



Submission No. 9
(SKA Pathfinder Radio Telescope)

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Submission to the PWC on the proposed Australian SKA Pathfinder Radio Telescope

ASKAP Science Working Group

- S. Dougherty (Dominion Radio Astrophysical Observatory, Penticton, Canada)
- I. Feain (Australia Telescope National Facility, CSIRO)
- S. Johnston (Australia Telescope National Facility, CSIRO)
- T. Osterloo (ASTRON, The Netherlands)
- I. Stairs (University of British Columbia, Vancouver, Canada)
- L. Staveley-Smith (University of Western Australia)
- R. Taylor (University of Calgary, Calgary, Canada)
- S. Tingay (Curtin University of Technology)
- M. Verheijen (University of Groningen, The Netherlands)
- J. Wall (University of British Columbia, Vancouver, Canada)

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Australia has a proud history in radio astronomy with a tradition of success founded on the construction of large radio telescopes capable of world-leading science and available for use by astronomers world-wide. The iconic symbols of the Parkes radio telescope, now approaching its 50th anniversary, and the Australia Telescope Compact Array (ATCA), which turns 20 this year have a high impact both with the scientific community and with the public at large.

In the international arena, radio astronomers have been considering the idea of a 'Square Kilometre Array' (SKA) since the mid 1990s. Such a telescope would provide a two orders of magnitude increase in collecting area over existing telescopes and have the ability to revolutionise many areas of astrophysics. The SKA is currently in its research and development phase by a consortium of 17 countries (including Australia) with operations planned to begin in 2020. There are two potential hosts for the SKA, Australia and South Africa.

We are therefore at a critical junction in both Australian and interna-

tional astronomy. The SKA needs to build demonstrators to test key aspects of the science, the technology and the site prior to commencement of the full SKA. The Australian community also recognises that the time is right to follow on from Parkes and the ATCA with a new facility.

The Australian Square Kilometre Array Pathfinder (ASKAP) will serve these purposes admirably. ASKAP will consist of at least 30 parabolic antennas each 12-m in diameter and will achieve a very high survey speed through the development of focal plane array technologies allowing a 30 square degree patch of sky to be observed at any one time. From a science perspective, ASKAP has four main goals:

- to carry out world-class, ground breaking observations directly relevant to the SKA Key Science Projects;
- to demonstrate and prototype technologies for the mid-frequency SKA, including field-of-view enhancement by focal-plane phased-arrays on new-technology 12-m class parabolic reflectors;
- to establish a site for radio astronomy in Western Australia where observations can be carried out in a superb radio-quiet environment.
- training the next generation of scientists and engineers in preparation for the SKA.

The technological innovation of ASKAP and the unique radio quiet location in Western Australia will enable a powerful synoptic survey instrument that will make substantial advances in SKA technologies and on three of the SKA key science projects: the origin and evolution of cosmic magnetism, the evolution of galaxies and large scale structure, and strong field tests of gravity.

In conjunction with the international astronomy community, the ASKAP Science Working Group has identified the headline science goals for ASKAP which are:

- The detection of a million galaxies in atomic hydrogen emission across 80% of the sky out to a redshift of 0.2 to understand galaxy formation and gas evolution in the nearby Universe.
- The detection of synchrotron radiation from 60 million galaxies to determine the evolution, formation and population of galaxies across cosmic time and enabling key cosmological tests.

- The detection of polarized radiation from over 500,000 galaxies, allowing a grid of rotation measures at $10'$ to explore the evolution of magnetic fields in galaxies over cosmic time.
- The understanding of the evolution of the interstellar medium of our own Galaxy and the processes that drive its chemical and physical evolution.
- The characterization of the radio transient sky through detection and monitoring of transient sources such as gamma ray bursts, radio supernovae and intra-day variables.
- The discovery and timing of up to 1000 new radio pulsars to find exotic objects and to pursue the direct detection of gravitational waves.
- The high-resolution imaging of intense, energetic phenomena through improvements in the Australian and global Very Long Baseline networks.

The ASKAP Science Working Group recognises that ASKAP is a key step on the strategic pathway towards the SKA. Enabling ASKAP to maintain its current project schedule is very important in order to maximise its input to and impact on the international SKA project.

