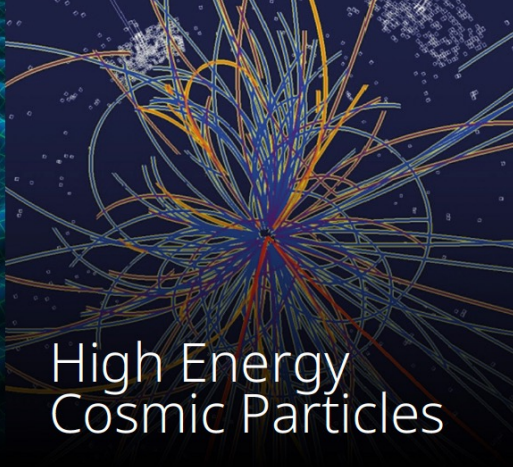
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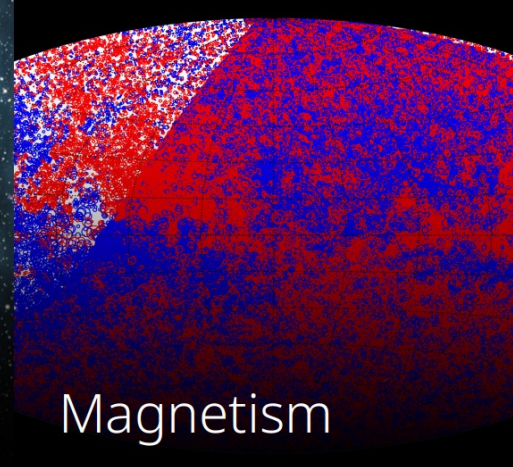
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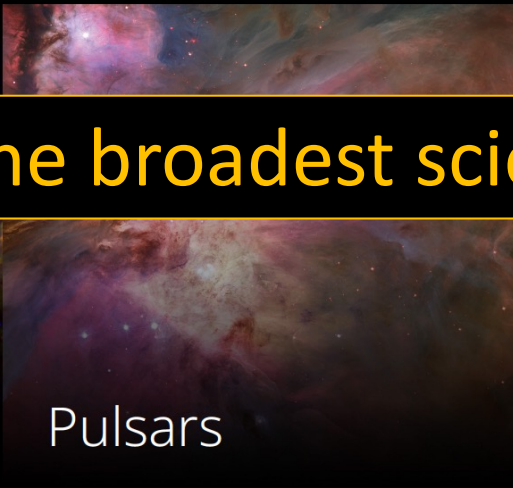


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Our Galaxy



Pulsars



Solar, Heliospheric & Ionospheric Physics



Transients



VLBI

Slide from Phil Diamond / SKAO



# SKAO Science Working Groups



Cosmology



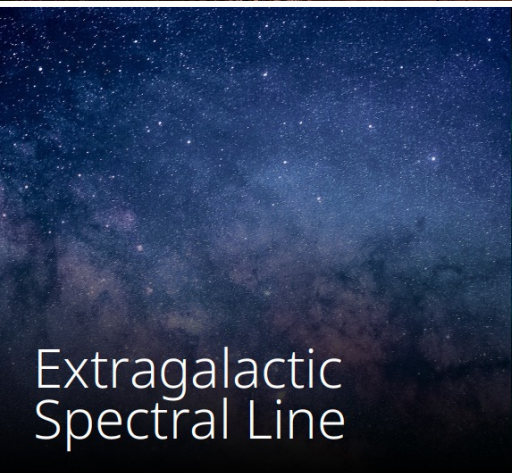
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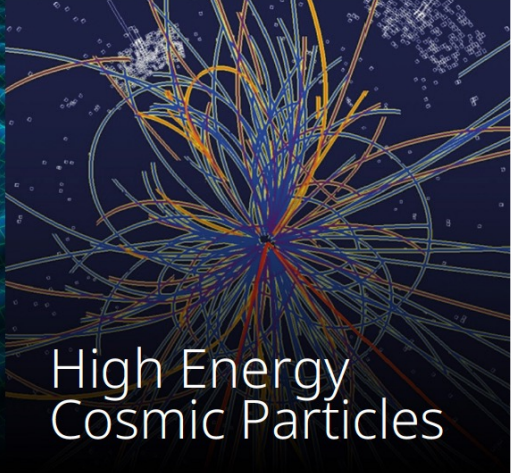
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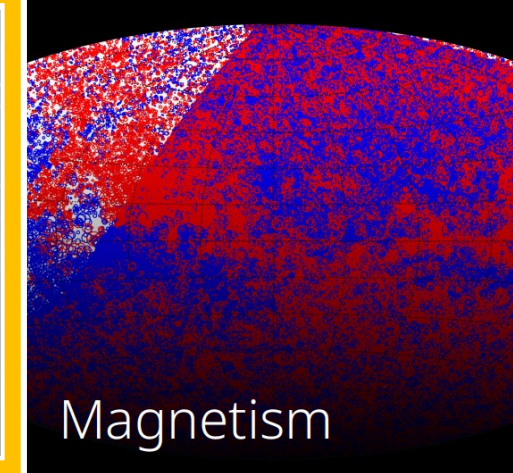
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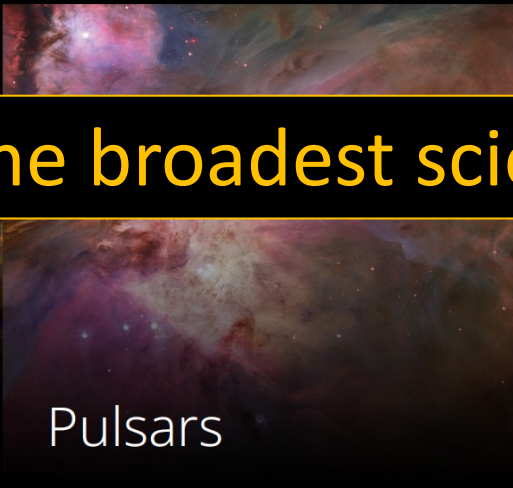


