SKA SWG Update

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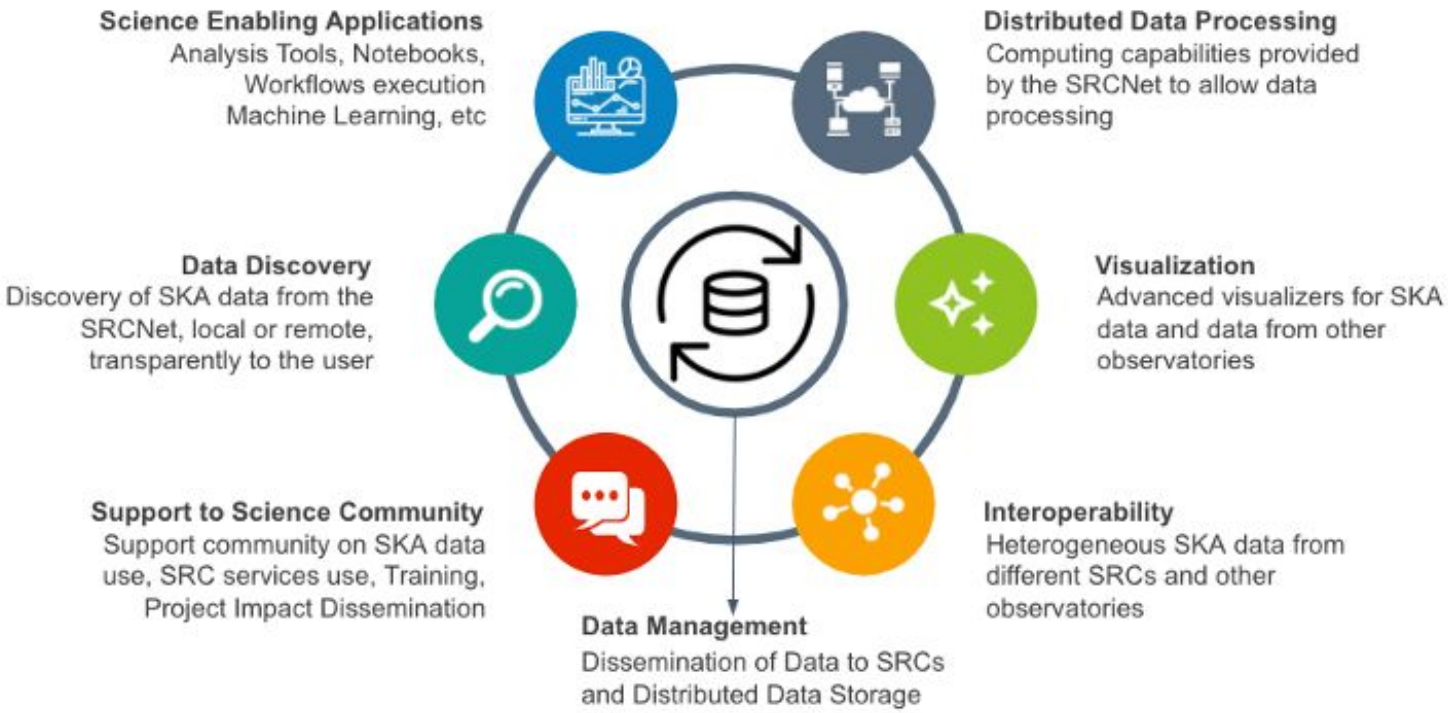
SKA Science Update

- Science Operations Topics (Shari Breen)
  - SRCNet and Sensitivity Calculator
- Science Meetings
- AOB

