

THE GREATEST MAP EVER MADE

AUSTRALIAN ASTRONOMERS
ARE USING THE NCI TO CARRY
OUT THE LARGEST SURVEY OF
THE VISIBLE UNIVERSE YET

It will be a feat of cartography to rival the achievements of Captain James Cook, the most detailed map of the heavens ever compiled, charting a vast dome of stars extending from the equator to the South Pole.



The Southern Sky Survey is a deep, digital map of all that can be viewed through the most sophisticated sky-mapping telescope yet built, from asteroids and comets, stars near and far in the Milky Way to distant quasars close to the dawn of the universe. It encompasses all 20,000 square degrees that can be seen from the Southern Hemisphere.

"This project pushes the frontiers of technology in several respects," its leader, Professor Brian Schmidt of the Australian National University's Mt Stromlo Observatory says. "We are using the new fully robotic SkyMapper telescope. It is the widest-field instrument in the world of this size and does all aspects of observing automatically.

The imaging camera of SkyMapper embraces an enormous field of view (5.7 sq degrees with 268 million pixels) with very high sensitivity from blue-wards of where the eye can see to the far infra-red. "No other camera in the world has this combination," Brian says. "Over recent years we have developed the software to robustly sift terabytes of data, accurately calibrate it, and automatically pick out interesting objects for further inspection.

"We're producing torrents of data, as much as 225 terabytes (trillion bytes) in all—which is why we need the phenomenal processing power of the NCI supercomputer."

The project has five main objectives:

- A census of large objects out beyond Neptune in the Kuiper Belt and Oort Cloud, in far more detail than any existing survey.
- Discovery of nearby young stars to help in understanding the early evolution of solar systems.
- Study of the oldest, most metal-poor stars in the Milky Way, to probe how the first stars in the Universe formed.
- Discovery of distant Galactic stars to map the halo of the Milky Way and learn how it evolved to its current state.
- Observation of a large sample of very old Quasars in order to probe conditions in the early Universe.

While the whole sky has been mapped at every wavelength from gamma-ray to radio, optical telescopes still find substantially more objects—yet even they have drawbacks. "Their power to pinpoint objects' position and brightness are an order of magnitude less than what is needed to measure things like the star's temperature, chemical abundance and surface gravity. Those are the measurements that tell astronomers what stars are really like and how far away they are." Brian says.

"Recent spectacular advances in detector technology have enabled us to overcome these drawbacks. The Charge Coupled Devices (CCDs) we use to collect the light from the telescope are more than 50 times as sensitive as the old photographic plates. The recent development of digital cameras with tens of millions of pixels has also overcome one of the big limitations of digital technology."

SkyMapper, located at the ANU's Siding Spring Observatory near Coonabarabran, NSW, is among the first of a new generation of dedicated, wide-field survey telescopes and began observations in May 2009. While other large sky surveys are under way in the northern hemisphere it is the only one of its kind observing the south, and is significantly more sensitive in the ultraviolet than any competitor.

"We will see more in the infra-red than previous surveys, and are observing an area 2.5 times greater than the current largest survey," Brian explains. "We are using specific filters that allow us to gather more detailed physical information about stars. We are observing many epochs through time—from our own solar system to the early origins of our galaxy and the universe itself. We cover things as small as an asteroid to the largest of stellar objects."

The Southern Sky Survey will prove a goldmine for undergraduate, PhD students, and post docs in Australia and around the world, Brian predicts. It will help to train a new generation of gifted astronomers to continue the task of exploring and disclosing the wonders of the universe.

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