

Overview of Telescope Facilities



Rubin In-Kind Program

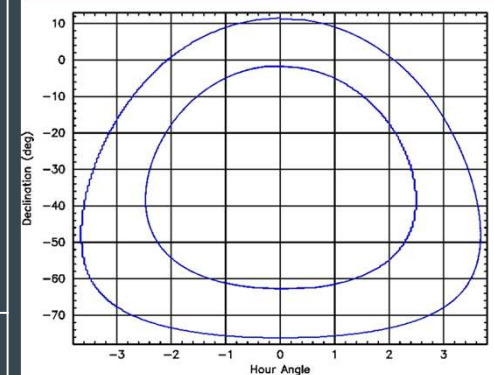
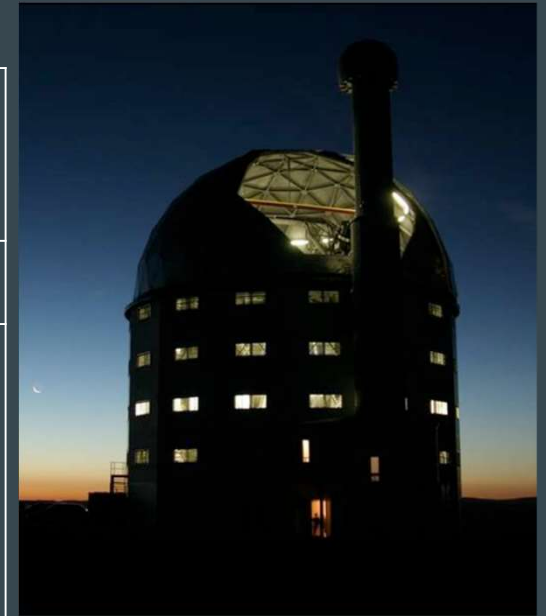
South African Optical Facility Access

SALT & SAAO telescopes

David Buckley, SAAO

Key Numbers for SALT

Aperture	<p>7 – 8.3 m effective filled aperture (moving 11 m pupil)</p> <p>92 x 1.2 m hexagonal segments</p> <p>8 arcmin FoV</p>
Wavelength range	320 – 900 nm (visible); 800 – 1700 nm (NIR; from 2023)
Instrument suite	<p><i>Robert Stobie Spectrograph (RSS)</i></p> <ul style="list-style-type: none"> • Low- medium res ($R \sim 350 - 9000$) longslit & MOS • Polarimetric modes (linear, circular, all-Stokes) • Fabry-Perot etalons for imaging spectroscopy <p><i>SALTICAM</i></p> <ul style="list-style-type: none"> • Visible imaging camera with multiple filter sets • High speed (~ 10 Hz) capability <p><i>High Resolution Spectrograph (HRS)</i></p> <ul style="list-style-type: none"> • Fibre-fed single object (+ sky) • Three resolution modes ($R \sim 15,000, 34,000, 70,000$) • High stability modes (ThAr, iodine, laser freq comb) <p><i>NIR IFU spectrograph (commissioning in 2022)</i></p> <ul style="list-style-type: none"> • ~ 25 arcsec IFUs (212 fibres); $R \sim 2000 - 5200$
Other relevant facts	Can access $+11^\circ < \text{Dec} < -76^\circ$ (restricted viewing annulus on the sky)



Current SALT Instruments

- Prime Focus Spectrograph (RSS)



- HRS: High Resolution Spectrograph (HRS)

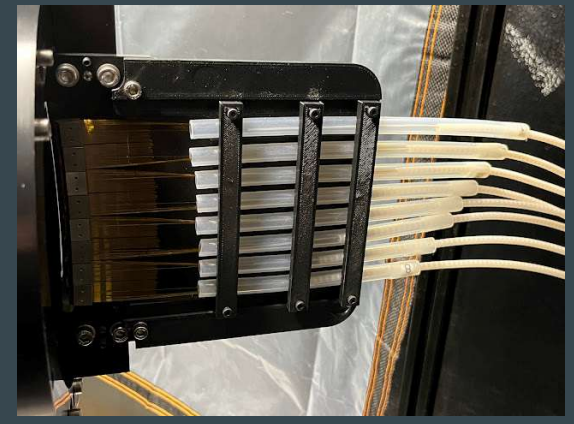
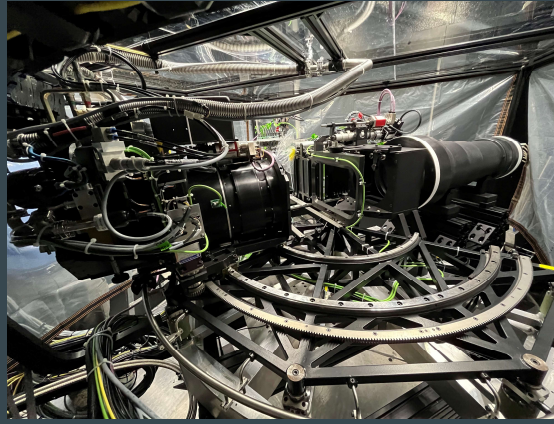


