

# Non-accelerator particle, nuclear & astroparticle physics

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## Status

- Non-accelerator potentially includes a wide range of topics that span particle, nuclear, astro, cosmology and quantum physics.
- We have made a first pass at defining these topics  
→ now seek feedback on the proposed scope of non-accelerator.

## Dark matter

- direct detection - WIMPS (SABRE, CYGNUS, future low mass experiments)
- direct detection - axions (Organ, ADMX, future experiments)
- indirect detection (CTA, HESS, SKA, Fermi, IceCube, KM3NET)
- dark matter theory
- cosmological simulations

## Neutrinos

- Oscillation experiments (HyperK, DUNE, etc - solar, atmospheric, reactor and supernova neutrinos, neutrino mixing parameters, CP violation)
- Neutrino telescopes (IceCube and KM3NET)
- Tritium endpoint experiments (neutrino mass)
- Double beta decay experiments (Majorana mass)
- Coherent neutrino nucleus scattering (link to DM direct detection)

## Precision tests of the Standard Model

- CP violation -- electric dipole moment experiments
- precision tests of CPT or Lorentz invariance
- varying fine structure constant

## Astroparticle Physics and Cosmology

- Cosmic rays -- particle physics interactions at extreme energies (CTA, Auger, IceCube, SKA)
- CMB -- measurement of neutrino mass,  $N_{\nu}^{\text{eff}}$ , dark matter interactions
- Baryogenesis, Inflation, dark energy and other BSM theory

# Astroparticle Physics in Australia

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

Jan. 2020 – Over 70 subscribers to email list.

In 2019 a discussion paper was developed to address:

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

Will aim to update this paper on an annual basis or thereabouts to reflect developments in the community.

# Astroparticle Physics in Australia - Discussion Paper

Version 3 4 October 2019

Astroparticle physics worldwide has grown considerably over the past 20 years with formal recognition in, for example, worldwide (<https://iupap.org/commissions/c4-commission-on-astroparticle-physics/>), and European (<https://www.appec.org/>) discussions, several journals using 'Astroparticle Physics' in their title, and, many multi-national facilities attracting several billion Euro in funding. Australia has also experienced a growth in astroparticle physics activities.

This document for the Australian astroparticle physics community outlines a number of discussion points currently under consideration. The key purpose of this paper is to initiate discussion on the topics defining astroparticle physics, and, the future actions on community building and funding plans.

The email list for discussions is here: [ozastroparticle.physics@list.adelaide.edu.au](mailto:ozastroparticle.physics@list.adelaide.edu.au)

To subscribe to this list, use this link:

<https://list.adelaide.edu.au/mailman/listinfo/ozastroparticle.physics>

1. **Astroparticle physics in Australia – Potential Topics and Challenges**
2. **Key projects/involvements for Australian astroparticle physics**
3. **Consider an astroparticle physics chapter of the Astronomical Society of Australia (ASA), or AIP.**
4. **Future funding ideas for Australian astroparticle physics; e.g. ARC Centre of Excellence**
5. **Other discussion points.**

- **Version 3 sent to ASA & AIP executive late November 2019.**
- Both executive committees are favourable to creating a joint chapter/group.
- They are working out implications for their governance/constitutions:  
Mostly technical issues regarding membership of one body and not the other.