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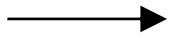
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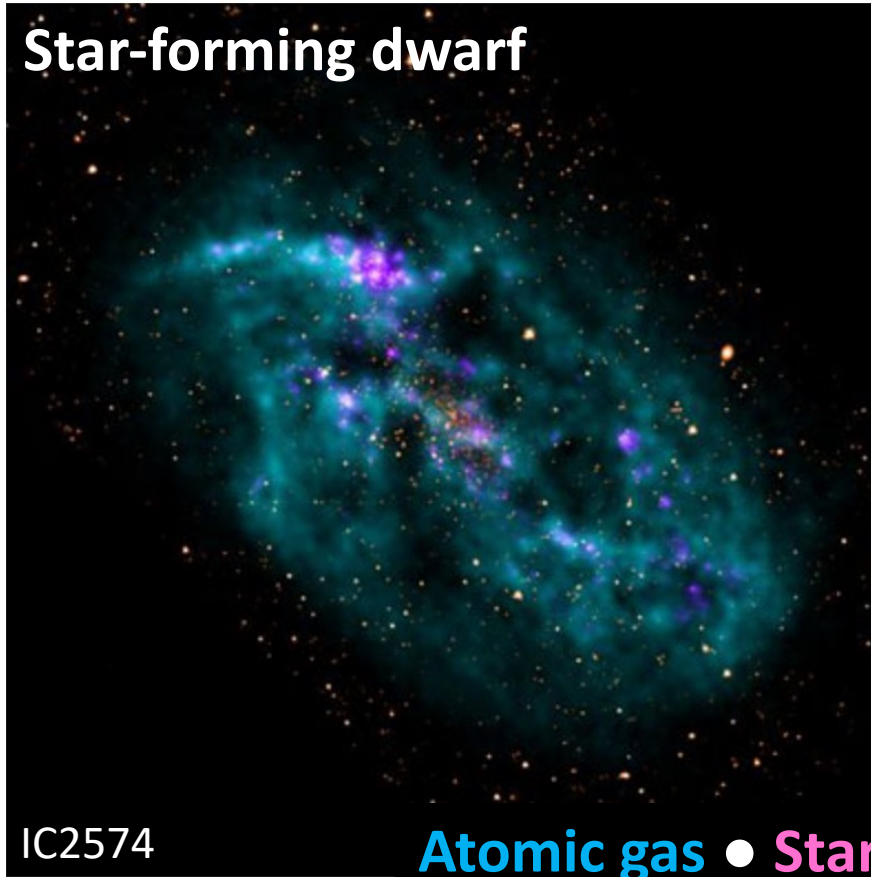
VLBI

# Atomic gas (HI) in disk galaxies

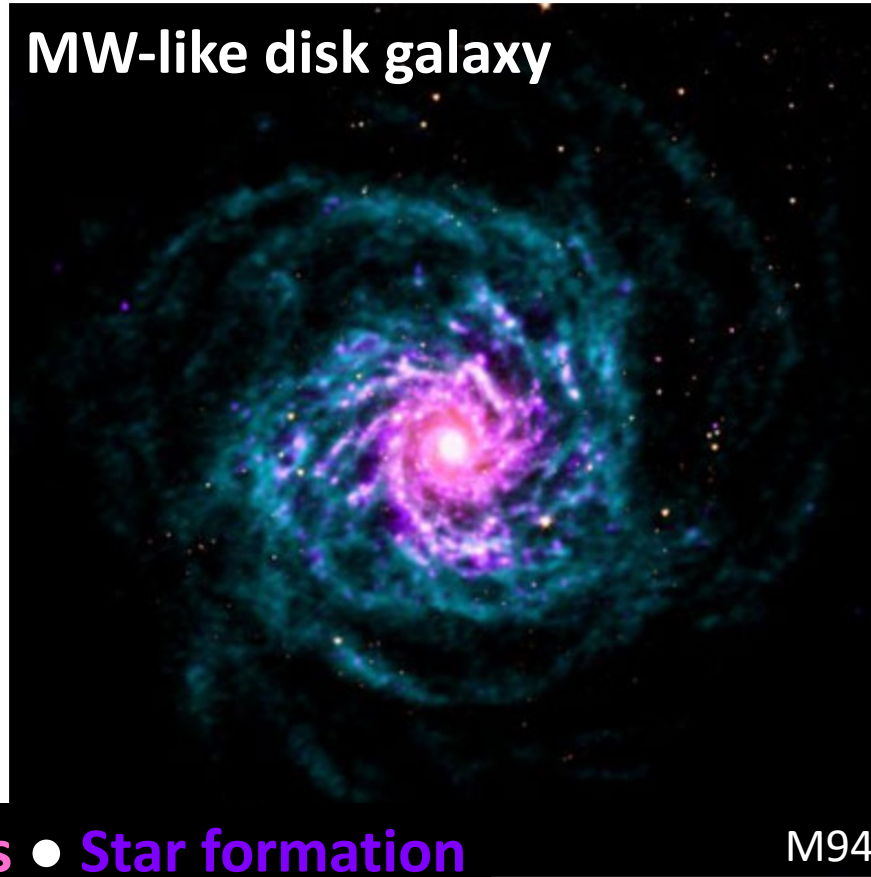
HI is more abundant than stars in dwarfs



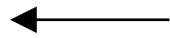
Star-forming dwarf



MW-like disk galaxy



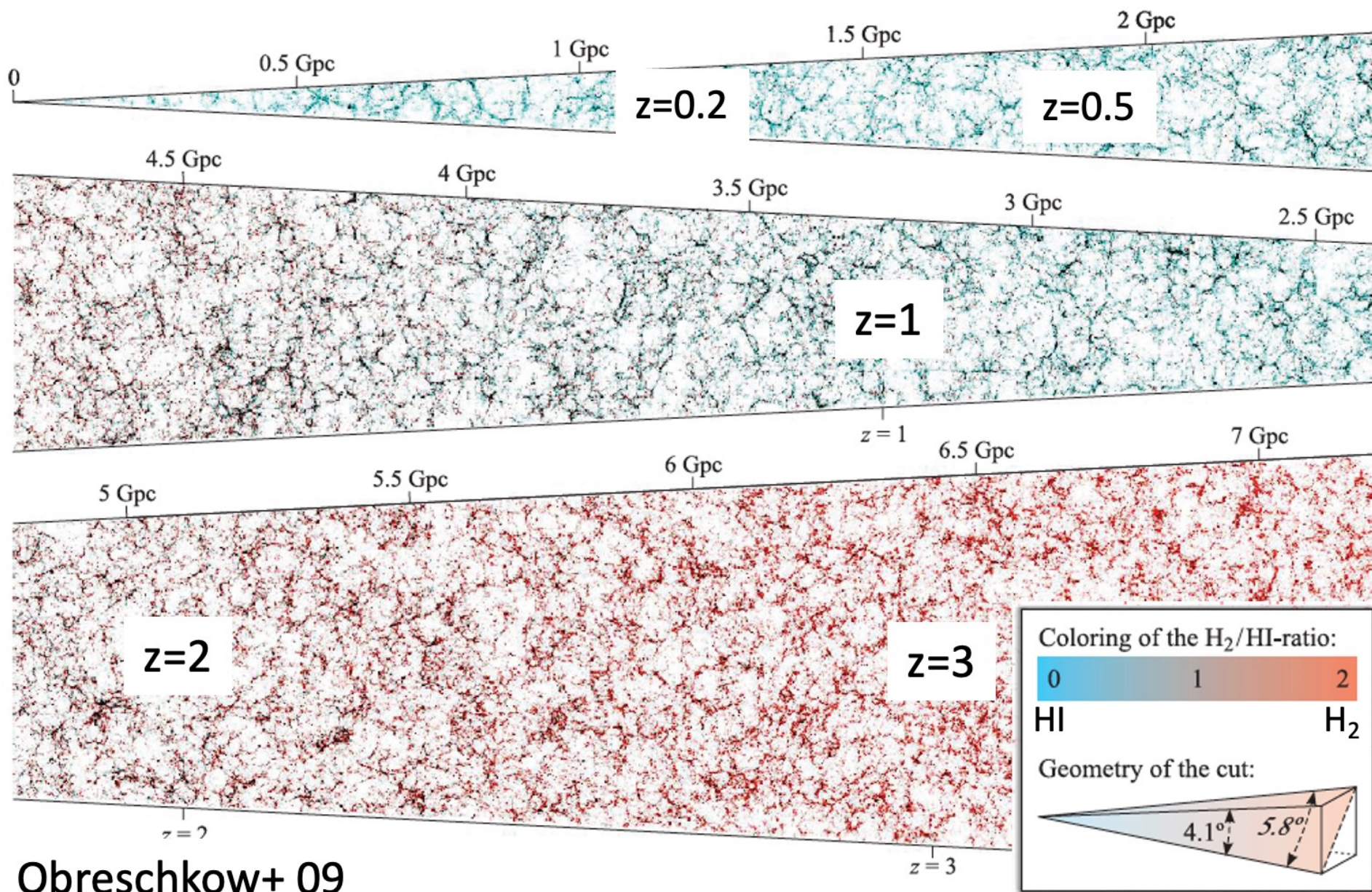
HI disks extend farther into halos than the stars



