

## 1. CTA Consortium Membership Categories

Based on the new CTAC MoU to come into force (next month or so)

### Category I guidelines:

- to contribute in an identified fashion to the CTAC duties
- to invest a significant fraction of their time in CTA, and
- to have well-defined contributions, e.g. for hardware, software analysis, infrastructure or scientific/technical management.

Can opt in on ALL CTAC publications

S. Einecke, G. Rowell, M. Filipovic

### Category II:

Individuals who do not qualify as Category I Members may be admitted as Category II Members, if they bring an identifiable benefit to the CTAC.

Category II Members can be invited by the CTAC to participate in and potentially lead Consortium publications in cases where direct and significant contributions are made.

G. Rowell to propose Cat I members to CTAC Committee (final authority).

## 2. LIEF #3 Application 2020 for 2021-2025 funding. Overlap 1yr with LIEF #2

LIEF #1 2015 for CTA pre-production ~\$450k

LIEF #2 2017-2021 for CTA construction & support ~\$450k/yr

LIEF #3 Construction/operations  $\geq$  \$500k/yr

**For CIs - please ensure you have no more than 1 active LIEF in 2020!**

### Possible LIEF CIs

Adelaide - Rowell, Dawson, White, Veitch

WSU – Filipovic

UNSW – Ashley

Sydney - Boehm, Green

Monash – Balazs

ANU – Bicknell, Crocker

Nagoya – Tajima

MPIK (Heidelberg) - Hinton

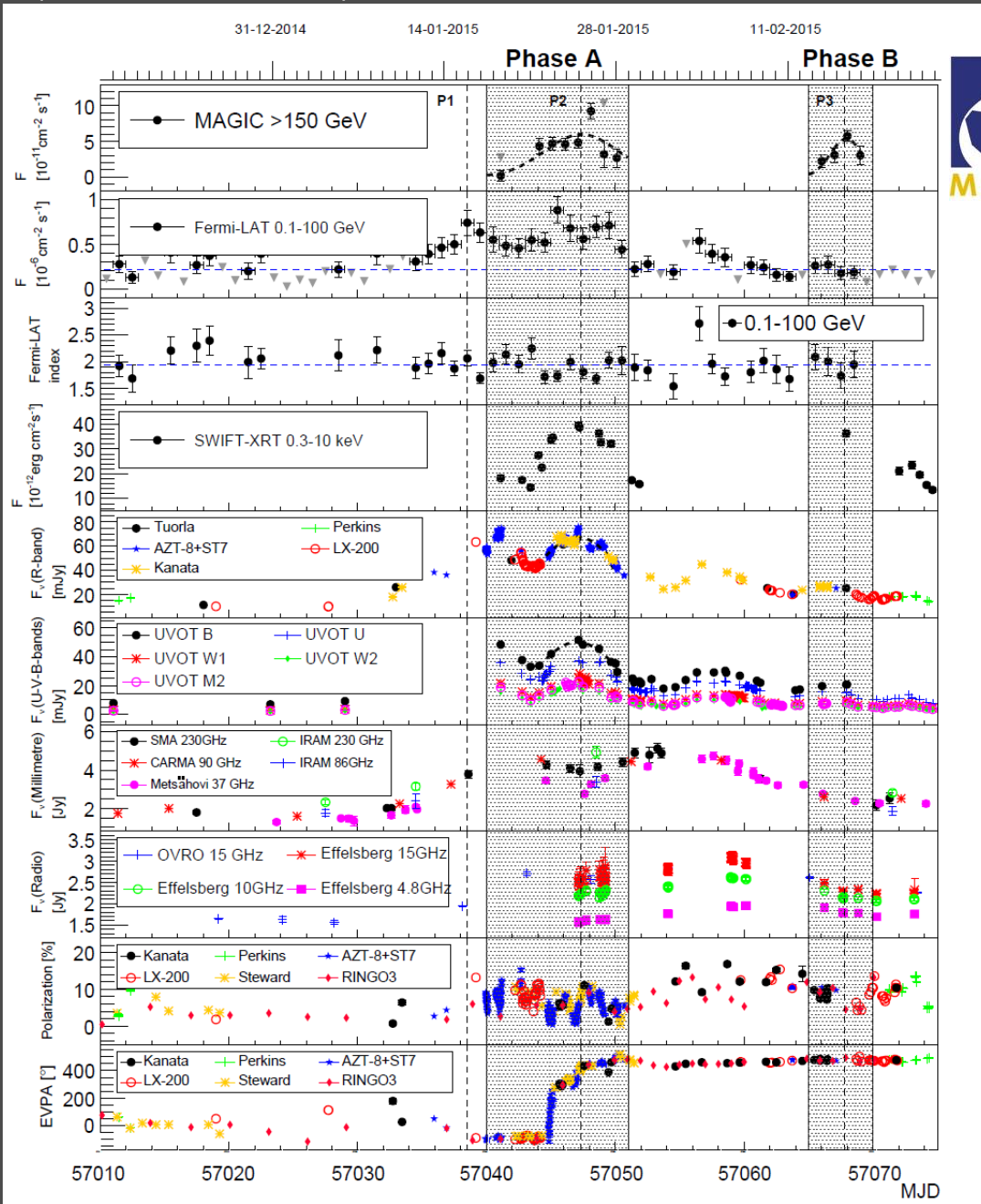
+ other Oz?

