

SKA Transients Science Working Group

Update:

1. Science Working Groups
2. Science Assessment Workshop conclusions
3. Sicily / Headline science rates
4. Use cases
5. Science prioritisation process

SKA Science Working Groups

These are **not** key science projects!

- Epoch of Reionisation and Cosmic Dawn
- Pulsars
- Cradle of Life
- Cosmic Magnetism
- HI
- Transients
- Continuum
- Cosmology

(NB SKA MEMO 125 had previously identified pulsars, HI [inc. EoR] as key science for phase 1, with a nod to “Discovery”)

The SKA Transients Science Working Group

- **Goal:** optimise SKA for transients and variables
- **Chairs:** Fender and Macquart
- **Core membership:** Trott, Bignall, Stappers, Law, Deller, Chatterjee, Murphy, Corbel, Hessels, Paragi, Karastergiou, Woudt, Rupen
- **Advisors:** Keane, Hallinan, Buitink, Swinbank, Armstrong, van Leeuwen, Miller-Jones, Lazio, Siemion, Kuulkers, Perez-Torres, Morrisson, Wijers, Rossi, Burlon, Ghirlanda, Yu, Zhi, Croft, Donnarumma, Wilkinson, Rushton, Agudo, Grainge

Open to requests to join from community

Highest priorities

(identified in Science Assessment Workshop Jan 2014)

- Commensal Transient Searches
- Rapid (robotic) Response to Triggers

also

SKA1-VLBI important for localisation and – for nearby sources
– spatially resolving structure

Higher frequencies (at least to 5 GHz) give better localisation
as well as earlier and more peaked light curves

Sicily SKA conference

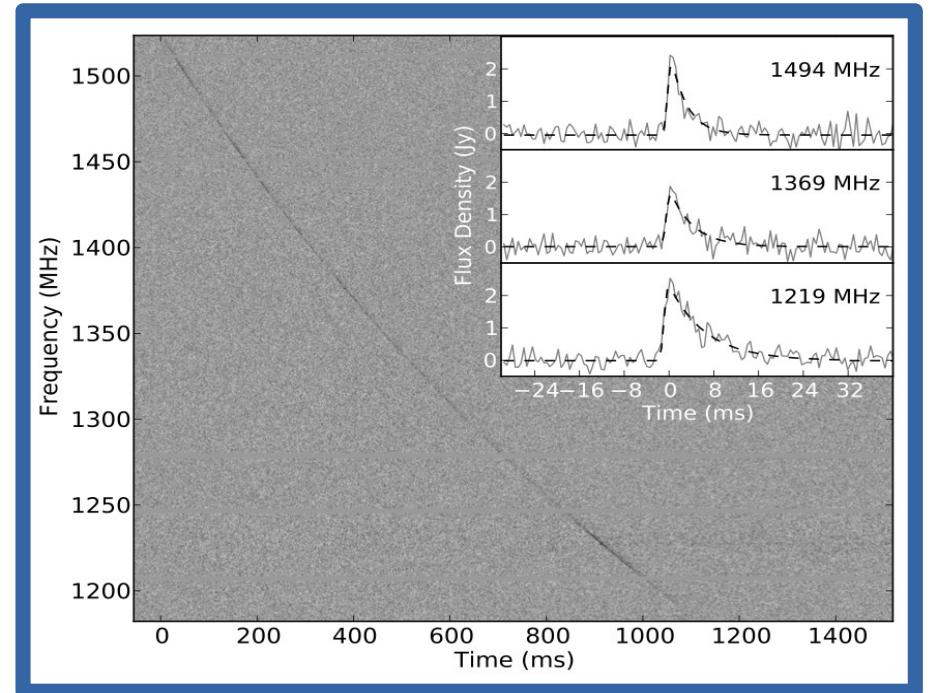
TRANSIENTS	
The Transient Universe with the Square Kilometre Array	Rob Fender
The SKA View of Gamma-Ray Bursts	Davide Burlon
SKA as a powerful hunter of jetted Tidal Disruption Events	Immacolata Donnarumma
Incoherent transient radio emission from stellar-mass compact objects	Stephane Corbel
Fast Transients at Cosmological Distances	Jean-Pierre Macquart
Exploration of the Unknown	Peter Wilkinson
Thermal in the Time Domain: Radio Emission from Novae and Symbiotic Stars	Michael Rupen
Variability of Active Galactic Nuclei	Steve Croft
Investigations of supernovae and supernova remnants in the era of SKA	Lingzhi Wang
A systematic search for CCSNe in the local Universe	Miguel Perez-Torres
Early Phase Coverage of Extragalactic and Galactic X-ray Transients and Exploration of Non-stationary Accretion Regimes	Wenfei Yu

Predicted rates for SKA (assuming 100% efficient commensal)



Tidal Disruption Events
GHz (MID & SURVEY): ~1 / week

GHz rates for some classes of object ~well estimated, and will be **very large** for SKA



Fast Radio Bursts
GHz (MID & SURVEY): ~ 1 / day
MHz (LOW): lots?? none??

Lorimer et al. (2007), Thornton et al. (2013), van Velzen et al. (2014)

Use cases

- FRBs (Macquart)
- Commensal imaging (Fender)
- Stowed commensal (Fender)
- Multiple source monitoring (Rupen)
- Transients VLBI (Paragi)
- ESEs / subarrays (Bignall)

Science Prioritisation process

- SWGs to provide SPO with 3-10 key science goals
- July 2014: Appointment of Science Review Panel
- Sept 2014: Review of initial rankings, SRP report
- SEAC review
- Board meeting
- Oct/Nov 2014: Public release of “Mission Critical” science goals for SKA1
- December 2014: SPO presents costed rescope possibilities to SRP
- March 2015: Board makes rescope decision



Transients key **science** goals

- Precision Cosmology with Impulsive Radio Bursts
- Accessing New Physics using Ultra-Luminous Cosmic Explosions
- Black hole accretion, growth and feedback
- Detecting Electromagnetic Counterparts to Gravitational Wave Events

Project office scoring

- How fundamental is scientific impact? [+10]
- Importance of radio contribution? [+6]
- Within radio context, importance of SKA1? [+6]
- Fraction of SKA1 required to achieve? [+1]
- Synergies with other wavelengths? [+4]
- Instrumental risk? [-2]
- Astrophysics/Population risk? [-2]
- Scientific technique risk? [-2]

Specific feedback for Transients SWG

- Several things “not demonstrated”:
 - *Real-time signal extraction*
 - *Real-time detection and triggering*
 - *Real-time commensal processing has not been demonstrated*
 - *Rapid response yet to be demonstrated*

So let's demonstrate these things to them

Summary

- SKA Transients SWG is pushing for commensal searches, rapid response (as well as higher frequencies and VLBI). With these additions, SKA(1) will be a powerful transients machine.
- The science review process is well underway
 - Top science cases already ranked
 - Transients are now considered “as key” science as other more traditional cases
 - Rescoping options to be considered in Dec 2014
 - Board decision March 2015