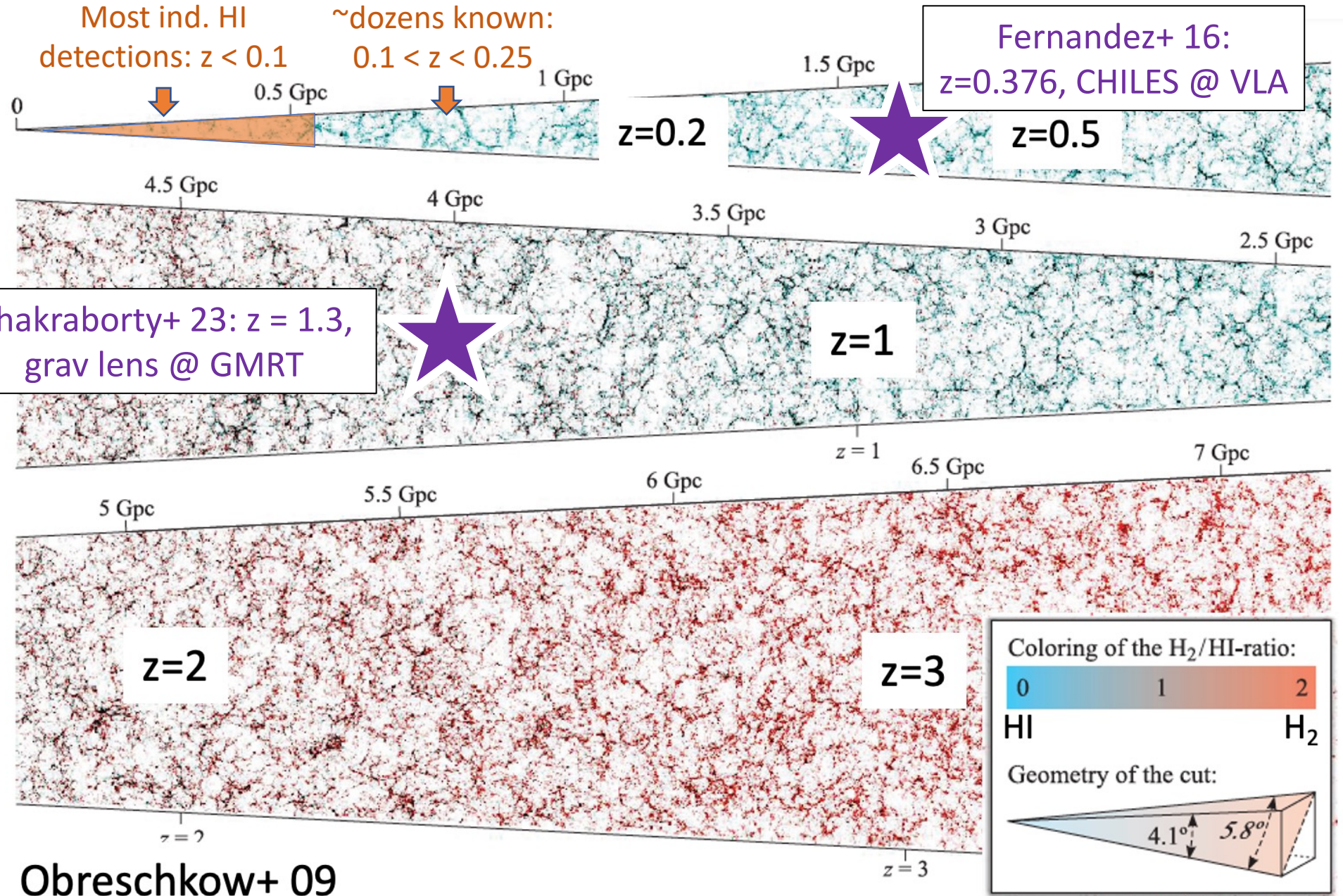
Atomic gas • Stars • Star formation

The HI content, morphology and kinematics of galaxy populations probe cosmological galaxy formation