- SALT Imaging Camera (SALTICAM)



Future SALT Instruments (from 2023/24)

- NIR IFU Spectrograph (800 – 1700 nm)

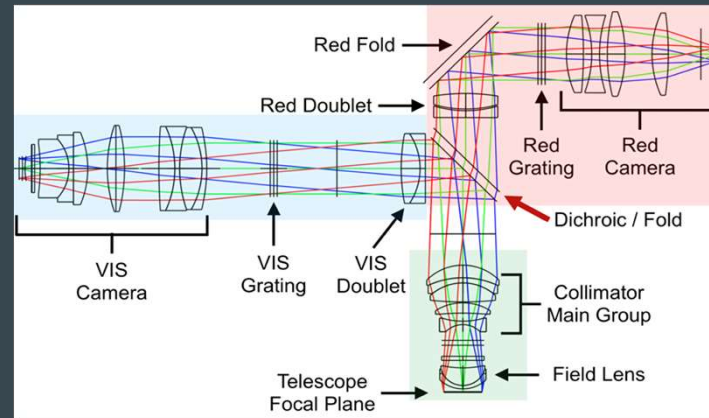


- RSS Dual: UV/VIS + Red (320-900nm)

Adding new efficient Red arm ($R \sim 2000$)

Interchangeable fold/dichroic (split @634nm)

56% peak efficiency (excl. tel & slit losses)



SALT Telescope Time Available

50 h per year (only hours used are charged)

Applying for Telescope Time

- Semester based proposals (starting 1 May, 1 Nov)
- Phase 1 submitted to TAC; Phase 2 for detailed description
- ToOs can be submitted as part of accepted proposals
- Time is awarded in 4 priority classes (P0 – P3) with an oversubscription of 50% in P3 to guarantee a full queue

Observation Scheduling

All SALT observations are queue-scheduled

Observations undertaken by dedicated astronomy operations staff

Proposal targets maybe added (e.g. transients)

Automated target and observing block submission

- First version of SALT API to be released soon
- REST-ful API will allow automated submission and web socket based end-point for following submission process
- Current submissions submitted as XML
- JSON support, probably in the form of templates, under consideration