SRCNet use cases

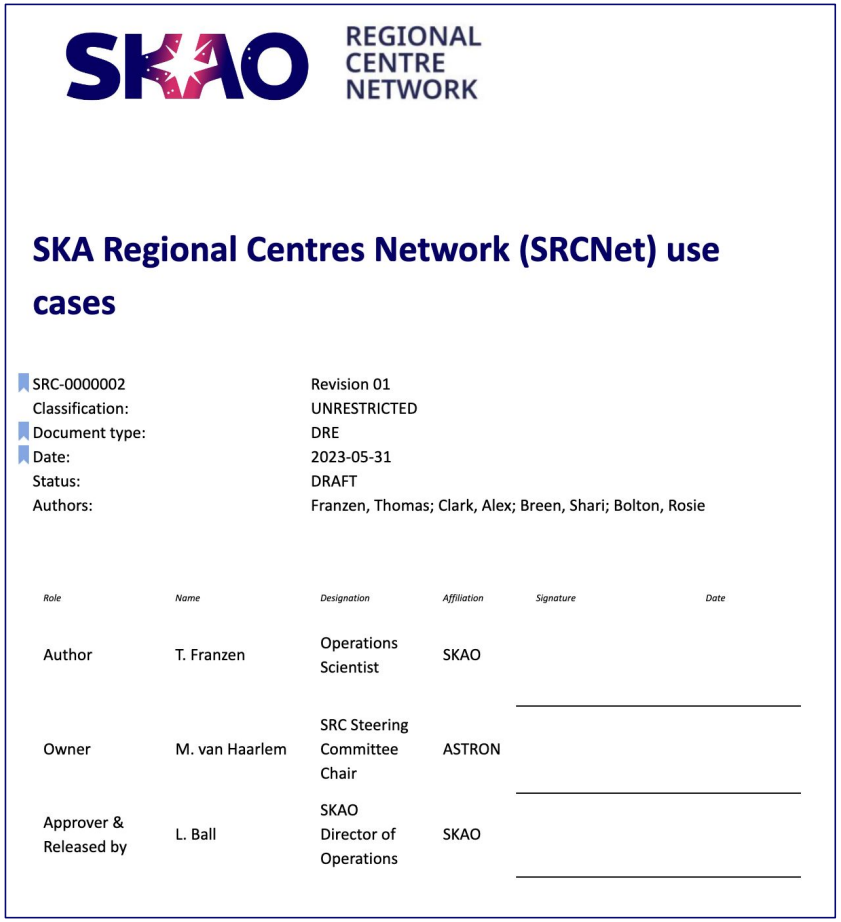
SRC Network is critical

Delivering SKA data products to scientists, storing SKA data for future use, computer facilities to undertake scientific analysis and local user support all fall outside of the construction budget



SRCNet Use Case Document

- Getting close to publishing version 1 of the document!!
  - Combines user stories derived through SWG answers to the SRCSC WG6 TP1 survey
  - Needed for the SRC review (to support the architecture document)
  - Can be shared with the future users through the SWGs and other avenues to make sure that we get a more and more representative set of use cases to help SRCNet prototyping!