# The cosmic HI census



# The cosmic HI census



## State of the art:

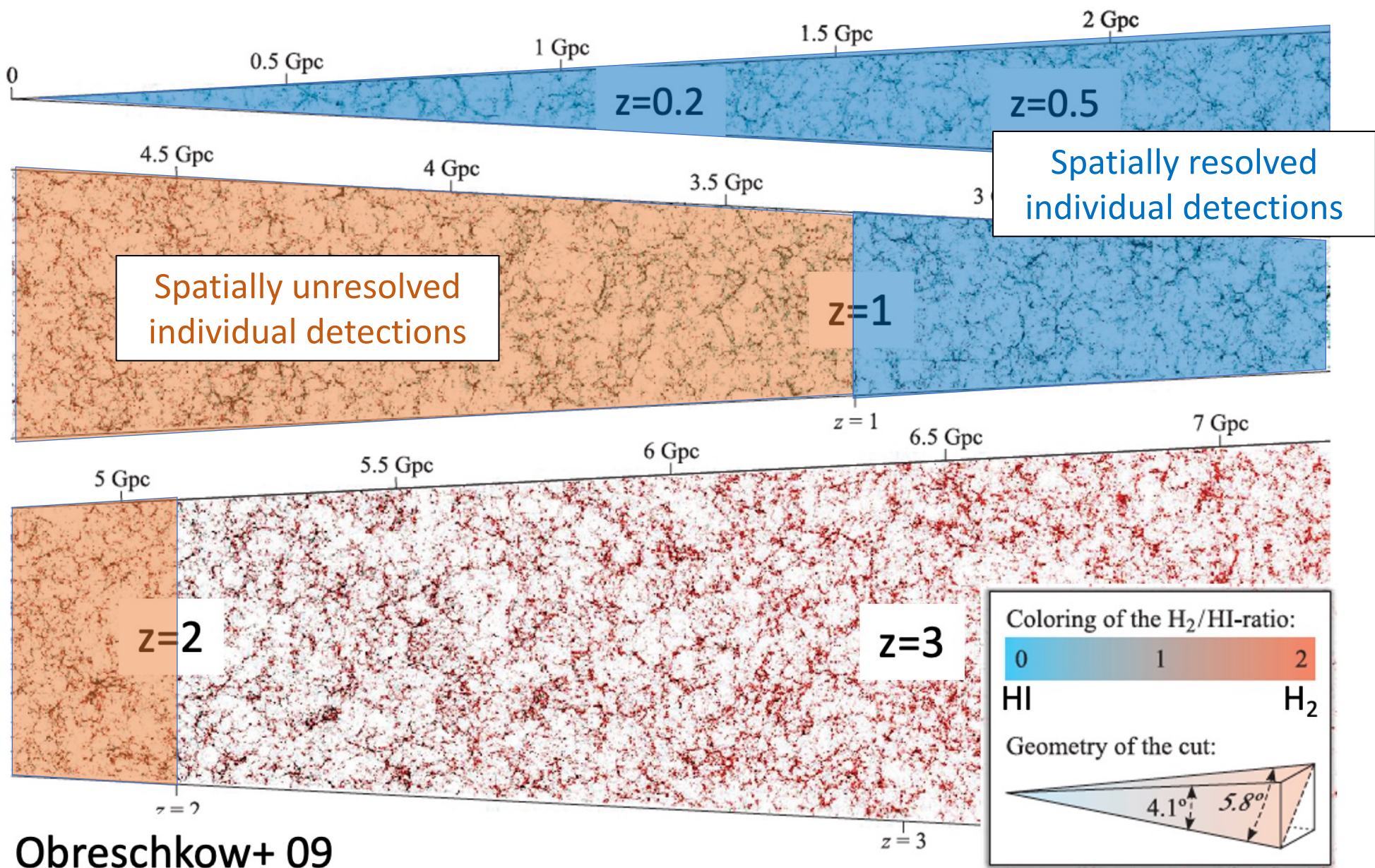
HI out to  $z \sim 0.1$ ,  
targetted maps  
within 100 Mpc.

Few individual  
galaxy detections  
at  $z > 0.1$ .

# The cosmic HI census

SKA KSP,  
10,000 hrs  
(~2030-35):  
AM buildup  
across cosmic  
time

HI out to  $z \sim 2$ ,  
map HI disks  
[ $\log(M_{\text{HI}}/M_{\odot}) > 10$ ] to  $z \sim 1$ .



# SKAO Science Working Groups



Cosmology



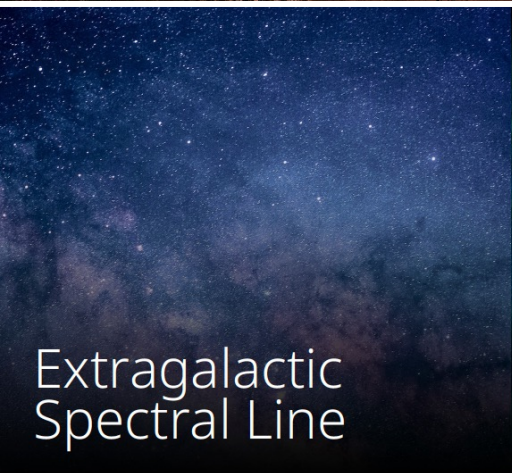
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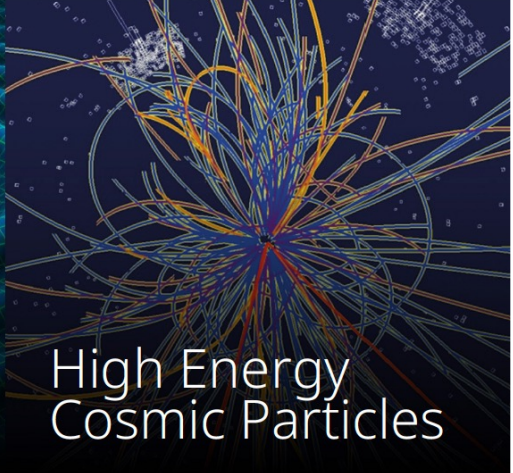
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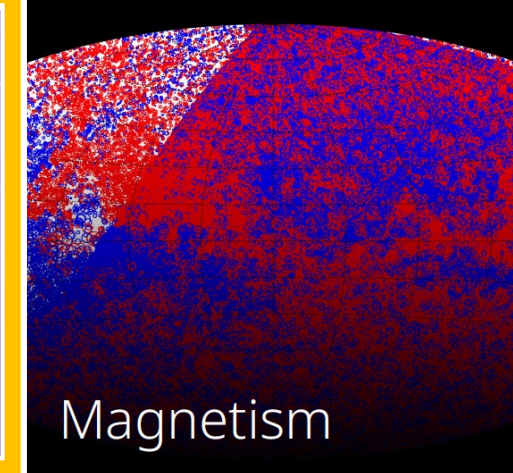
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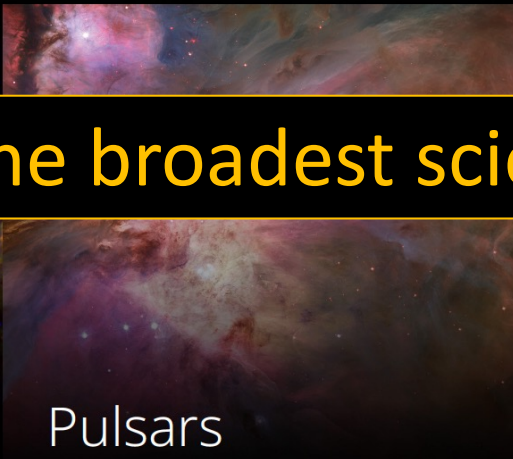


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Slide from Phil Diamond / SKAO

