SkyMapper

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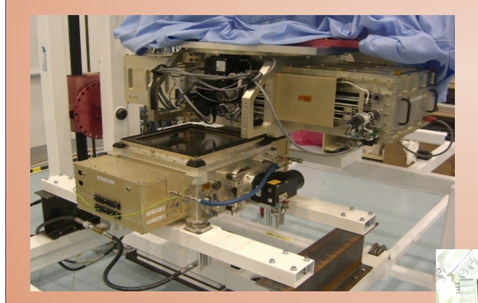
THE AUSTRALIAN NATIONAL UNIVERSITY

The SkyMapper telescope, currently under construction by RSAA, ANU is the first of a new breed of wide-field survey telescopes. The 1.35m SkyMapper telescope will possess a 268 Megapixel focal plane (32 2x4K E2V CCDs) spanning a 5.7deg^2 field of view. We present an update on the construction of the SkyMapper telescope, and an overview of its capabilities. SkyMapper's primary goal is to undertake the Southern Sky Survey : a six color (uvgriz), six epoch digital record of the entire southern sky.

The SkyMapper Detector

A wide-field Cassegrain Imager is under development. It features a fast-readout, low-noise 268 million pixel CCD mosaic that provides a 5.7 square degree field of view. The devices have excellent quantum efficiency from 300nm-950nm, near perfect cosmetics, and low-read noise, making them well suited to the all-sky Ultraviolet through near-IR Southern Sky Survey.

- 32 E2V CCD44-82 devices: 2048x4096 15 micron pixel CCDs
  - Broadband coated
  - 40 micron (thick) deep depletion devices
  - Reduced fringing, inc. red response
  - 9% interchip gaps (99% w.5/6)
- 16384x16384 0.5" pixels
- Using new Pan-STARRS controllers (Onaka)
- Readout in ~15 seconds !! and Readnoise ~5e-



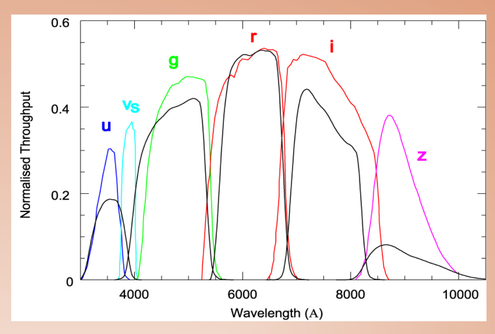
Camera, Filter housing (6 filter slots) and cooling system beeing assembled (June 2008)

Cooled with closed cycle cryogenic system
Off-Axis Guider

Focal plane : 32 2x4K CCDs

Filter set 'uvgriz'

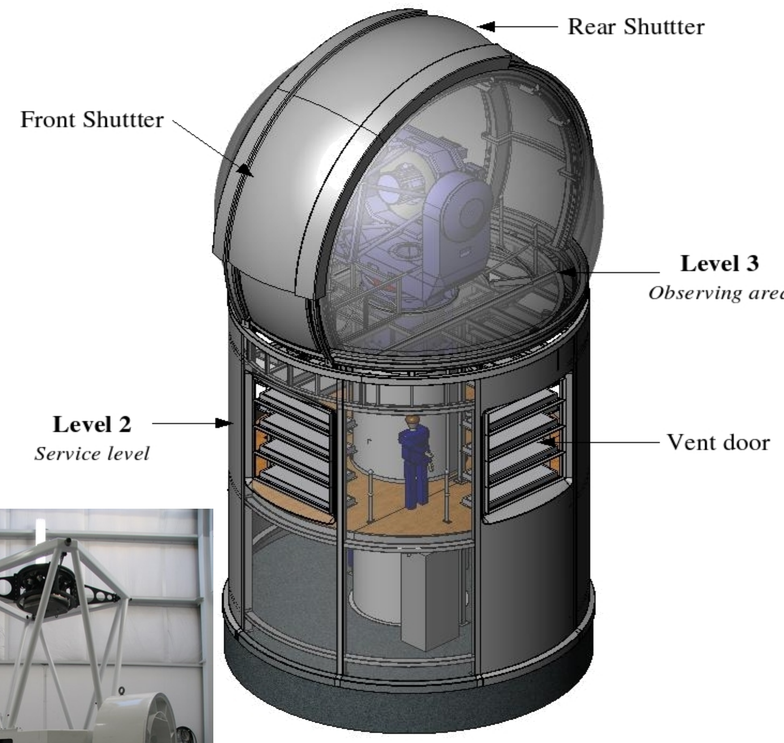
The following figure shows the expected throughput of the instrument plus detectors not including atmospheric extinction compared to the Sloan Digital Sky Survey instrumentation (black curve).