### 3. CTA Linkages with Radio, Optical programmes

- Optical monitoring/polarimetry from Australia 1m/2m class.
  - Bespoke polarimeter for AGN ( $m_v > 13$ ) J. Bailey few \$k?  
NCRIS industry funds?
- ISM inputs into Galactic plane analysis
  - Prepare Mopra CO data – galactocentric (N. Maxted)
  - GALPROP time-dep (P. Marinos, T. Porter, G. Rowell, F. Voisin)
- FRBs + transients
  - VOEvent UTMOST links underway with HESS  
(G. Rowell, F. Schussler, H. Ashkar, C. Flynn, V. Gupta, )
  - DWF links with HESS (G. Rowell, J. Cooke)
- Radio surveys MWA/HESS links  
(M. Filipovic, N. Maxted, G. Rowell, N. Hurley-Walker)
- MoUs/agreements for CTA (from 2020/21)?
  - Need contact points for discussions
  - ASKAP, ATCA, >2m optical...

# Synergies with Optical Astronomy

MWL light-curve of BL-Lac type S5 0716+714  
(MAGIC collab 2018)



- Transient studies

- Polarisation angle swing looks very interesting!

- CTA is considering its own on-site 1m class telescopes

1. Limiting magnitude 20 for photometry
2. Limiting magnitude 17 for polarimetry
3. Polarimetric accuracy 0.5 to 1%
4. 5'x5' Field of View (FoV)
5. Intranight cadence
6. Fast (< 2 arc-min) re-pointing

- 2m class telescope access via MoUs etc.

Australia:

Unique longitude coverage in S hemisphere with strong optical community.

# CTA Timeline (late 2018 status)

## Project Phases

**Pre-Construction**

Current Phase

**Pre-Production**

2019-2021

**Production**

2021-2025



First Pre-Production  
Telescopes on Site

## Current Phase

**Pre-Construction**



CTA Offices Open  
in Bologna

Infrastructure Design  
& Procurement



ERIC  
Established

Q1 2017

Q3 2017

Q1 2018

Q3 2018

Q1 2019

Q3 2019

Q1 2020

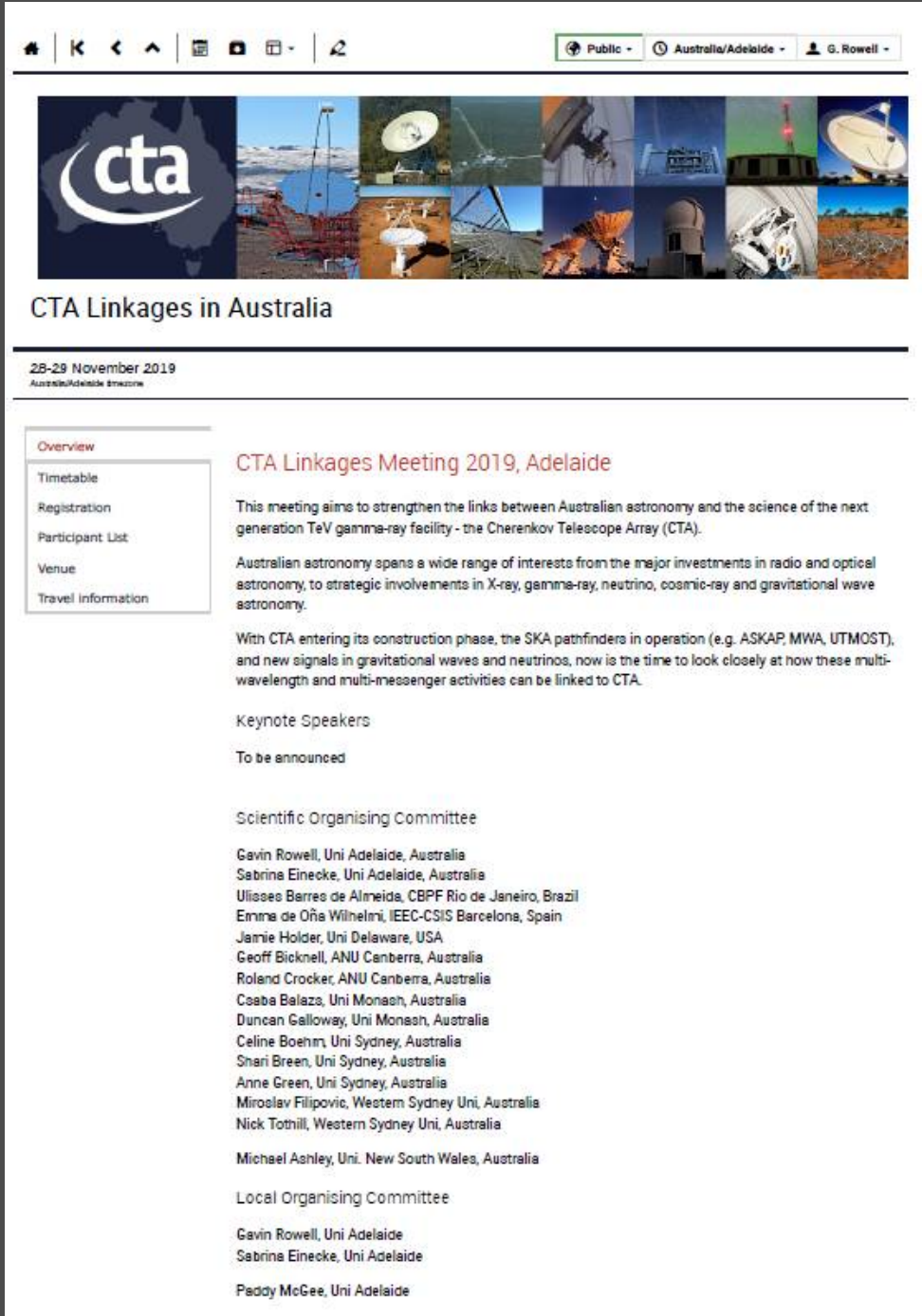
LST 1 Prototype  
Completed on  
North Site