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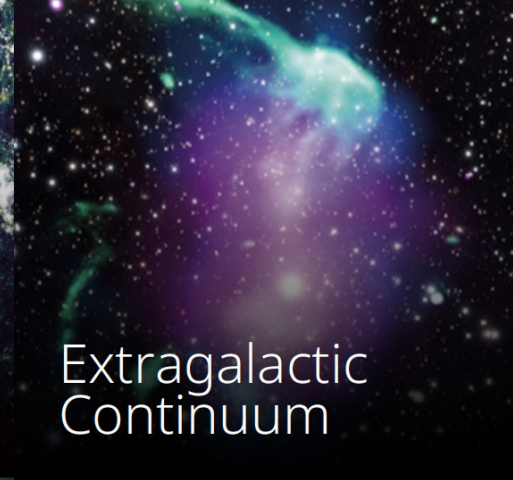
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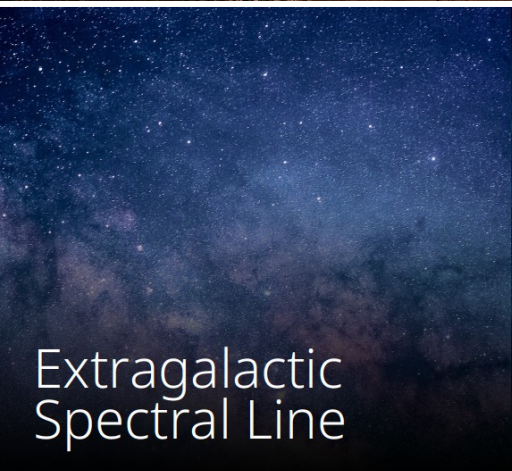
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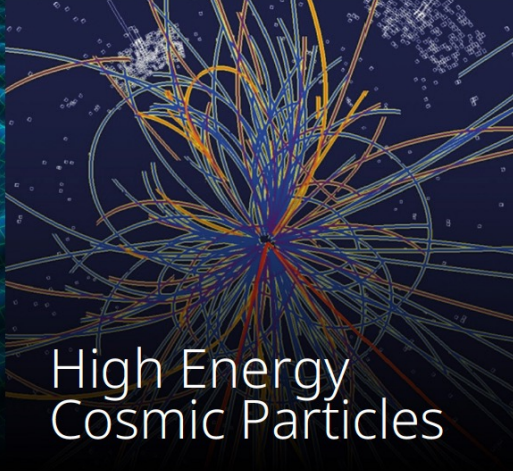
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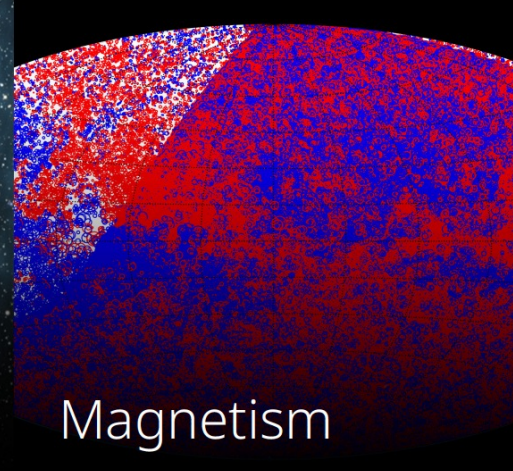
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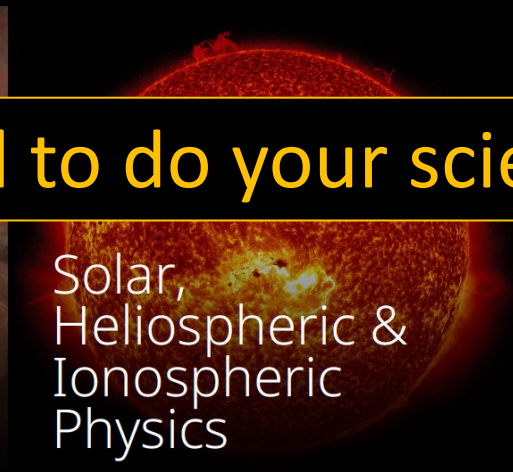
**What do you need to do your science with the SKA?**



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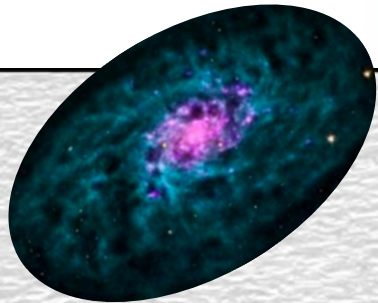
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VLBI

*Slide from Phil Diamond / SKAO*

# Technical Workshares



## Interferometry

Radio wave amplitudes and arrival times make radio sky maps. Canadians lead the world at building **correlators** that combine radio signals. Canada will build the correlator for SKA-Mid.



# The SKA: broader impacts



The SKA's broader impacts plan is structured around the UN Sustainable Development Goals.

*"The SKAO is one observatory, with two telescopes, on three continents; a 21st century observatory and an inter-governmental organisation with sustainability and respect to all our communities at its heart, driven by a commitment to fundamental science and technology."*

*SKAO vision statement*



[skao.int/en/explore/impact-society](https://skao.int/en/explore/impact-society)

# SKA Regional data Centres (SRCs)

A federated global network of SRCs will provide user data access, host the SKA Science Archive and support the SKA community.

