The SkyMapper 1.3m Telescope is situated at Siding Spring Observatory (NSW) near the Warrumbungle National Park, Australia’s first Dark Sky Park. Owned and operated by ANU, its observations started in the year 2014 and will run until 2020. The resulting image of the sky will have one trillion (1,000,000,000,000) pixels and record billions of stars and galaxies with their locations, shapes and luminosities in six optical colours. These colours are crucial to differentiate stars of different mass, size and chemical composition, galaxies at different distance and with different levels of star formation, as well as actively growing supermassive black holes. All processed imagery will be freely accessible to the public at http://skymapper.anu.edu.au

Using repeat observations SkyMapper reveals transient phenomena from nearby pulsating stars to distant supernovae and new unknowns.

CAASTRO helped a unique collaboration to arise, which may reveal for the first time optical light from the enigmatic “Fast Radio Bursts” that were first found at the Parkes Telescope. The Australian SKA Pathfinder (ASKAP) will shadow the SkyMapper Telescope from 2018 as it completes its sky survey. ASKAP can pinpoint radio bursts with enough precision to highlight which pixel in SkyMapper images may show optical light at the same time. Any light other than radio waves helps to reveal more about these completely unexplained radio bursts, which for the duration of a millisecond outline entire galaxies in their radio emission.

The SkyMapper Transient Survey will provide unprecedented understanding of Dark Energy through detailed observations of distant Type Ia supernovae. They tend to behave in a similar way, shining very brightly at a known luminosity before fading away. As we have learned, we can judge their distance from how bright they appear. Together with their redshifts, we can map the expansion history of the Universe.

The main issue in current studies of Dark Energy is that populations of nearby and distant supernovae are different. Known nearby supernovae are collected in a selective process, while distant supernovae are more diverse, causing subtle inconsistencies when measuring Dark Energy.

SkyMapper, designed to find nearby supernovae with equal diversity, so that we can compare apples with apples when measuring the expansion history of the Universe. As a result, we will characterise the mysterious Dark Energy to a new level. Will that reveal its nature?

With the help of Taipan, SkyMapper will find the most massive black holes in the early Universe. Less than a billion years after the Big Bang, their masses reach ten billion suns. We will learn whether these black holes grow by rapidly accreting matter or have a mysterious primordial origin. Taipan will also reveal the largest superstructures in the Universe and test its homogeneity.

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SkyMapper has already found the most chemically pristine star known in our Galaxy. It formed 13 billion years ago in the primordial gas cloud of the Milky Way. SkyMapper will find many such stars and provide deep insights into how galaxies form.