SKAO REGIONAL CENTRE NETWORK

SKA Regional Centres Network (SRCNet) use cases

SRC-0000002	Revision 01
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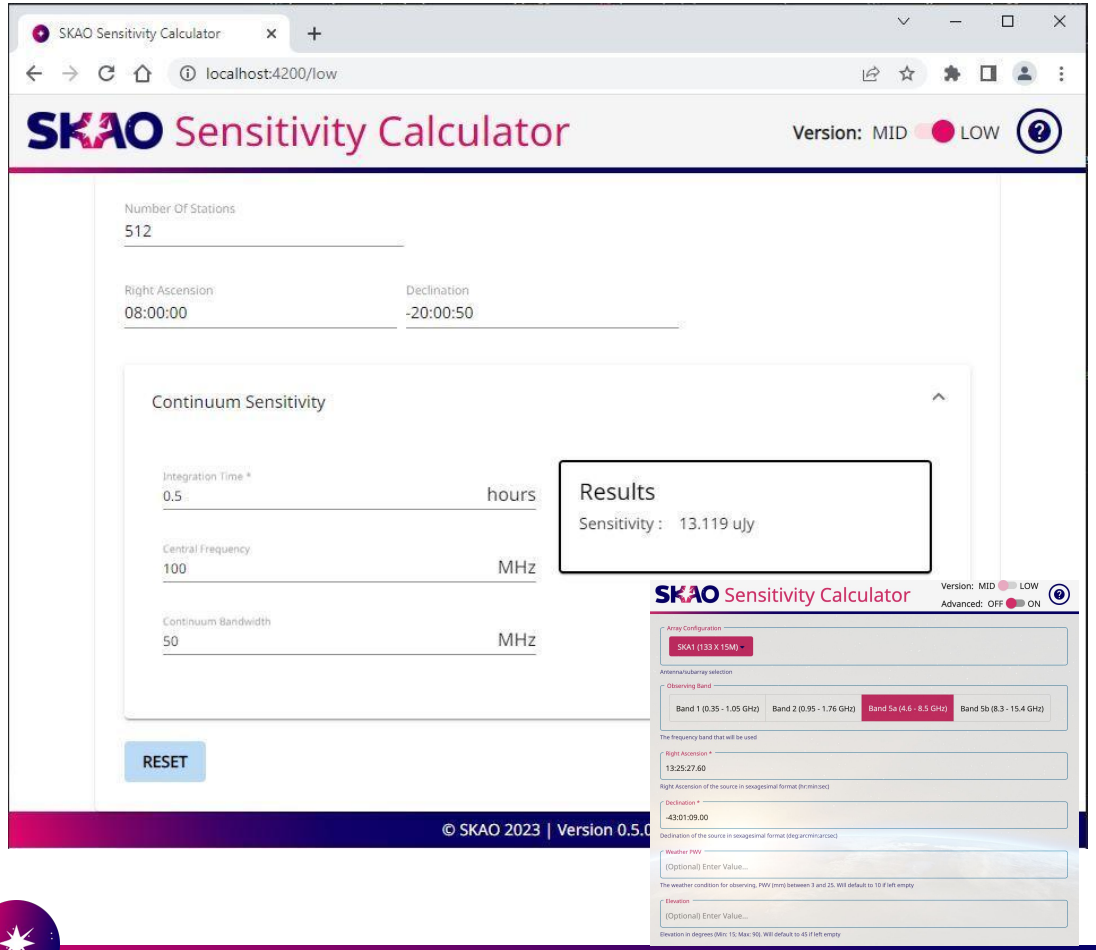
Approver & Released by	L. Ball	SKAO Director of Operations	SKAO		

SRCNet Use Cases: examples from the document

2c	Image cube analysis		
2c1	Generating image cutouts	A user would want to generate their own sized image of a patch of sky. A user would want multiple postage stamps of various sources from one or more (full-Stokes) images selected from a reference catalogue, with the option of stacking these. The sky position/object name and region size would need to be provided as a minimum. Additional flags could be provided, such as frequency/velocity range, time range, and polarisation properties. A user would want a coverage map to identify the constituent pointings.	SRC-281 SRC-287 SRC-291 SRC-297 SRC-302 SRC-318 SRC-349 SRC-391
2c2	Mosaicking	Combine multiple pointings into a larger (full-Stokes) image, potentially covering thousands of square degrees, taking into account the pixel weights. One of the outputs from the mosaicking should be a weight map, or equivalently a noise map. This could be part of 2a1, 2a2, 2a3 and 2c1, where the user simply gives a position and region size, mosaicking is performed automatically if required, and the user is informed.	SRC-281 SRC-297 SRC-324 SRC-332 SRC-339 SRC-364 SRC-371
2c3	Combining multi-epoch	Regrid and co-add together images at multiple epochs to improve the sensitivity. RMS noise	
	data in image domain	maps or weight maps could be provided to weight the images. The software should be capable of dealing with various astrometric projections.	
2c4	Generating cubelets	Extract subsections (in sky area, frequency and polarisation) of an image cube for detailed investigations.	SRC-290 SRC-357
2c5	Extracting regions	Create regions (point, line, rectangle, ellipse, polygon etc.) on an image cube for use within the package. Image planes should be included in the region selection. Allow the user to label regions and modify their appearance (colour, line thickness etc.). A user may want to export regions as a region file for analysis with another tool, or import region files from another tool.	
2c6	Computing image statistics	Compute statistics (sum, mean, rms, maximum etc.) in an image cube (or subregion of an image cube in sky area, frequency and polarisation). There should be the option of querying multiple regions, and printing the results to screen or in a text file.	
2c7	Generating image histograms	Visualise image data within a selected region as a histogram.	
2c8	2D Gaussian fitting	Perform image 2D Gaussian fitting to extract the position, flux density and size of a source. It should be possible to fit multiple sources and print the fitted parameters to screen or a text file.	
2c9	Measuring distances	Measure a geodesic distance between two locations on an image.	

