



# Advanced Metrology

CI

RA/Tech

ANU: Tims (0.4)

Froehlich (B, 0.5), Slavkovská (A, 0.5)

UWA: Tobar (0.1)

McAllister (A, 0.4), A/B (0.5)

Goryachev (0.1)

Ivanov (AI, 0.5)



Australian Government  
Australian Research Council



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# Advanced Metrology

## Developing methods to measure contamination in detector materials

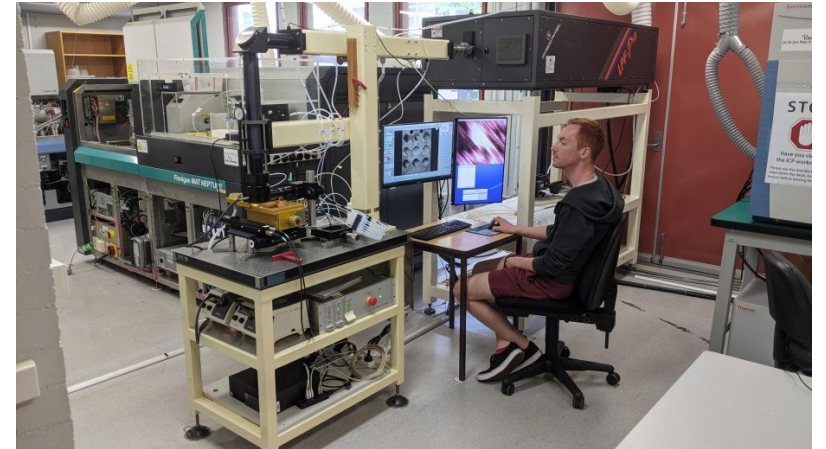
Immediate focus on  $^{40}\text{K}$ ,  $^{129}\text{I}$ ,  $^{210}\text{Pb}$

Survey relevant, existing capabilities of ultra-sensitive techniques/laboratories  
e.g. ICP-MS:

- PNNL (USA) –  $^{40}\text{K}$
- Developing local capability: collaboration with ANU Research School of Earth Science
  - Laser ablation, Quadrupole, Sector field ICP-MS, etc

*see Z. Slavkovská later today*

Also TIMS, AAS, ...



# Advanced Metrology

## Gamma- spectrometry

Immediate focus on measuring U/Th/K - (Rn progeny)

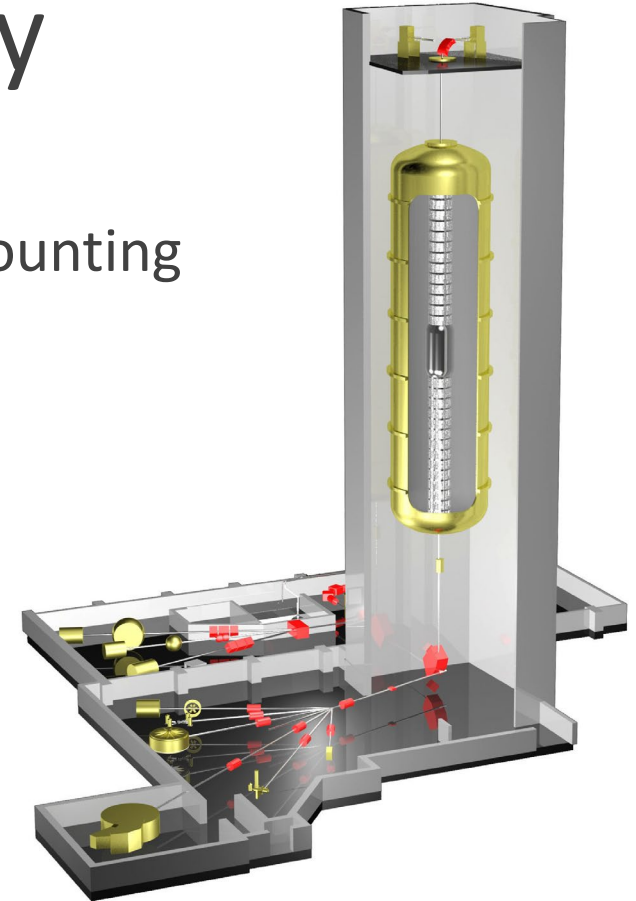
- HPGe ultra-low background gamma-ray counting at Gran Sasso (Italy)
  - Some capability at ANU
  - Low background at ANSTO
- Ultra-low background capability part of SUPL
- Other low background laboratory capabilities (Aus/NZ) being assessed