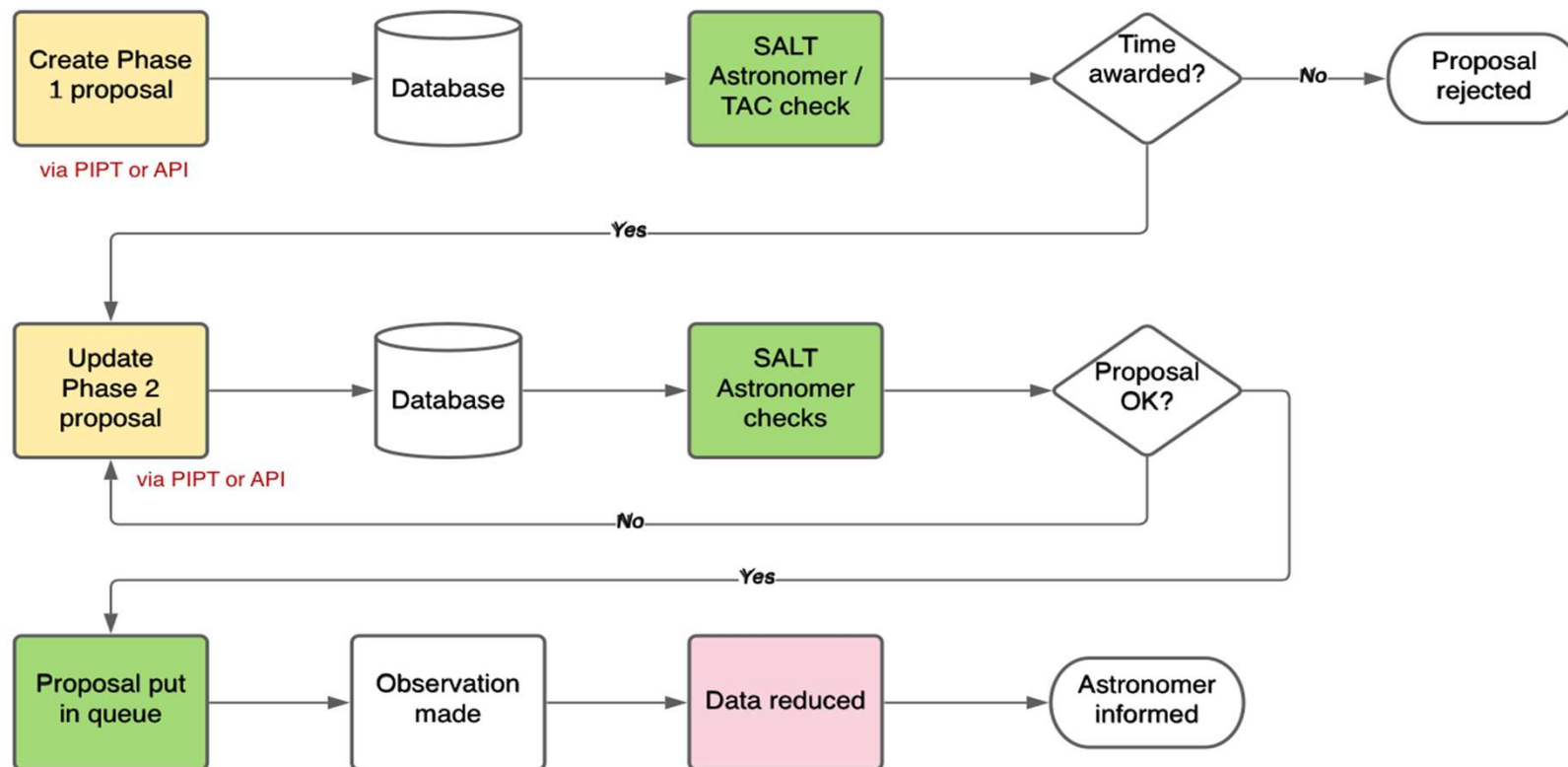
Python library

- To simplify the use of API, SALT will provide a Python library which will serve as a wrapper around the API
- The library will be available vi PyPI (pip install PyAstroSALT)

Accessing data products

- All raw and pipelined reduced data available by the next day. Raw data can be accessed immediately.

SALT Proposal Phase flowchart



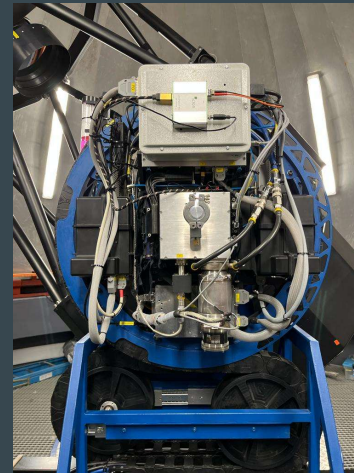
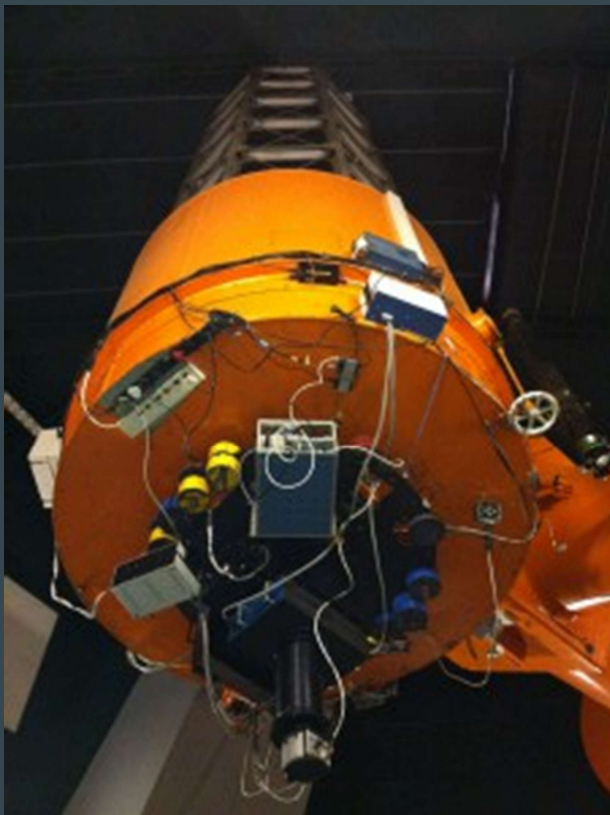
Key Numbers for SAAO Telescopes