Sensitivity calculators

Mid and Low sensitivity calculators



- Development is well underway
  - Needed for commissioning and verification
  - Community planning
- *Almost* available to the community for continuum and zoom modes
- Expected in ~Oct, available through “science user” space on the website (with users guide)
  - Other modes are coming soon
- Contains some basic validation but not all
- Will be replaced by the PPT which will include complete validation - telescope, CBF, SDP etc
- Accessibility is important to us!!

Science Meetings

- EAS 2023, SKAO Lunch Session, 10 – 14 July 2023, Krakow (see next slides)
- MWA: 10 Years of Ops, 25 – 28 July , Perth
- URSI GASS 2023, 19 – 26 August, New Facilities session, Sapporo
- Science at Low Frequencies IX, 11 – 15 Dec 2023, Amsterdam
- MeerKAT @ 5, 20 – 23 February 2024, Stellenbosch
- SKA Cosmology Conference, March 2024, Lausanne, in early planning stage
- IAU GA, August 2024, Cape Town, various SKA Science events planned
- SKA Science Conference, Summer 2025, Germany, planning still to begin in earnest

Lunch session ”On the road to the SKA” (LS12)

- Friday 14 July 12h30–14h00
- ~25-30 attendees
  - The SKA
    - Project description and key science - Tyler Bourke (SKAO)
    - Status, Operations & Data - Shari Breen (SKAO)
  - SKA Science
    - Extragalactic continuum - Isabella Prandoni (INAF)
    - Radio stars and Planetary Nebulae - Marcin Hajduk (UWM)
    - Pulsars and FRBs - Jason Hessels (UvA/ASTRON)