# Advanced Metrology

## Accelerator Mass Spectrometry (ANU/ANSTO)

- Contaminant radionuclide measurements through atom counting
- Unstable/stable atom ratios of  $10^{-12} - 10^{-17}$
- $^{129}\text{I}$  done,  $^{210}\text{Pb}$  under development
  - See M. Froehlich later today
- Sample-dependent chemistry – ANU expertise
- Improvements in AMS capability (ANU):
  - Mass filtering
  - TOF detector timing and energy resolution
  - Integration of new systems with fast isotope switching system



# Precision Metrology

## New techniques and technology for Direct Detection

Led by UWA

- Observables include, frequency, phase or power, etc

Low Energy metrology for:

### Axion Detection

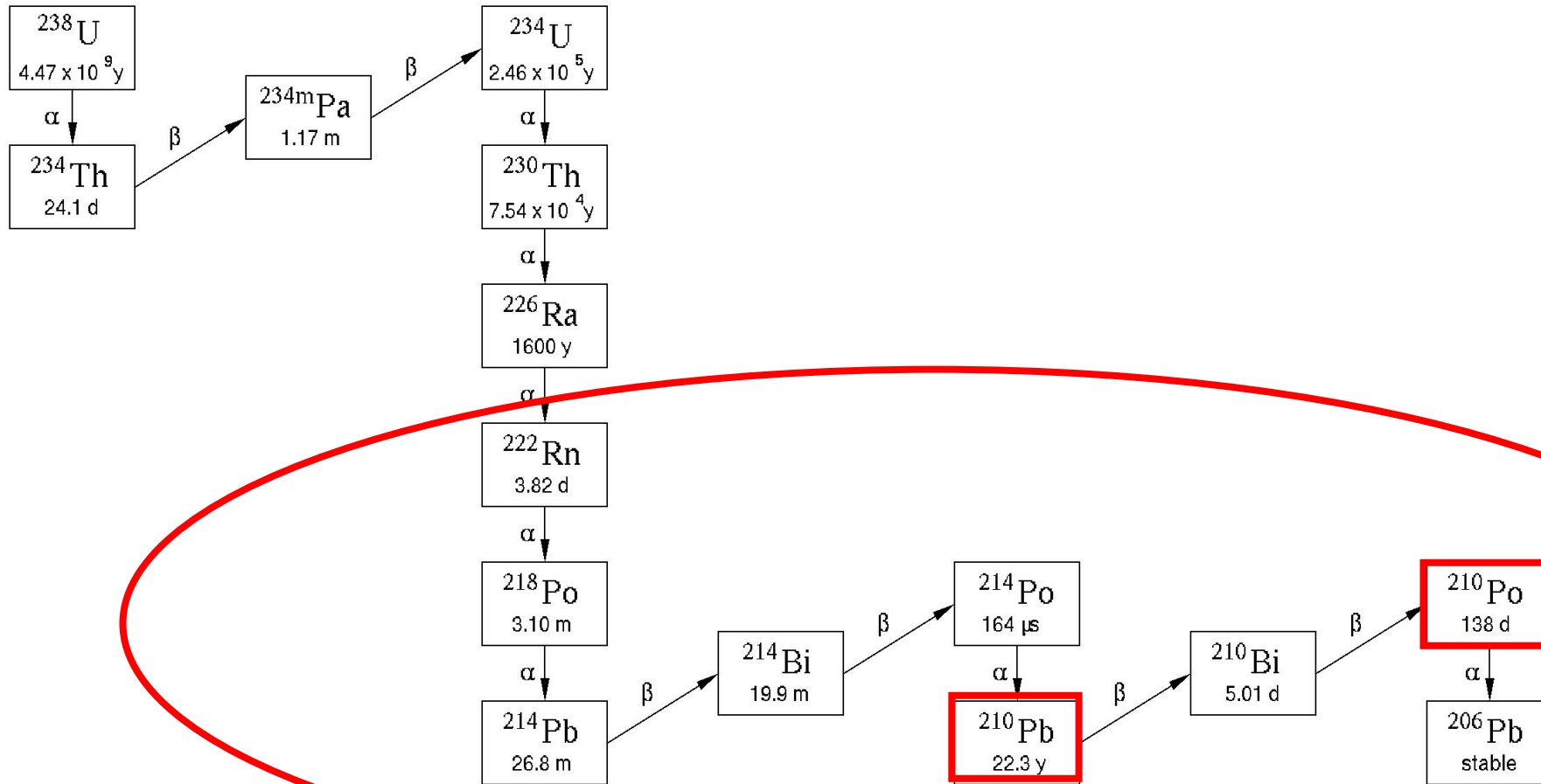
- Photonic frequency and power

### WIMP and WISP Detection

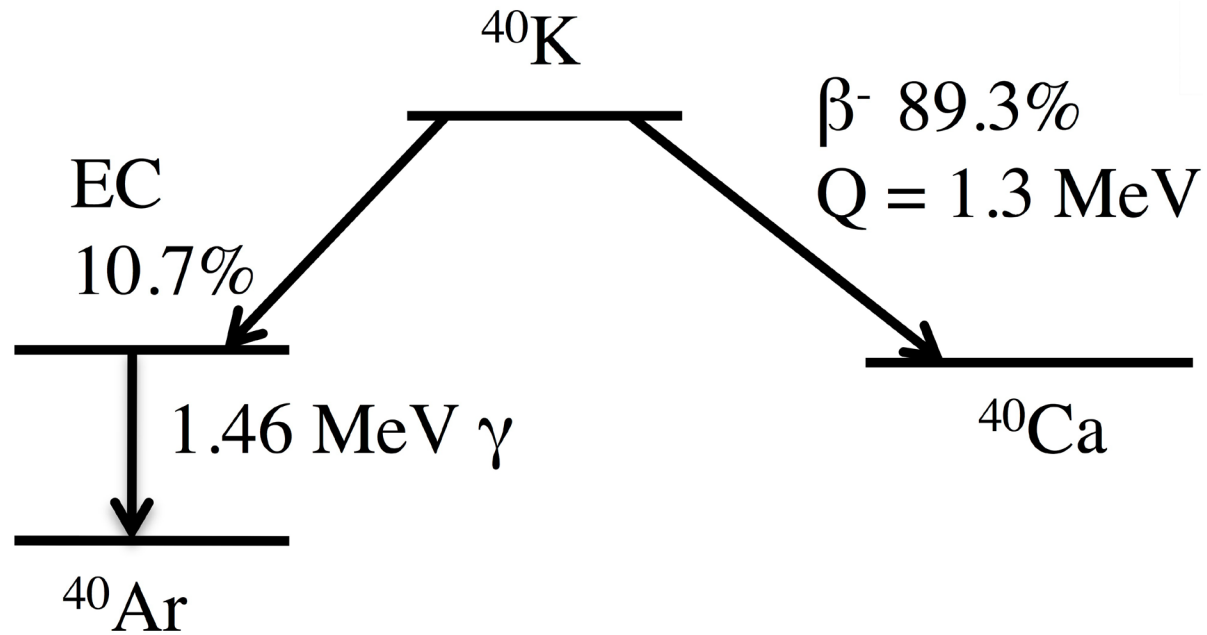
- Photonic, phononic, spintronic frequency
- Quantum metrology, to improve low temperature detection



