The Huntsman Telescope

Lee Spitler
https://huntsman.space/

Photo by Sarah Caddy
LO-COST: Lee's Outstanding Cost-effective Optical Systems Team

INSTRUMENT SCIENTIST
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GALAXY CAVE GOBLIN
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UNIVERSE SIMULATOR
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SOFTWARE WRANGLER
WILFRED GEE

MISSION COMMANDER
LEE SPITLER

EXOPLANET HUNTER
JAMIE ANDRES ALVARADO MONTES

ALIEN HUNTER
SARAH CADDY
Image credit: Fergus Longbottom
Optical: Huntsman HI: Westmeier, Braun & Koribalski, 2010
Transit Photometry with the Huntsman Telescope

![Diagram of planet orbiting a star with brightness and time axes.](Photo by Sarah Caddy)
10 lenses equivalent to a D~0.5m telescope

Full field of view
1.9° x 1.3°

Pixel scale
1.24"x1.24" per pixel

Image sensor
Sony IMX183,
Back-illuminated, 84% QE,
1.6e- RN, 12-bit, 15000e FW

Canon 400mm 2.8L IS II telephoto lens
D=14cm

20 Mega pixels
CMOS image sensors
ZWO ASI183MM Pro
Current filters:
g-, r-, Halpha, SII, Lum, blank

Not installed:
Exoplanet diffuser, polarising filter
27101 - LRGB

Luminance, Red, Green, and Blue astronomy filter set

| Filters in this Set | Price |
|---------------------|-------|
| 27040 (AS)          | $     |
| 27041 (AS)          | $     |
| 27042 (AS)          | $     |
| 27043 (AS)          | $     |

https://www.chroma.com/
Movie Mode

CMOS sensor with electronic shutter means we can observe with exposure times as short as 32 microsecond.

With ~19 frames/second for full field per camera means that ~10 lenses can obtain a 190 frames/second "movie" of the sky.

Why hasn’t this been possible before?

*CCD have long readout & exposure times or optimised for a small field of view (e.g. EMCCD)*

*CMOS sensitivity has improved rapidly*
Data rates are the a challenge:
40 megabytes per image *
20 frames / second *
8 hours / night *
10 cameras *
= 200 terabytes / night
~6 GB / second
Need edge computing

Jetson Xavier NX
Proxima Cen
M-dwarf
$R = 9.45$ mag

Optical Photometry & Spectroscopy

$Z_{adko} g'$
TESS (scaled $\times 10$)
H$\alpha$ EW

$5\sigma$

$1\sigma$

$t + 58605.38154$ MBJD (hour)
"complex" flare event

e.g. 1 minute time resolution

Information about the physics of stellar flare heating and radiation

Davenport et al. 2014
https://iopscience.iop.org/article/10.1088/0004-637X/797/2/122
Initial survey will be only sensitive to bright sources/events
Future surveys can target fainter sources/events
Macquarie can make instruments for larger telescopes
Misc COTS devices

- Acroname USB hub
  - Can power cycle each USB port via App
- Software Bisque Paramount MEII
  - 109kg payload capacity - we are very near the limit
  - Controlled via TheSkyX software, linked to our control software via TCP/IP cmds
- Fitlet-2 fanless control computer
  - Atom x7-E3950, RAM: 16 GB, M.2 SATA 250 GB, -20°C to 70°C
- UPS, NPS, router, ethernet switches
- Weather station
  - AAG cloudwatch, PurpleAir dust monitors (one outside, one inside dome)
  - SQM and TESS sky brightness monitors
    - [https://tess.dashboards.stars4all.eu/d/datasheet_stars54/stars54?orgId=1](https://tess.dashboards.stars4all.eu/d/datasheet_stars54/stars54?orgId=1)
    - [https://www.purpleair.com/map?opt=1/mAQI/a10/cC0&key=PN8NL7OCYY3VLZJ6#18.87/-31.2720966/149.0616937](https://www.purpleair.com/map?opt=1/mAQI/a10/cC0&key=PN8NL7OCYY3VLZJ6#18.87/-31.2720966/149.0616937)
- Lights
  - Zigbee-based wifi light controls unstable, now use USB-powered LEDs
non-COTS equipment

● Lens tubes - designed by AAO intern
● AC to DC power supply - assembled by Daniel B, SSO/ANU Staff
● Filter-wheel / lens adaptor - designed by A. Horton & MQ METS
● Dome controller - designed by F. Longbottom, MQ PhD student
● Dome shutter controller - designed by Steve Lee
● The dome - made by AstroDomes