EAS2023 – SKAO Poland Engagement event

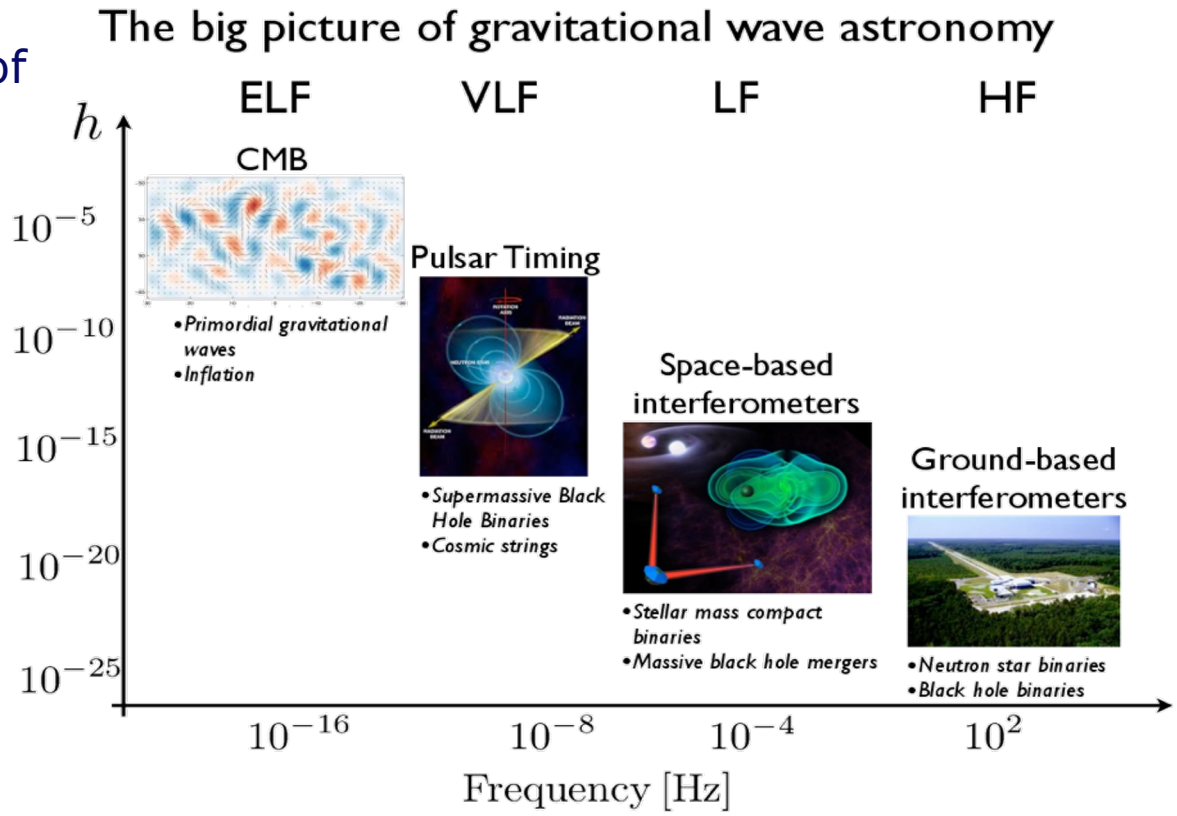
- Engagement event with the Polish astronomy community (Wed. eve)
- 30+ attendees
  - Moderator: Agnieszka Pollo (Head of Astrophysics Division, National Center for Nuclear Research), with support from Mathieu Isidro
  - Introduction to SKA and SKAO – Thijs Geurts (Head of International Relations, SKAO)
  - Project Description, Key Science, SWGs – Tyler Bourke (Project Scientist, SKAO)
  - Status, Operations & Data – Shari Breen (Head of Science Operations, SKAO)
  - Personal Journey to SKAO – Bartosz Idzkowski (Electronics Engineer, SKAO; previously SKAO JPM SKA-Low; CTA PM; from Krakow)
- Very engaged audience; excellent initial discussions with the Polish community, and the path forward (future engagement e.g. Poland SKA Day)
- Many participants stayed after for discussions over drinks/food
- Poland involved in LOFAR, SALT, JIVE, ESO, CTA, HESS, Ligo-Virgo, Athena, Einstein, …

Any Other Business

- News from SWG Chairs?
- …

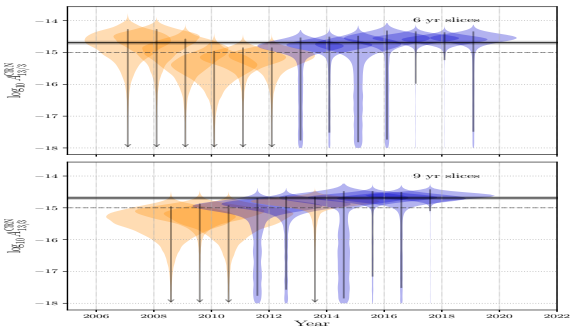
Recent Science Highlights: nano-Hz Gravitational Waves

- Coordinated publication (29 June) of possible detection of the stochastic Gravitational Wave Background in pulsar timing data
- Results from Australian (PPTA), Chinese (CPTA), European (EPTA), Indian (InPTA) and North American (NANOGrav) pulsar timing teams
- Probes GW background of super massive black hole (10^7 – 10^9 M_{Sun}) mergers