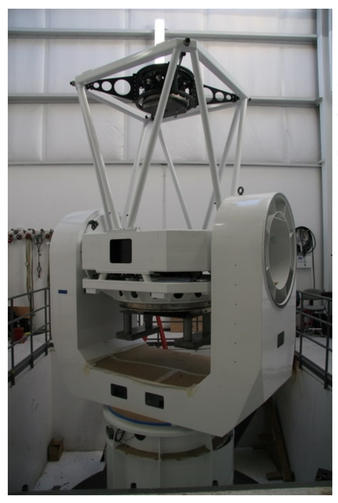


Expected Survey Depth (1.5" seeing) detection at 5 sigma level

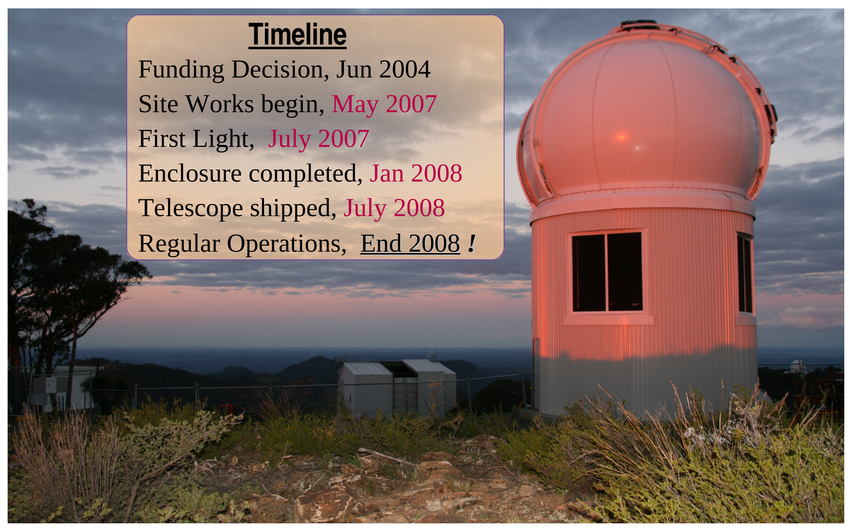
With the combination of 6 epochs (110s exposure), the catalogued will be between 0.4 and 1 magnitude deeper that the SDSS one.

	u	v_s	*g*	*r*	*i*	*z*
1 epoch	21.5	21.3	21.9	21.6	21	20.6
6 epochs	22.9	22.7	22.9	22.6	22	21.5
SDSS	22	n/a	22.2	22.2	21.3	20.5





The 1.35m SkyMapper telescope, assembled by EOS (Tucson, Arizona) will be located at Siding Spring Observatory



Southern Sky Survey

The SkyMapper telescope will provide a survey of the entire southern sky

- Multi-colour, multi-epoch of southerly 2 Л steradian
- Star and Galaxy photometry (3% global accuracy)
- Astrometry (better than 50 mas)
- Cadence: hours, days, months and years.
- Five years to complete

Main Survey Science:

- Bright z>6 QSOs : probes of the ionization history of the Universe.
- What's the distribution of large Solar-System objects beyond Neptune?
- What is the history of the youngest stars in the Solar neighborhood?
- How far does the galactic dark matter halo extend - what is its shape?
- Gravity & metallicity for on order of 100 million stars, the assembly and chemical enrichment history of the bulge, thin/thick disk and halo?
- Extremely metal poor stars.
- accurate photometric calibration of galaxy redshift surveys: 2dF/6dF.

Non-Survey Science:

- Planet Transits
- GRB + Low-z Supernovae
- Undiscovered members of the local group – Sculptor, Cen A too…
- Surveys in non-standard filters (Halpha, Mg …)
- Microlensing (Galactic Center)

Data collection

We can expect the Southern Sky Main Survey to generate a catalogue of ~1 billion stars and galaxies, each observed 36 times.

0.7 Tb collected in a 12 hour night at maximum
150 Tb of reduced data
5 Tb for the photometric database

It will be the largest astronomical dataset ... for a few years !!

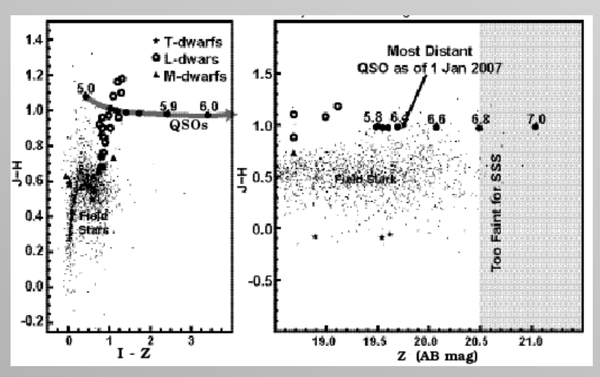
Virtual Observatory

- **Deliverables to the community:**
  - Data (epoch, RA, DEC, mags, galaxy shape info,…) to be available through a web-served interface which provides catalogs over a user defined area
  - Images to be available through a web-served interface which provides images over a user defined area

High-z QSOs (z>5.8)

The Southern Sky Survey (SSS) will find more than 150 of the most distant quasars allowing us to undertake a definitive study of how the Universe made its final transition from beeing neutral to ionised. We know that within 1 billion year of the Big Bang, some galaxies had formed ; this is evidenced by many galaxies now discovered at z>=6. Curiously, even at this early epoch, the inter-galactic gas seems to be ionised. We can tell this due to the lack of continuous Lyman-alpha absorption in the spectra of these objects (called the Gunn-Peterson effect). Some objects must have existed earlier still and pumped out enough UV photons to ionise nearly all the baryons in the Universe.

The re-ionisation event of the Universe is patchy. A definitive study needs observations of many QSO sight lines (z>=6) . QSOs at these redshifts are very rare: we estimated from the SDSS work (Fan et al.) than about 30 bright high-z QSOs will be found in the SSS database. They will be bright (Z<20) enough for a necessary follow-up with a 8 meter class telescope. Overall, using the latest values from X.Fan (private communication), our sensitivity and our spatial coverage, we expect to discover ~170 high-z QSOs (to Z~20.5 and z>=5.8) thereby increasing the number of distant quasars known by an order of magnitude. Furthermore, our improved sensitivity in the reddest part of the z-band, compare to SDSS, should allow us to find objects as distant as z~6.8 (see figure).



Left panel : High-z QSOs will be found on the basis of 3 criterias :
- i drop-out technique (most flux are in the z-band)
- Rejection of the main contaminant, M, L and T red dwarfs, based on their proper motion
- IR colours (J-H vs I-Z) . Field stars are from SDSS+UKIDS surveys.

Right panel shows that the most distant QSO yet discovered will be visible in the SSS database to z~6.8.