**Submission**

# 2016 National Research Infrastructure Roadmap
# Capability Issues Paper

| | |
|---|---|
| **Name** | **Geoffrey Taylor** |
| **Title/role** | **Professor/Director CoEPP** |
| **Organisation** | **Uni of Melbourne** |

Question 1: Are there other capability areas that should be considered?

*High Energy Particle Physics, generally as a category of accelerator science, and fundamental physics.*

Question 2: Are these governance characteristics appropriate and are there other factors that should be considered for optimal governance for national research infrastructure.

*Governance should include priority setting for the broader field of particle physics, which in principle*

Question 3: Should national research infrastructure investment assist with access to international facilities?

*Yes. It is absolutely critical that Australia's national research infrastructure investment include a strong and continuing commitment to important international facilities, that are out of reach of any reasonable national research infrastructure budget but are available in partnerships that give a "seat at the table" in management as well as access for our researchers and industries.*

Question 4: What are the conditions or scenarios where access to international facilities should be prioritised over developing national facilities?

*The uniqueness of the facility and the inability to match the capability or quality (or both) at a national facility. Such a characteristic of critical international facilities should be approached for including into our national infrastructure via partnership arrangements.*

*Or when there is an expectation of participation at an international facility as quid pro quo for international researchers using some facility hosted in Australia.*

Question 5: Should research workforce skills be considered a research infrastructure issue?

Question 6: How can national research infrastructure assist in training and skills development?

*They should become a critical platform in training. If they are not at the sharp end of facilities in their field and hence capable of training at the highest levels, they should not be considered critical national research infrastructure.*

Question 8: What principles should be applied for access to national research infrastructure, and are there situations when these should not apply?

*Quality researchers, quality proposed research, with potential for important research outcomes.*

**Advanced Physics, Chemistry, Mathematics and Materials**

Question 21: Are the identified emerging directions and research infrastructure capabilities for Advanced Physics, Chemistry, Mathematics and Materials right? Are there any missing or additional needed?

*High energy particle physics is clearly at the pinnacle of international fundamental science and must be supported via a national infrastructure program.*

Question 22: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

*There are several major particle physics programs with which Australia would do well to engage in, especially through formal arrangements with CERN:*

- *The continued participation of the CERN/LHC program via the ATLAS collaboration.*
- *Participation in the major LHC upgrade programs beginning with the high luminosity upgrade the HL-LHC for 2026 to achieve a factor of 10 times the event sample, and then the high energy upgrade HE-LHC to ~double the LHC energy.*
- *Participation in the Compact Linear Collider (CLIC) development.*
- *Participation in the development of plans and technology the next generation, 100km circumference machine, the FCC.*
- *Participation in the applied accelerator technology program including compact medical accelerators for particle beam technology.*
- *Participation in the development of massively distributed computing (grid morphing in major open cloud computing) and further development of management and analysis of massive data sets.*

Question 23: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Advanced Physics, Chemistry, Mathematics and Materials capability area?

*A methodology for increasing awareness of and collaboration across the disciplines in the physical sciences.*

**Underpinning Research Infrastructure**

Question 30: Are the identified emerging directions and research infrastructure capabilities for Underpinning Research Infrastructure right? Are there any missing or additional needed?

*Computing, data storage and management, and networking capacity, both within Australia and internationally have ubiquitous roles across the entire research environment and must be maintained and developed with their critical nature kept at the forefront of management decisions.*

Question 31: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

*Medical accelerator development for particle beam therapy is an emerging area. Collaboration in this field, between institutions and with industry is evolving rapidly.*

**Data for Research and Discoverability**

Question 34: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

*The Horizon 2020 program in Europe, to build upon the grid program started in particle physics and finding great need across many disciplines, and building into a critical open-source large scale e-infrastructure.*

**Other comments**

If you believe that there are issues not addressed in this Issues Paper or the associated questions, please provide your comments under this heading noting the overall 20 page limit of submissions.

*In response to the request by the Roadmap committee I have kept responses to the relevant questions to a minimum.*

*The need for Australia to be part of the international particle physics community as all advanced nations are is quite critical. There is no half measure for full participation in this field. The facilities' size in capital cost, complexity and operation, the timescales for conception, development and execution of the key facilities, the large, highly trained and highly capable personnel, the high quality management and the need for continuing and deep engagement by a range of industries make multi-national collaboration in this field essential.*

*For nations to be properly involved, commitment to long-term investment and collaboration is critical. Only then can the full benefits be realised nationally, including scientific, industrial, technological and cultural benefit. Australia need to provide access to and participation in developments for the key areas of Big Research. As with astronomy, biology and materials research, high energy physics participation in the major international laboratory should be considered an essential part of our National infrastructure in the long term.*

***Associate Membership at CERN** would bring to Australia such an array of benefits in the only way that is possible – international collaboration.*