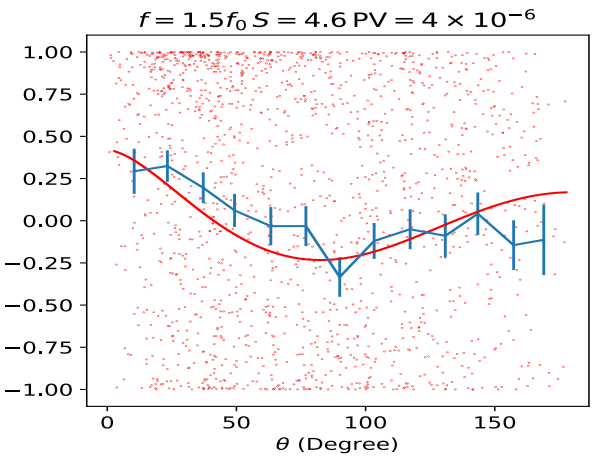
Recent Science Highlights: nano-Hz Gravitational Waves

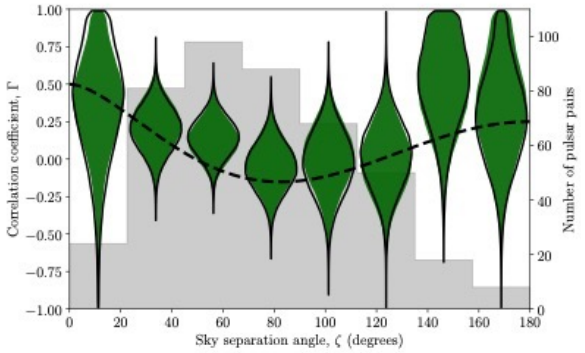
- Significance per individual PTA is still low, but should improve when all combined
- Gravitational strain amplitude, ~3x10^{-15}, near max of predictions
- Still some poorly understood effects…



Reardon et al (PPTA) 2023

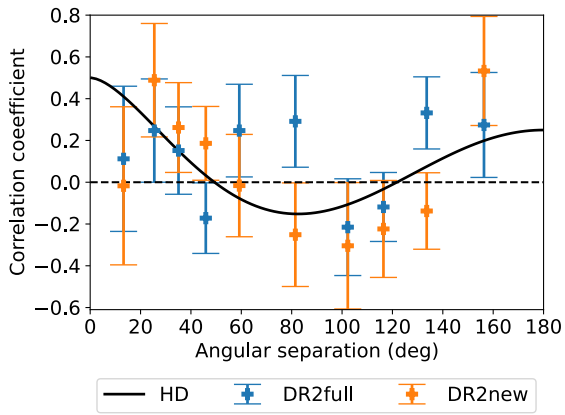
Xu et al (CPTA) 2023

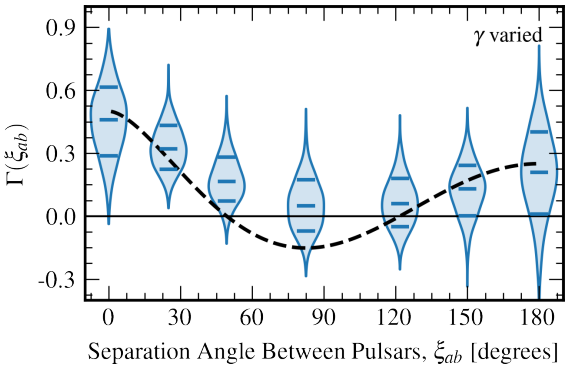




Reardon et al (PPTA) 2023

Antoniadis et al (EPTA+InPTA) 2023





Agazie et al (NANOGrav) 2023

We recognise and acknowledge the Indigenous peoples and cultures that have traditionally lived on the lands on which our facilities are located.

SKAO

www.skao.int