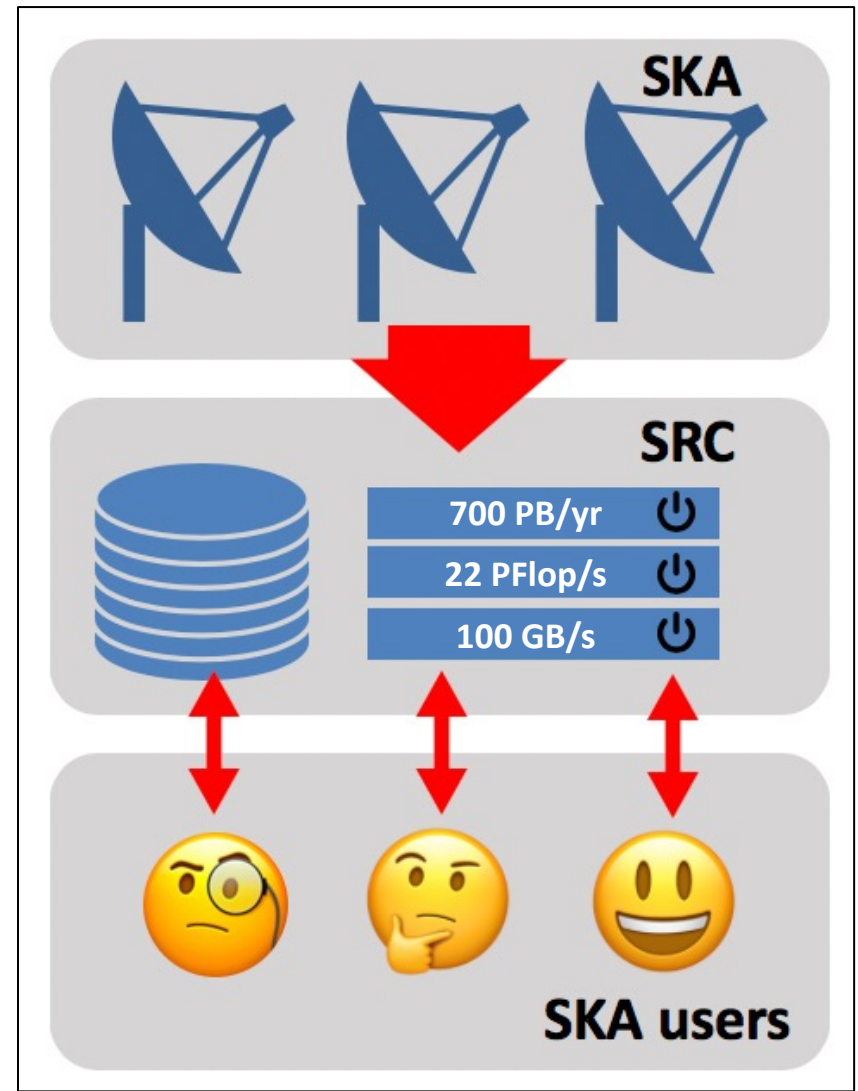
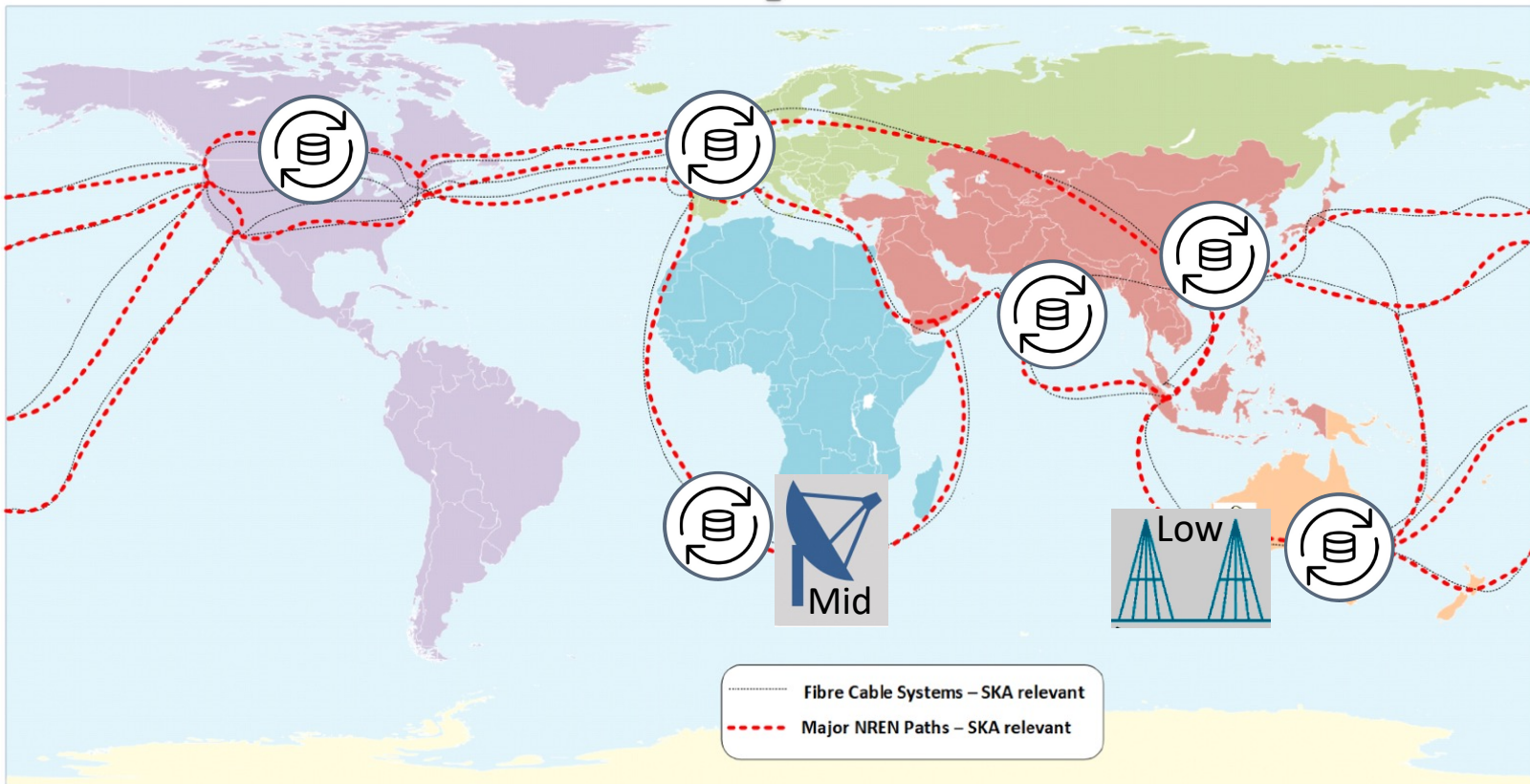