Aperture	1.9 m , 1.8 m PRIME (commissioning in 2022) 1.6 m KMTNet, 1.4 m IRSF, 1.2 m MONET-South; 2 x 1.0 m, 0.65 m MeerLICHT, 2 x 0.4 m MASTER
Wavelength range	320 – 900 nm (visible) for most NIR for two (zyJH PRIME and JHK _s IRSF)
Instrument suite	Wide field (1.5 – 4 deg ²) imaging: PRIME, MeerLICHT, KMTNet Low-medium resolution spectroscopy (Spupnic on 1.9-m, Mookodi on 1.0 m) High speed photometry (SHOC on 1.0 m's, Mookodi on 1.0m) High speed polarimetry (HIPPO on 1.9 m)
Other relevant facts	A suite of telescopes are being incrementally networked into the SAAO's <i>Intelligent Observatory</i> .

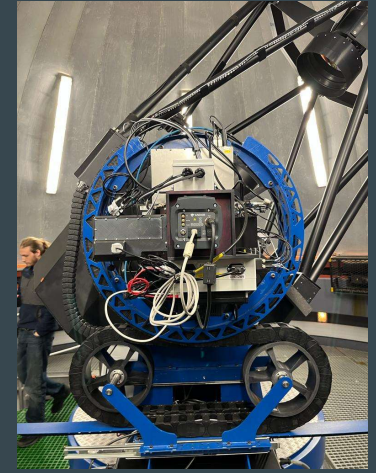


SAAO Owned Telescopes:

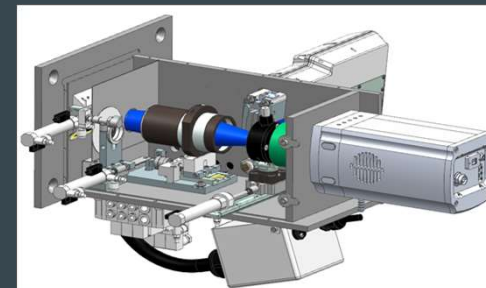
- 1.88-m
- New 1.0-m *Lesedi*



Nasmyth 1
Low res spectrograph
& imager (fast)



Nasmyth 2
~20 arcmin FoV camera



- + Old 1.0-m:
Wide-field imaging polarimeter (~2023)

SAAO Hosted Telescopes (with access):

- PRIME IR 1.8-m

Japan (Osaka/AstroBiology Centre)/US (NASA GSFC/UMD/
South Africa collaboration)

zyJH imager (4 x Hawaii 4RG arrays; Roman Space Telescope)

1.5 sq degree FoV

ToO override for transients

First light with small FoV *z* & *H* cameras in July 2022

Science camera installation in Sep 2022

Science operation by late 2022/early 2023



SAAO Hosted Telescopes (with access):

- MONET-South



- MONET: Two 1.2m telescopes at SAAO and McDonald
- Fully robotic via pyobs software
- Use LCO portal as web frontend
- ToO functionality work-in-progress
- Can be on target within seconds, due to fully open roof
- Future integration into SAAO's "Intelligent Observatory"

pyobs

pyobs - An Observatory Control System for Robotic Telescopes

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SAAO Intelligent Observatory (IO) **Vision**

All telescopes integrated into an the IO

- Coordinated science across telescopes in the era of multi-messenger astronomy
- Science on any time scale
- Submit observation requests at any time
- Observe from Sutherland, Cape Town or anywhere or automatically
- Respond to alerts, computer generated requests, automation, robotisation
- Advance SAAO into the 4IR



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SAAO Intelligent Observatory (IO) **Status**

Main SAAO Telescopes

- 1.9m, 1.0m, Lesedi(1m) hardware and software upgraded ✓
- Remote operations ✓
- Scripted observations ✓

Observatory Control system (from LCO)

- Locally installed and configured for Lesedi ✓
- Programmatically submit observation requests ✓

Ongoing

- Add other telescopes + instruments to the OCS



SAAO Telescope Time Available

- 52 h per year

Applying for Telescope Time

- Trimester based proposals for SAAO telescopes
- Other hosted telescopes different proposal periods (see SAAO website for details)

Observation Scheduling

- Telescope time is currently allocated weekly to individual PIs or PI groups
- Remote observing increasingly supported

Accessing data products

- All raw can be accessed immediately following the observations.
- Data reductions are the responsibility of the individual astronomers who obtained the observations.
- Some reduction programs have been and are being developed.