Financial  
Threshold  
Reached

## 4. “CTA Linkages” Meeting 28-29 Nov. 2019

- Just prior to TeVPA 2019 (Sydney) 2-6 Dec. 2019
- Linkages with current major astro funding in Oz (ASKAP, MWA, ESO, aLIGO, AAO)
- Invited speakers?
  - Some key CTA people.
  - Leaders of Australia radio/optical programmes
  - Waiting on TeVPA invited speaker list.



The screenshot shows the Indico event page for "CTA Linkages in Australia". The page header includes navigation icons and user information: "Public", "Australia/Adelaide", and "G. Rowell". Below the header is a banner image with the CTA logo and various telescope images. The event title is "CTA Linkages in Australia" and the dates are "28-29 November 2019". A sidebar on the left contains a menu with "Overview" selected, and other options: "Timetable", "Registration", "Participant List", "Venue", and "Travel information". The main content area is titled "CTA Linkages Meeting 2019, Adelaide" and contains the following text:

This meeting aims to strengthen the links between Australian astronomy and the science of the next generation TeV gamma-ray facility - the Cherenkov Telescope Array (CTA).

Australian astronomy spans a wide range of interests from the major investments in radio and optical astronomy, to strategic involvements in X-ray, gamma-ray, neutrino, cosmic-ray and gravitational wave astronomy.

With CTA entering its construction phase, the SKA pathfinders in operation (e.g. ASKAP, MWA, UTMOST), and new signals in gravitational waves and neutrinos, now is the time to look closely at how these multi-wavelength and multi-messenger activities can be linked to CTA.

**Keynote Speakers**  
To be announced

**Scientific Organising Committee**

- Gavin Rowell, Uni Adelaide, Australia
- Sabrina Einecke, Uni Adelaide, Australia
- Ulisses Barro de Almeida, CBPF Rio de Janeiro, Brazil
- Emma de Oña Wilhelmi, IEEC-CSIS Barcelona, Spain
- Jamie Holder, Uni Delaware, USA
- Geoff Bicknell, ANU Canberra, Australia
- Roland Crocker, ANU Canberra, Australia
- Csaba Balazs, Uni Monash, Australia
- Duncan Galloway, Uni Monash, Australia
- Celine Boehm, Uni Sydney, Australia
- Shari Breen, Uni Sydney, Australia
- Anne Green, Uni Sydney, Australia
- Miroslav Filipovic, Western Sydney Uni, Australia
- Nick Tothill, Western Sydney Uni, Australia

**Michael Ashley, Uni. New South Wales, Australia**

**Local Organising Committee**

- Gavin Rowell, Uni Adelaide
- Sabrina Einecke, Uni Adelaide
- Peddy McGee, Uni Adelaide

## 5. Other TeV Gamma Ray Projects

- Cherenkov Ring (TeV monitoring network, incl. Australia).
  - CTA 'extension' for 24hr TeV source monitoring (MST, 3xSSTs?)
- Southern Gamma Ray Survey Observatory “HAWC++ South”