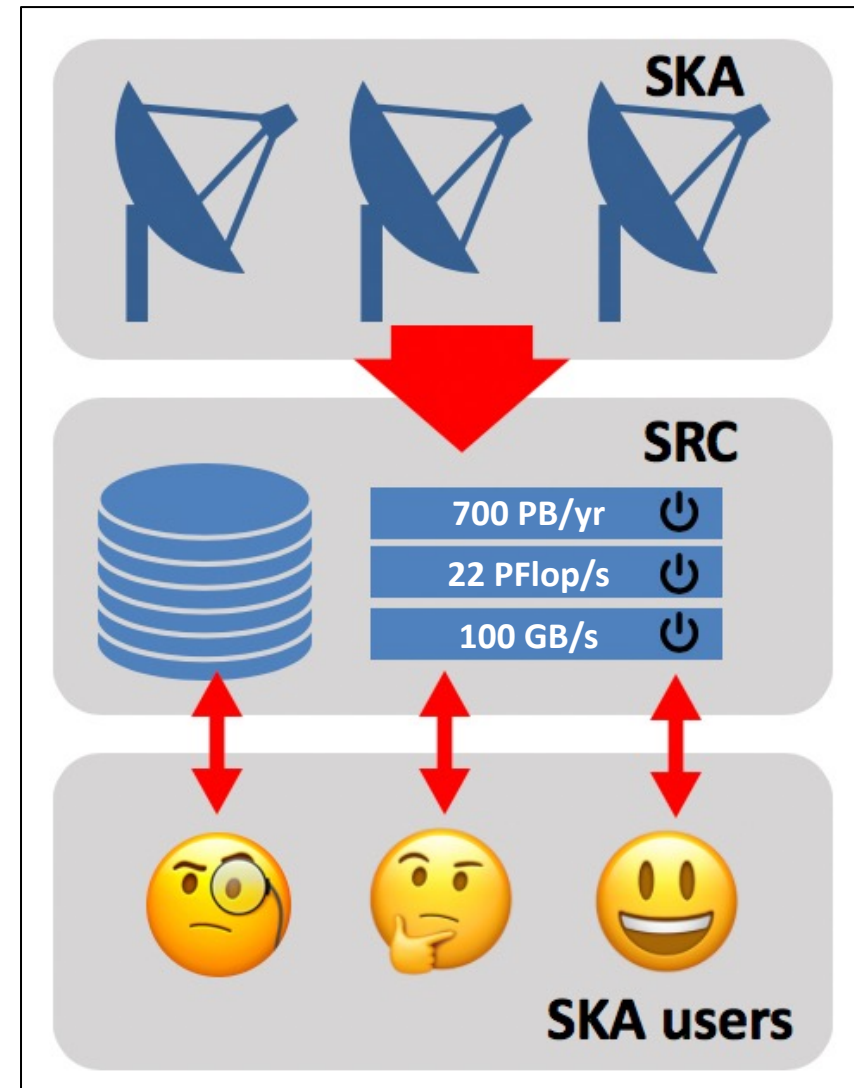
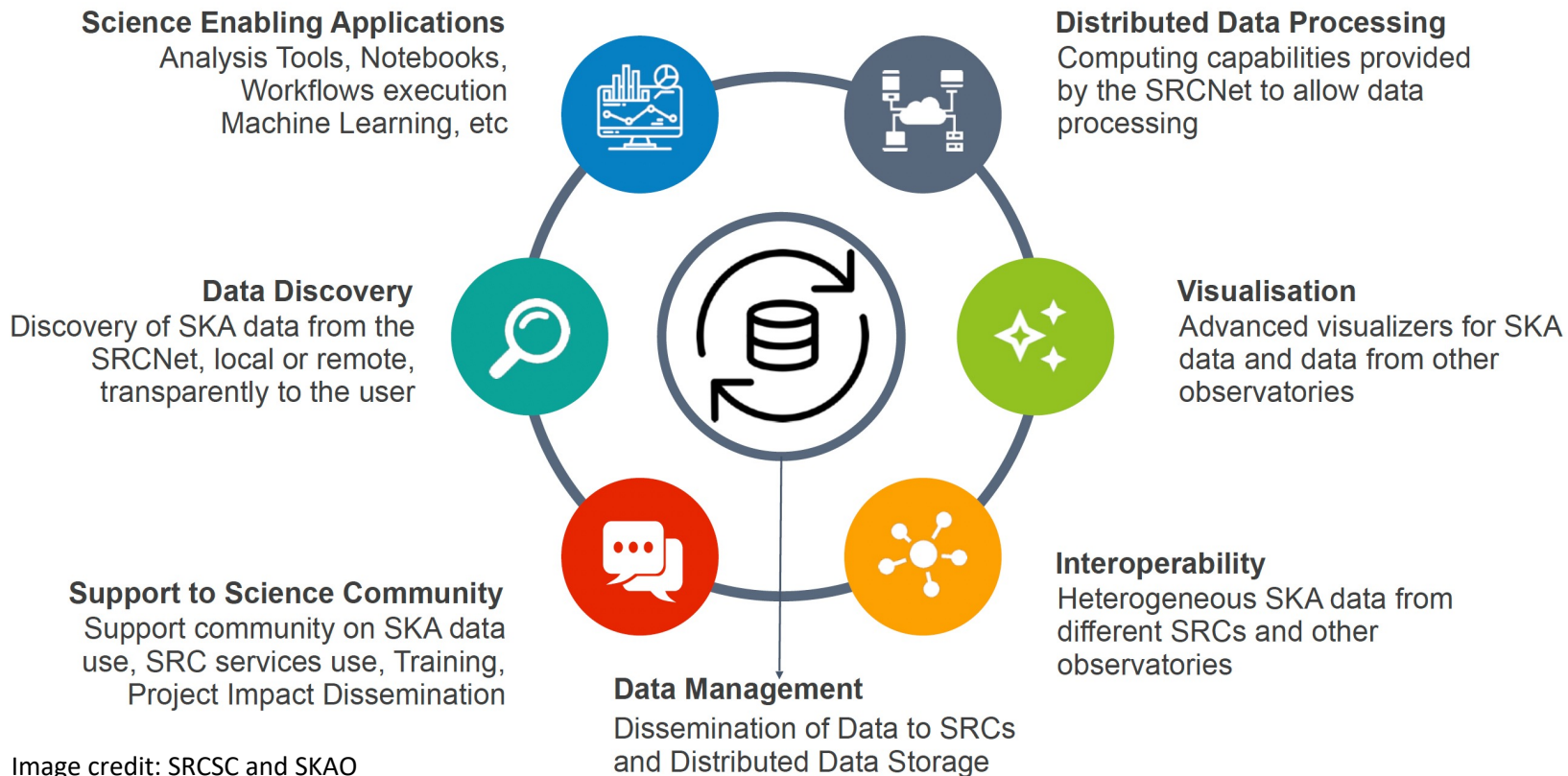