# Advanced Metrology



# Advanced Metrology

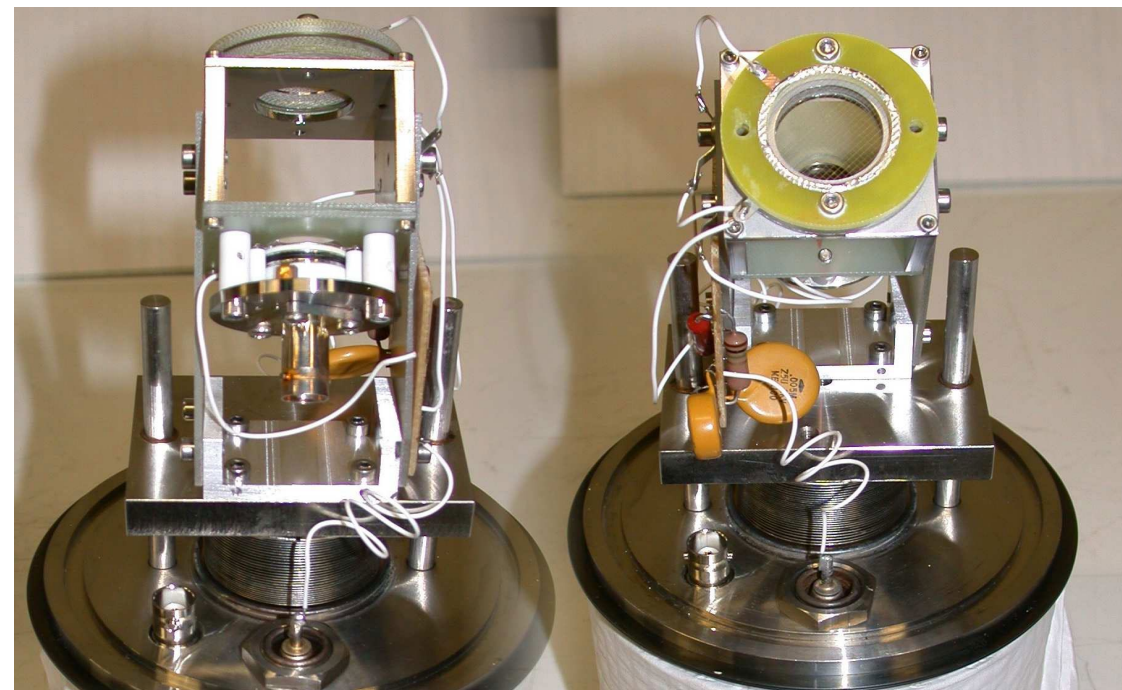
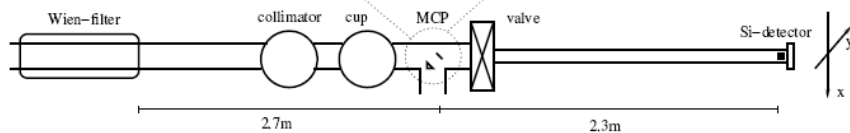
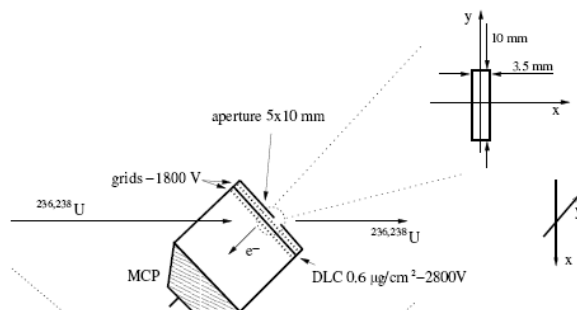
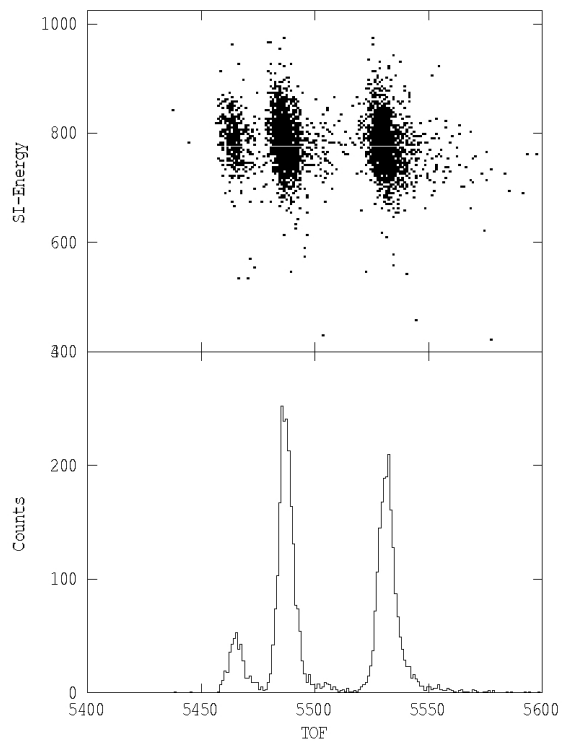