## 6. CTA Symposium (Bologna 6-9 May 2019)

<https://www.cta-symposium.com/>

G. Rowell, M. Filipovic, R. Crocker

## 7. CTAC General Meeting (Lugarno 3-6 June 2019)

S. Einecke, M. Filipovic

CTA-Australia Website [cta-observatory.org.au](http://cta-observatory.org.au)



## 8. Astroparticle Physics in Australia

Email list for discussions: [ozastroparticle.physics@list.adelaide.edu.au](mailto:ozastroparticle.physics@list.adelaide.edu.au)

Plan: Consider the following discussion points. Google doc to be used to iterate discussion across community. Aim for final google doc by end of 2019.

Discussion points:

1. What topics define astroparticle physics in Australia?
2. Key projects/involvements for Australian astroparticle physics
3. Consider an astroparticle physics chapter of the Astronomical Society of Australia (ASA).
4. Future funding ideas for Australian astroparticle physics; e.g. ARC Centre of Excellence
5. Other discussion points?



# 1. Australian Astroparticle Physics – Potential Topics

## *Particle physics using astronomical observations*

- 1a. High energy photons and particles (GeV+)
- 1b. Relativistic flows - jets, collimated beams in astrophysical settings
- 1c. Extreme environments - neutron star equation of state, core collapse, nucleosynthesis
- 1d. Particle acceleration and propagation mechanisms (solar system and beyond)
- 1e. Indirect (astronomical) dark matter searches
- 1f. Standard model at extreme energies ( $> E_{\text{eV}}$ ?)
- 1g. Exotics - Lorentz invariance, axions.
- 1h. Particle cosmology

## 2. Key projects/involvements for Australian astroparticle physics

- X-rays            eROSITA,..
- Gamma rays    HESS, CTA, CherenkovRing, SGSO,..
- Cosmic rays    Pierre Auger Obs., other CR monitors..
- Neutrinos       IceCube, KM3Net,....
  
- Radio, IR, Optical        Not limited specifically but studies of non-thermal sources, transients, surveys  
→ clear implications for particle acceleration, non-standard model physics, extreme environments.
  
- Theoretical                Particle acceleration, transport, interaction, beyond standard model, SN simulations, accretion/jets

### 3. Consider a new chapter of the Astronomical Society of Aust. (ASA) for Astroparticle Physics or something similar?

The ASA's strategic plan (draft circulated Jan. 2019) floats the idea of new ASA chapters devoted to scientific themes, beyond ANITA (for theory).

We therefore should seriously look at such a chapter devoted to astroparticle physics, high energy astrophysics and/or something similar. The chapter would ideally be charged to develop the ASA's position on matters of importance to our community.

This might be compared to the High Energy Astrophysics Division (HEAD) of the American Astronomical Society.

e.g the by-laws of the HEAD <https://head.aas.org/bylaws>

#### II. Object

*The object of the Division for High Energy Astrophysics (hereinafter called "the Division") shall be to assist and promote the advancement of research and the dissemination of knowledge of high energy events, particles, quanta, of relativistic gravitational fields, and of related phenomena in the astrophysical universe, and to promote the coordination of this research and knowledge with other branches of science.*

#### 4. Future funding ideas for Australian astroparticle physics;

This may be based around funding for facility involvements and larger-scale funding for personnel/hardware.

A major topic no doubt would be an ARC Centre of Excellence (CoE). What topics should a CoE in Astroparticle Physics consider?

- Should cover topics not in any CoEs present and planned (Astro3D, OzGrav,...)

Origin of cosmic rays (galactic + extragalactic)

→ role of CRs in magnetic fields, astrochemistry, star formation

Origin of elements - nucleosynthesis

What/where is dark matter and what is its role in the Universe?

Extreme astro environments

- Total effectiveness greater than sum of individual efforts
  - Need synergies in techniques & applications that are **most** likely to succeed in 7 years
  - CoE Personnel should utilise several facilities (membership of each..)
  - Industry linkages – build something in Australia or local contributions
- ARC CoE “Extreme xxxxxx” ?

"A joyous romp through the extreme universe.... Gaensler's book is so good I am going to steal some of his ideas for my lectures. I have no higher praise!"—**ROBERT P. KIRSHNER**,  
Professor of Astronomy at Harvard University  
and author of *The Extravagant Universe*

A Guided Tour of the Fastest,  
Brightest, Hottest, Heaviest, Oldest,  
and Most Amazing Aspects of Our Universe

# EXTREME COSMOS

Bryan Gaensler, PhD



# COSMIC BULLETS

HIGH ENERGY PARTICLES IN ASTROPHYSICS

ROGER CLAY • BRUCE DAWSON

FOREWORD BY PAUL DAVIES

## 5. Other discussion points?

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