Astronomical Society of Australia

AUSTRALIAN INSTITUTE OF PHYSICS

The Astronomical Society of Australia and the Australian Institute of Physics welcome the opportunity to provide feedback on the draft Priorities. As representatives of two of Australia's peak bodies for the physical sciences, we are pleased to see the contributions of our disciplines, astronomy and physics, recognised in the draft.

While the draft Priorities capture several important challenges and opportunities, we have identified two critical gaps. Specifically, we suggest that the Priorities would be strengthened by:

1. **Explicit inclusion of critical technologies in communication and positioning, timing and sensing.** These are currently the only broad areas which appear in the Government's List of Critical Technologies in the National Interest but are not included in the draft Priorities.

2. **Inclusion of discovery research as a further Priority.** This fundamental pillar underpins all other Priorities. If this is not possible due to the broad scope of discovery research, we suggest including an explicit statement (for example, in a preamble) to emphasize the essential role of such research in all Priorities. This needs to be the main focus of Australia's science and research effort, with any specific initiatives being supported in parallel.

We now provide more context to these suggestions.

(1) We were surprised to find several critical technologies missing in "*Priority 3: Enabling a productive and innovative economy*" under "*Harnessing emerging technologies at scale*" and "*Creating future industries*". Specifically, communications and positioning, timing and sensing are the only broad critical technology areas (from the Government's List of Critical Technologies in the National Interest) not appearing in the draft Priorities. We advocate for correcting this, via an explicit reference in the list of emerging technologies on p. 11:

- *Australia will build new industries and accelerate productivity by having sovereign knowledge and access to develop and harness impactful emerging technologies, particularly in advanced navigation, sensing and communication; AI; quantum; and biotechnology.*

Australian physics and astronomy have a proud history of leading in several critical technology areas. Indeed, two explicitly listed focus areas, quantum and semiconductors, have come out of discovery physics research. Many aspects of two further areas, advanced radio and optical communications, and satellite and positioning technologies, have emerged from astronomy and physics research.

Australia currently has several competitive advantages in communications, positioning, timing and sensing. These research areas also contribute to national security. The counterfactual of not investing in these areas – as would be the case if they are not included in the Priorities – would have Australia lag behind competitor economies in building industries of the future, and not have sufficiently advanced sovereign capability.

(2) We were disappointed to not see fundamental, discovery research as a fifth, underpinning national Priority. As stated in the Terms of Reference, the Priorities are *"a signal-setting tool, give clarity on the areas government considers important and help encourage activity and growth in these areas"*.

Omission of fundamental research from the list sends a message that this is not a priority for Australia, with downstream consequences for translational and applied research in due time. This point was also explicitly raised in the submissions to the Priorities Taskforce by the Australian Academy of Science and Science and Technology Australia, the two organisations with the largest reach and hence best placed to speak on behalf of all Australian scientists; as well as in the peak bodies roundtable attended by our representatives.

In our own disciplines, fundamental physics research has led to quantum and semiconductor technologies. Fundamental research in astronomy has enabled accurate positioning including via GPS, minimized disruptions to vital satellite services and electrical power grids, improved medical imaging techniques, and facilitated development of smart phone cameras and WiFi networks. Research excellence by Australian astronomers has also led to direct $1.8 billion foreign investment in Australia through construction of the Square Kilometre Array. *None of this would have happened without sustained investment in fundamental physics and astronomy research.*

Fundamental science is also essential for inspiring people, and attracting them to STEM. An explicit focus area in the National Science Statement is to "*enable and grow a STEM-skilled workforce*" – but participation by Australians in STEM subjects is stagnating or going backwards. Yet Australia needs skilled professionals to fill a rapidly-growing number of STEM jobs (e.g. 1.1 million tech jobs by 2030). Discovery sciences such as astronomy and physics are often the gateway for STEM-curious minds. They also make a large contribution to training a STEM-capable workforce that benefits the nation. For example, almost one third of astronomy PhD graduates become data science specialists, contributing widely across the Australian economy in areas as diverse as energy, biotech and medical industries, defence research, supercomputing, business and non-profit enterprises. Physics graduates make similarly broad contributions. Any reduction in focus on fundamental research is likely to undermine this production pipeline, with potentially serious long-term consequences.

Finally, fundamental sciences such as astronomy and physics provide an exceptional opportunity for both international and domestic engagement. Worldwide collaborations, across cultures, are essential for advancing these disciplines. The fact that every culture has its own relation to the sky gives us an opportunity to engage on a fundamental level with other cultures and nations, especially Australia's First Nations – the world's oldest astronomers.

For these reasons, we strongly support the recent statement by the Academy of Science on the importance of appropriately resourced discovery research. We respectfully suggest that the Priorities should reflect this, by listing fundamental research as an underpinning pillar.

Thank you for consideration of our suggestions above, and for your stewardship of Australian science.

Best wishes,

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