**EC leaves a hole in the K-shell**


**→ 3 keV Auger electron**

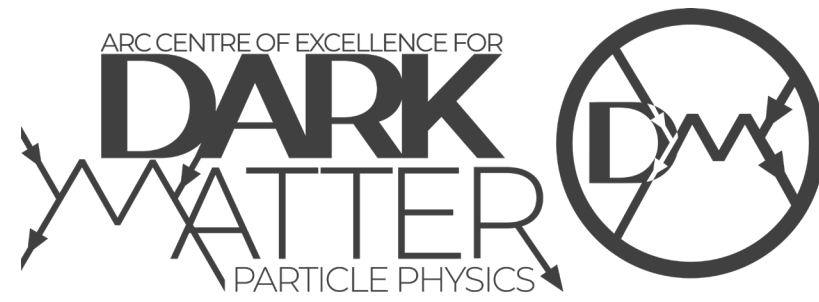


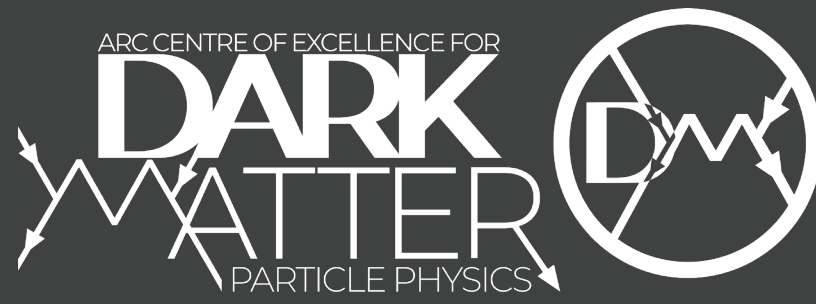
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ARC CENTRE OF EXCELLENCE FOR  
**DARK**  
MATTER  
PARTICLE PHYSICS













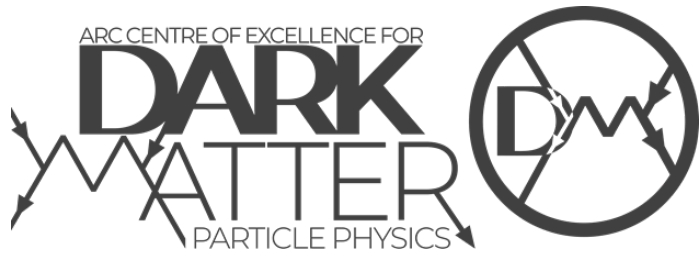












## INTERNATIONAL PARTNER ORGANISATIONS:



The University of Sheffield.