Image credit: E. Rosolowsky

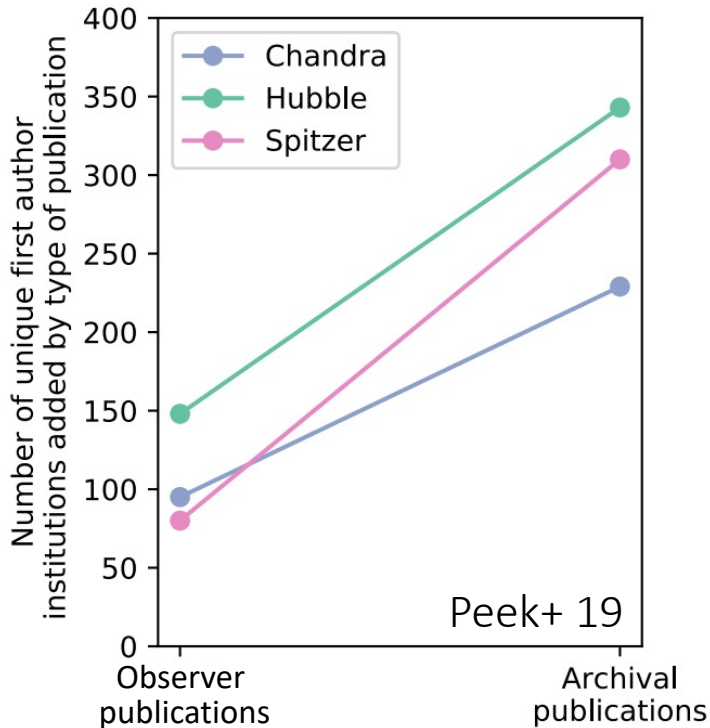
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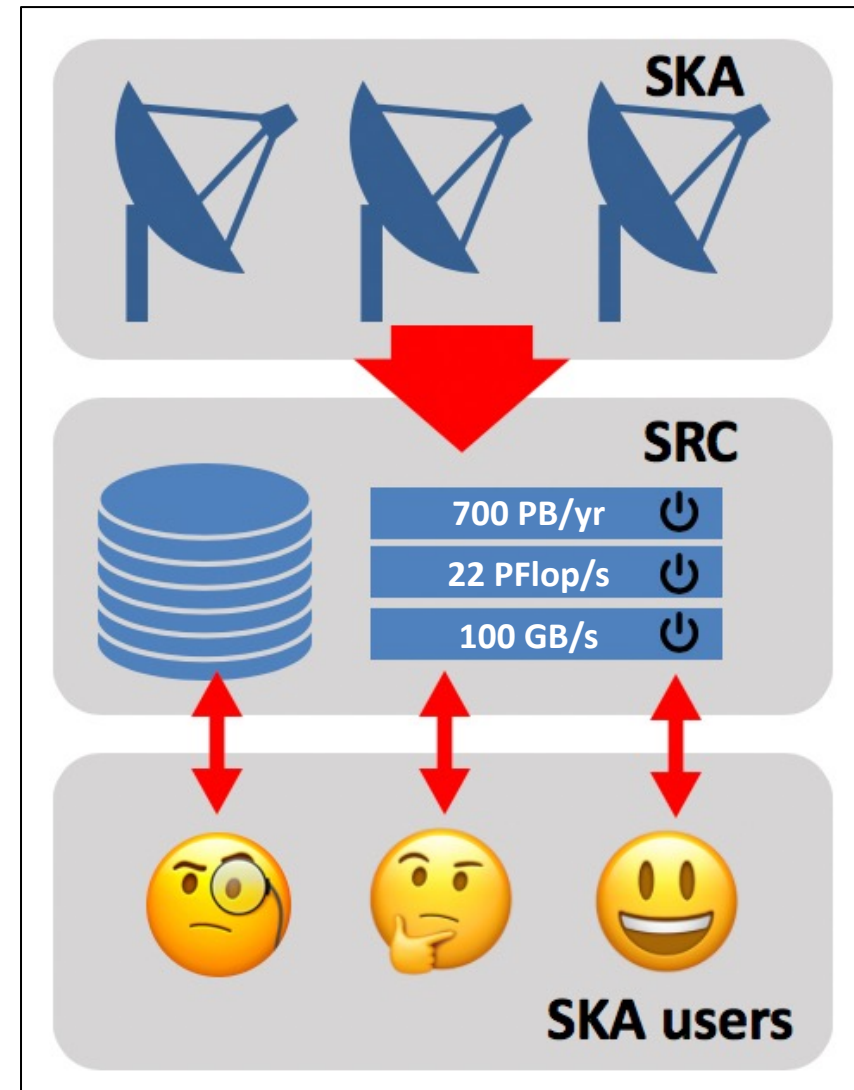
# SKA Regional data Centres (SRCs)

A Canadian SRC will be the hub of Canadian SKA activity, fostering scientific productivity and research inclusion.



- Half of all NASA observatory science stems from archival data, and archival users within and beyond North America are more diverse than users of the telescopes.

[arxiv.org/abs/1907.06234](https://arxiv.org/abs/1907.06234)



Robust data science platforms  
foster research inclusion.



# SKAO Science Working Groups



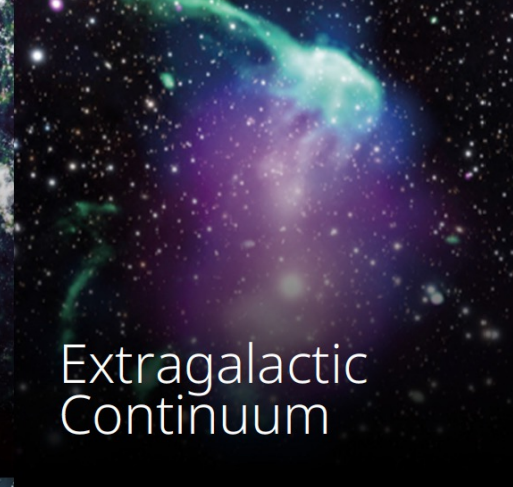
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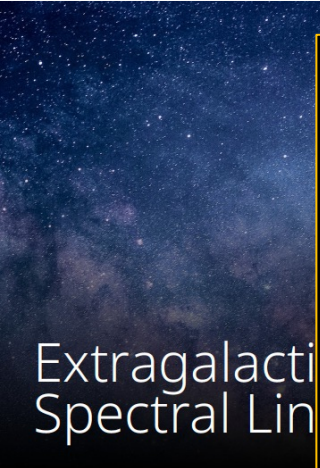
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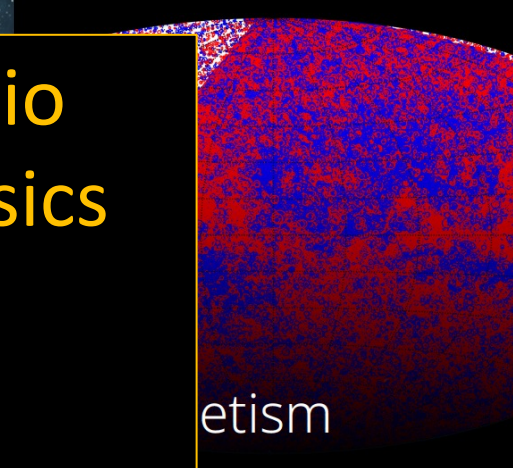
Extragalactic Continuum

Canada is a member of the world's biggest radio telescope. It's a generational investment in physics and astronomy.

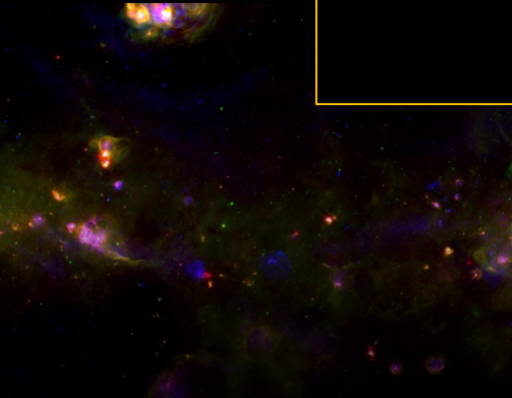
What will the SKA do for YOU?



Extragalactic Spectral Line



etism



Our Galaxy



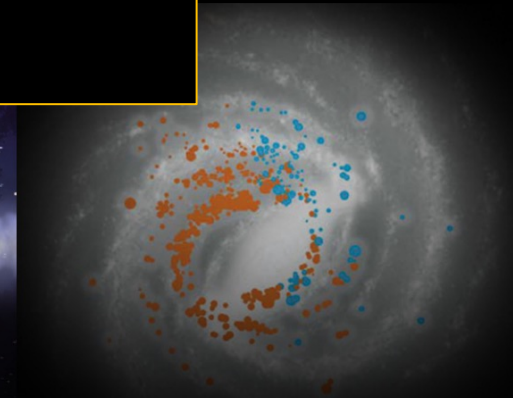
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